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EFFECT OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES ON THE PERFORMANCE OF MANUFACTURING FIRMS IN KENYA

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ABSTRACT

Due to the perceived performance implications of GSCM, research in this area has grown in recent years. However, the literature is limited on the performance implications of GSCM on firms especially in the developing countries. Thus, the literature has yet to furnish an accepted explanation on whether a positive relationship exists between Green Supply Chain Management (GSCM) Practices and firm performance. This dissertation has responded to this challenge through the exploration of the consequences of GSCM practices on the performance of manufacturing firms in Kenya. The study was guided by the following objectives: to establish the effect of green procurement on the performance of the manufacturing firms, to establish the effect of green manufacturing on the performance of the manufacturing firms, to establish the influence of green distribution on the performance of the manufacturing firms, to establish the effect of environmentally-oriented reverse logistics on the performance of the manufacturing firms and to establish the moderating effect of supply chain ecocentricity on the relationship between green supply chain practices and the performance of manufacturing firms. The study is built on the theoretical framework of the ecological modernization, resource based view, stakeholder, corporate environmental responsibility and social network and investigated four potentially important dimensions of GSCM and how such dimensions, in turn, shape firm performance. Specifically, a theoretical model was developed and tested on the basis of the hypothesized relationships among the four dimensions of GSCM, Supply Chain Ecocentricity as the moderating factor, and how these dimensions relate to firm performance. Significant results and good fit indices tested with multiple regression model and confirmatory structural model. Positivism paradigm approach, mixed method research and the cross-sectional survey research design were adopted in this study. The target population for this study were the manufacturing firms in Kenya. The study population were the manufacturing firms registered as members of the Kenya Association of Manufacturers as at 2014 and the respondents were the designated heads of

ISSN 2320-9186

supply chain management of these firms. A semi- structured questionnaire was administered through the e-mail survey. Secondary data was obtained from both published and unpublished records. The questionnaire was tested for validity and reliability. Both quantitative and qualitative techniques were used to analyse the data with the assistance of SPSS software program version 22, Ms-Excel for window 8 and Analysis of Moment Structures (AMOS) version 18. Supply chain ecocentricity moderating effect was tested by F-test. The study found that Green Procurement, Green Manufacturing, Green Distribution and Environmentally Oriented Reverse Logistics were individually predictors of firm performance with Green Manufacturing being the most significant predictor. In contrast, the study established that Supply Chain Ecocentricity is not a moderating factor in the study. The results support the current theories related to the study. Consequently, this study provides firms' managers with insights of how firms can develop a competitive edge through the implementation of GSCMPs. This study therefore, recommends that factors associated with Green Supply Chain Management need to be embraced by firms in their performance strategic plans as they have significant impact on performance. Further, the government should adopt a mixed policy on ecological management by focusing on both statutory regulations and internal directives with direct impact on firm performance such as tax rebate on eco-equipment and processes. The study concludes that greening initiatives within the manufacturing firms supply chain management has the potential of positively influencing their performance in terms of cost reduction and environmental product differentiation.

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CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter reviews the background of the study, statement of the problem, the study objectives, research hypothesis, justification and the scope of the study. The last section in the chapter covers the study limitations.

1.1 Background of Study

The primary goal of most businesses is to create and maintain a supply chain that can improve their business performance (Sirmon, Hitt & Ireland, 2007). Since the early 1990s, researchers have discovered that supply chain management plays an important role in helping firms improve performance (Mentzer, DeWitt, Keebler, Min, Smith & Zacharia, 2001). Supply chain management (henceforth SCM) is the strategic coordination of resource flows among members of the upstream and downstream supply chain (Mentzer *et al*., 2001). Ultimately, the goal of SCM is improving the long-term performance of firms in the chain (Ketchen & Hult 2007; Combs & Todd 2008). To create value, supply chains need to be managed in a proactive way that creates processes and common goals among the supply chain members (Min, Mentzer & Ladd, 2007). Indeed, research supports the idea that proactive supply chain management may represent an "inimitable competitive weapon" in the business environment, one that can deliver value for the firm (Ketchen & Hult, 2007).

Within SCM inquiry, researchers have begun to examine the impact of supply chain operations on the natural environment (Klassen & Johnson 2004; Zhu & Sarkis 2004; Handfield, Sroufe & Walton, 2005; Rao & Holt 2005; Vachon & Klassen 2008). La and Masters (1994) as cited in Hult, Ketchen and Slater (2004) trace green supply chain management practices to the concepts of supply chain and supply chain management. The simplest conception of a supply chain can be presented as the companies involved in all aspects of the upstream and downstream movement of products and services (Zhu &

ISSN 2320-9186

Sarkis, 2006). A typical supply chain consists of companies in a network linked by the basic processes/practices of supply, transformation, demand and returns (Zhu & Sarkis, 2006). Mentzer *et al*. (2001:4) more succinctly define a supply chain as: "a set of two or more entities (members), directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer".

The planning and coordination of these business practices to create a fit which deliver value to customers is described as supply chain management (Cooper & Schindler, 2006). Integrating environmental thinking into the planning and coordination of these practices is what breeds green supply chain management concept (Lambert & Cooper 2000; Council of Supply Chain Management Professionals, 2009). Green SCM is defined as the intra- and inter-firm management of the upstream and downstream supply chain practices aimed at minimizing the overall environmental impact of both the forward and reverse flows (Klassen & Johnson 2004; Zhu, Sarkis & Lai, 2008). Green SCM practices fall into four primary dimensions of supply chain management (Zhu *et al.,* 2008): green purchasing (in bound greening), green manufacturing (focal company), green distribution (out bound greening) and environmentally-oriented reverse logistics. These four dimensions of SCM capture key dimensions of green SCM practices (Zhu *et al.* 2008).Figure 1.1 brings these dimensions together and figuratively defines green supply chain.

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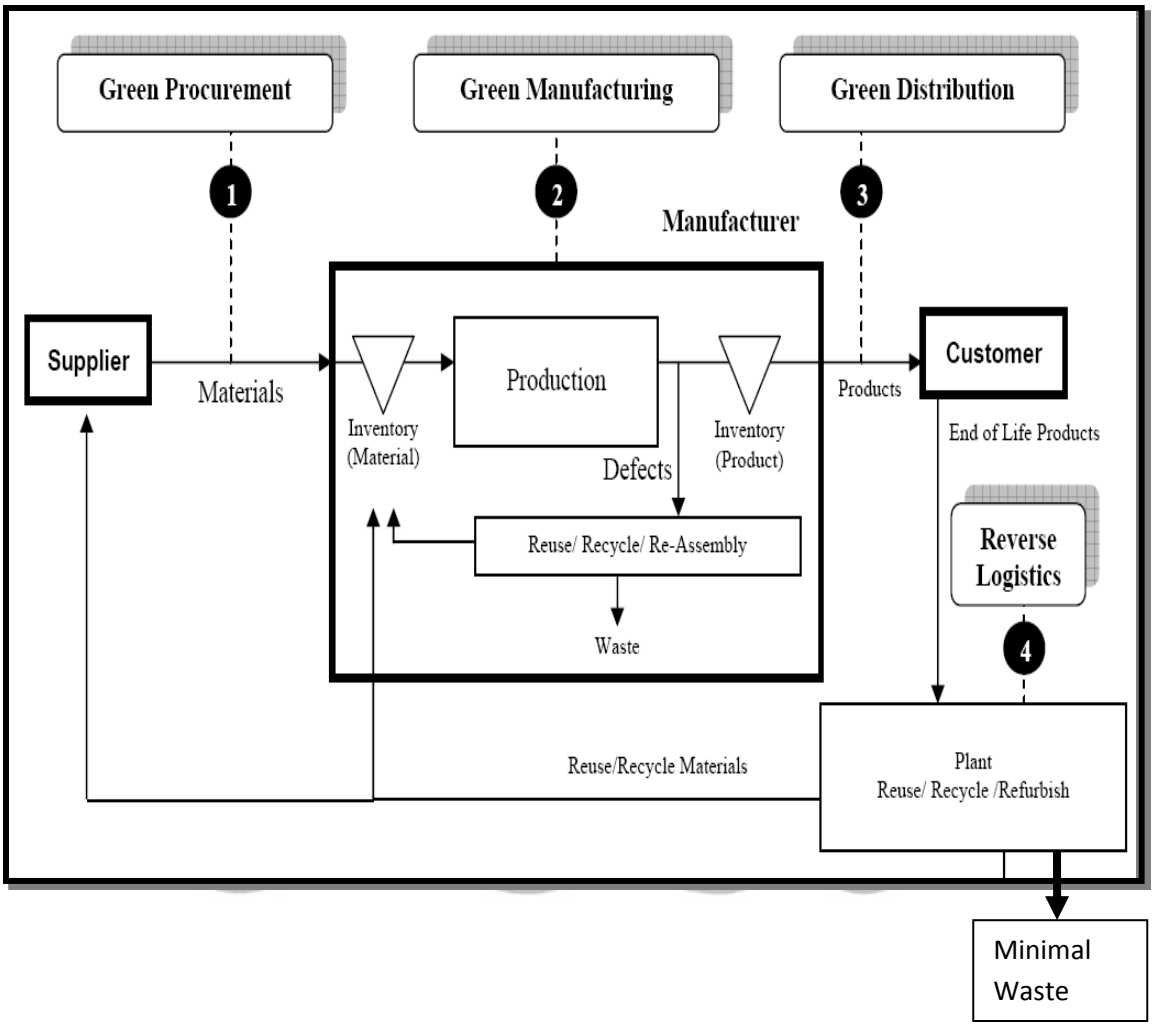

Figure 1. 1 GSCMP dimensions

Source: (Toke, Gupta & Dandekar, 2010)

Green supply chain management, also known as ESCM (environmental supply chain management) or SSCM (sustainable supply chain management) (Seuring, 2004), combines green purchasing, green manufacturing/production, green distribution and environmentally-oriented reverse logistics (Sarkis & Tamarkin, 2005). With increasing awareness of environmental protection worldwide, the green trend of conserving the Earth's resources and protecting the environment is overwhelming (Sarkis & Tamarkin, 2005). As a result, governments have enacted laws which require firms to take initiatives

that conserve the environment (Zhu & Sarkis, 2006), thereby exerting pressure on firms (Zhu & Sarkis, 2006). The pressure and drive accompanying globalization has prompted enterprises to improve their environmental performance (Zhu & Sarkis, 2006). Consequently, firms have shown growing concern for the environment over the past years (Harris, 2007).

The pressure on corporations to improve their environmental performances comes from both globalization and localization (Sarkis & Tamarkin, 2005). As a consequence, businesses commit substantial resources to environmental initiatives, and some research suggests that environmental practices in supply chain (Green Supply Chain) management shape firms' performance. When businesses use such practices, they can potentially improve performance through procedures that involve managing wastes, improving their reputation, and reducing overall costs (Hoffman 2000; Klassen & Johnson 2004; Handfield *et al*. 2005; Vachon & Klassen 2008; Zhu *et al*. 2008). Therefore, some firms have adopted Green Supply Chain Management (GSCM) practices as a way of attaining organization performance (Zhu & Sarkis, 2006).

Environmental or green practices in supply chain management are generally comprised of actions that reduce or eliminate waste and pollution, eliminate hazardous materials, consider product life-cycles, review supplier environmental performance, emphasize compliance, minimize the environmental impact of the firm's operations, and remediate environmental problems (Rao & Holt, 2005; Klassen & Johnson 2004; Handfield *et al*. 2005; Zhu *et al*. 2008; Stock, Speh & Shear 2002). In essence, green SCM practices concentrate on minimizing the environmental impact of the forward and reverse flows of the supply chain, while possibly creating economic value and lowering costs for the firm (Zhu & Sarkis 2006; Vachon & Klassen 2008).

Circumstantial evidence shows that firms have used GSCM practices around the globe in an attempt to improve performance. For example, the Nokia Corporation combines elements of SCM (supplier network management and supply chain design) with green capabilities and policies (products designed for the environment and supplier

involvement in environmental management systems) to create integrated GSCM practices intended to improve the financial performance of the company (Nokia Corporation, 2004). Similarly, 3M, Kodak and Xerox have all integrated aspects of green management practices in their supply chains with the goal of achieving higher firm performance (Klassen & Johnson, 2004).

Corporations aiming to implement GSCM may be seeking ways to enhance environmental and financial performance. However, for organizations to embrace GSCM, they require it to be tagged with some form of incentives (Zhu & Sarkis, 2006). In this study, the performance of the organization is singled out. This study is grounded on the literature that suggests that GSCM practices positively impact on organizational performance (Chien & Shih, 2007).

Interest in green SCM has been growing among researchers since the early 1990s (Handfield *et al*. 2005; Srivastava 2007). Scholars have investigated the benefits related to green operational practices and processes in the firm (Hart & Dowell 2010). However, empirical research into the impact of green SCM practices on firm performances has produced mixed results (Melnyk, Sroufe & Calantone 2003; Arkley & Davis 2007). This has led to a continuing discussion in the literature regarding whether or not green SCM practices can lead to higher firm performance. This study therefore attempted to move this debate forward in the Kenyan context by providing empirical data findings in the manufacturing sector in Kenya that can be used for in depth understanding of the topic.

1.1.1 Green Supply Chain Management in Kenya

Modern environment management and planning in Kenya can be traced to the Rio Earth Summit of 1992, which helped a great deal in raising understanding about the link between environment and development (UNEP, 1996). Following the summit, Kenya initiated the national environmental action plan (NEAP) process. This was completed in 1994. It recommended the need for a national policy and law on the natural environment (RoK, 2009). The policy process culminated into the Draft Sessional Paper No. 6 of 1999 entitled "Environment and Development." The legislative process gave forth the

Environment Management and Coordination Act (EMCA) No. 8 of 1999 as Kenya's first framework of environmental law (RoK, 1999) for addressing environmental challenges such as environmentally- related diseases, water and air pollution, climate change just to mention but a few. Indeed it is noted that Kenya's population is clearly vulnerable to environmentally related diseases, where the total disease burden caused by environmentally related causes stand at 24 percent largely due to manufacturing activities (WHO, 2004). This made the government, through the National Environmental Management Authority (NEMA) to act tough on the violators of the environmental regulations (RoK, 2009).

As a result, various economic sectors have embraced green supply chain practices in Kenya to comply with the government's environmental regulations and to address both environmental and performance issues (Ondiso, 2012; Jones, 2006). Firms in the agricultural sector have adopted environmentally friendly pesticides, afforestation, un-contaminated seedlings and irrigation practices which are eco-friendly. These are replicated across and within other sectors like tourism, wholesale and retail trade, manufacturing and construction (Kamande, 2011). For example, British America Tabaco (BAT) combines elements of SCM (procurement, vendor network management, waste disposal and product design) with natural environment sustainability capabilities and policies (products designed for the environment, choosing suppliers with strong environmental credentials, efficient use of energy, use of tobacco dust as fuel to provide heat, reduce waste to landfill and water and supplier involvement in environmental management systems) to create integrated green SCM practices intended to comply with the government regulations (BAT, 2012).

Similarly, East African Breweries Ltd, Bidco Industries Limited and Unilever Kenya have all integrated aspects of green management practices in their supply chains with the goal of complying with the government regulations and gaining acceptance in their operating environment through corporate social responsibility (CSR) (East African Breweries Ltd, 2012; Bidco Industries Ltd, 2012; and Unilever Kenya, 2011). Despite the

huge amount of resources involved, minimal attempt has been made to link the adoption of GSCM practices with the performance of the manufacturing firms in Kenya (Mukiri, 2012) even though there are possible performance benefits accruing to firms with environmental orientation practices (Seman, Zakuan, Jusoh, Shoki & Arif , 2012).

However, the promulgation of the Constitution of Kenya, 2010 marked an important chapter in Kenya's environmental policy development. Hailed as a green constitution, it embodies elaborate provisions with considerable implications for sustainable development (RoK, 2010). These range from the right to clean and healthy environment enshrined in the Bill of Rights. Chapter V of the constitution is entirely dedicated to land and the environment. It also embodies a host of social, political and economic rights of an environmental character, such as the right to clean water, food and shelter (RoK, 2010).

The country's new constitution (The Constitution Kenya, 2010) envisioned a green economy where all the players in the economic development of the country are expected to undertake their economic activities in a manner that minimizes the impact on the natural environment (RoK, 2010). It established a framework of natural environment management throughout the entire supply chain- Green Supply Chain Management (Kamande, 2011). This is in line with sustainable development objective of Vision 2030; Kenya road map for development (RoK, 2007).

1.1.2 Manufacturing Firms in Kenya

The study intends to look at the performance of manufacturing firms in Kenya with respect to cost efficiency and environmental differentiation. Manufacturing in Kenya, apart from being considered as the country's economic growth lever under Vision 2030 (RoK, 2007), is also believed to be the main cause of emerging environmental problems due to its traditional business operations (WHO, 2004). Various industries in the manufacturing sector such as textile, dyes, chemicals, plastics, rubbers, metals, machinery and equipment, electronics, automobile, printing, construction and others, are considered major sources of environmental problems. Traditional polluting industries

such as chemical, electrical and paper industries generally contribute higher environmental degradation (Lee, 2008).

In analyzing the performances of any entity, both the volume of output as well as the costs involved in producing that level of output, are taken into account (Hart & Dowel, 2010). While direct costs are easily reflected in prices, indirect costs present as external effects to the environment are not easy to capture through prices (Corbett & Klassen, 2006). To collect such externalities, the government imposes some penalties, such as environmental taxes and other environmental policy tools to force firms to internalize any externalities that arise from their operations. In this way, both the direct and indirect costs are reflected in the operational costs of the firm. In such a scenario, poor environmental practices by firms may have an impact on a firm's performance through increased operational costs. These occur as a result of inefficiency while sound environmental practices may be a source of financial gain for the firm through reduced waste, increased output per unit, reduced cost of energy and water due to improved efficiency (Kalirajan, Shand, & Bhide, 2010). In the words of Corbett and Klassen, (2006), good environmental management practices (green supply management practices) by manufacturing firms may be the "firing lever" to improved performance.

A study by Seman *et al*. (2012) amongst Malaysian manufacturing firms establishes that firms practicing sound environmental management practices within their supply chain scored 85 percent in technical efficiency with a very good financial and environmental performance compared to those without sound environmental management practices at 62 percent. Technical efficiency is defined as "the capacity and willingness of a firm to produce the maximum possible output from a given set of inputs and technology" (Kalirajan *et al*., 2010). However, a study by Kamande (2011) on the "Impact of Clean Production on the Performance of Kenyan Manufacturing Firms" establishes that manufacturing firms in Kenya are technically and environmentally inefficient in the way they carry out production. The study concludes that this inefficiency might be the cause of lack of competitiveness of locally manufactured products in the international market

where price and quality drive the market share. Ondiso (2012) and Mukiri (2012) establish that manufacturing firms in Kenya have embraced green practices as a way of addressing performance issues. The study however noted that green practices – performance association has not been confirmed empirically in Kenyan context. It was therefore imperative that a relationship be established between GSCM practices and performance in an attempt to qualify the concept as a strategy for improving efficiency and market share of the manufacturing firms in Kenya.

1.2. Statement of the Problem

Manufacturing is a key pillar in promoting economic and social development of a country (Yamfwa, Szirmai & Lwamba, 2002). Kenya Vision 2030 emphasizes the need for appropriate manufacturing strategy for efficient and sustainable practices as a way of making the country globally competitive and a prosperous nation (RoK, 2007). Nevertheless, most manufacturing firms in Kenya operate at a technical efficiency of about 59 percent (Kamande, 2011) compared to their counterparts in Malaysia that average about 74 percent (Kalirajan *et al*., 2010) raising doubts about the sector's capacity to meet the goals of Vision 2030 (RoK, 2007). Indeed, Chien and Shih (2007) advise that manufacturing firms should aspire to achieve at least 70 percent technical efficiency to be competitive and sustainably use natural resources. Their study suggest that firms operating below 70 percent technical efficiency are likely to experience low levels of revenue, high cost of production, low output per input, increased solid waste streams and relatively low survival rates (Chien & Shih, 2007). This then calls for a new manufacturing approach with the potential of improving the performance of the sector to be in line with the Vision 2030 (GoK, 2007).

In view of this, several methods of improving performance and efficiency such as quality assurance (QA), total quality management (TQM) , benchmarking, activity based costing, value based management and supply chain management are increasingly criticized for their impact on environment (Klassen & Johnson, 2004). There is a growing concern in all directions of business and management of developing the culture of green processes

which will be mindful of the environment. In the processes, the concept of GSCM has been suggested as one of the ways of improving performance while at the same time being mindful of the environment (Handfield *et al.*, 2005).

Consequently, a number of firms in the manufacturing sector in Kenya have embraced GSCMPs to address both economic and environmental performance (Ondiso, 2012; Mukiri, 2012). GSCMPs according to Seman *et al.* (2012) have the potential of improving the performance of firms. Hoffman (2000); Klassen and Johnson (2004) and Handfield *et al.* (2005) all suggest an association between GSCM and the performance of firms. However, there has been minimal research on GSCMPs – performance link within the manufacturing sector in Kenya (Kamande, 2011). The existing literature has focused on other continents other than Africa such as; America, Europe and some parts of Asia (Ondiso, 2012; Kamande, 2011; Mukiri, 2012). Indeed, existing research has not provided clear evidence on the effect of GSCMPs on the performance of firms within the manufacturing sector in Kenyan (Ondiso, 2012; Mukiri, 2012) hence the study on the effect of GSCMPs on the performance of the manufacturing firms in Kenya.

1.3 Research Objectives

1.3.1 General Objective

The broad objective of the study was to establish the overall effect of green supply chain management practices on the performance of the manufacturing firms in Kenya.

1.3.2 Specific Objectives

Arising from the general objective, the study was guided by the following specific objectives:

I. To establish the effect of green procurement on the performance of manufacturing firms in Kenya.

II. To establish the effect of green manufacturing on the performance of manufacturing firms in Kenya.

III. To establish the influence of green distribution on the performance of manufacturing firms in Kenya.

IV. To establish the effect of environmentally-oriented reverse logistics on the performance of manufacturing firms in Kenya.

V. To establish the moderating effect of supply chain ecocentricity on the relationship between green supply chain practices and the performance of manufacturing firms in Kenya.

1.4 Hypotheses

The following six hypotheses were used to address the study objectives;

1. H_0: Green procurement does not significantly influence the performance of the manufacturing firms in Kenya.
2. H_0: Green manufacturing does not significantly influence the performance of manufacturing firms in Kenya.
3. H_0: Green distribution does not significantly influence the performance of manufacturing firms in Kenya.
4. H_0: Environmentally-oriented reverse Logistics does not significantly affect the performance of manufacturing firms in Kenya.
5. H_0: Supply chain ecocentricity does not significantly moderate the relationship between GSCM practices and firm performance in Kenya.

1.5 Justification of the Study

Generally speaking, GSCM is the combination of economic and ecological efficiency to add more value with less environmental impact. It combines environmental and economic performance by enhancing the efficiency of production processes and creating new and better products and services using fewer resources and generating less pollution along with the entire value chain (Pagell & Wu, 2009). The emphasis of green SCM is not only

on resource use and pollution reduction but rather on value creation along with resource use and pollution minimization; which is a move towards sustainable growth. Therefore two primary justifications informed this study:

The first, from the outcome of the study, there would be a justification for firms to engage in green SCM practices as a strategy to improve both financial and environmental performance thereby moving towards sustainable growth which is one of the foundations of Kenyan Vision 2030 (GoK, 2007).

The second is that the study findings might shift environmental management focus from the statutory driven to business strategy driven which might shape firms' propensities to engage in environmental practices and have a greater impact on the natural environment management. Research implications of these contributions might benefit scholars and the arising managerial implications might benefit practitioners as discussed below:

1.5.1 Research Implications

There might be a number of research implications from the results of this study. Empirical research on performance outcomes from GSCM practices is limited, conflicting, and often inconclusive (Vachon & Klassen, 2008).First, this research empirically investigated green SCM practices and their impact on firm performance. The conclusions of the empirical study would contribute to a greater understanding of the relationship between green SCM and firm performance to the current knowledge in this area.

Lastly, this study used the concept of environmental management from management literature and expanded its role into the SCM literature. The inclusion of environmental practices in this study might contribute to the SCM literature as both the operationalization and empirical testing of these constructs are currently limited.

1.5.2 Managerial Implications

This study provides a number of potentially valuable insights for managers. Despite the scholarly and practitioner interest in green SCM, the literature has struggled to provide managers with applicable ideas and courses of action to manage green practices in supply

chains that ultimately improve performance (Pagell & Wu, 2009). The results of the empirical research in this study might provide managers with information on the nature of the relationship between green supply chain management and firm performance. Furthermore, the empirical results might help managers recognize that internal corporate cultures, in the form of environmental orientations aimed at improving firm performance may lead to the formation of Green SCM practices. This may be in contrast to the assumption some managers make that the implementation of environmental practices is based solely on external pressures and threats.

1.5.3 Policy Makers

A regulatory framework is a system of rules and the means to enforce them, usually established by a government or authority (Srivastsava, 2006). The outcome of the study might provide the government agencies with information that can be used for policy development focusing on environmental management by the manufacturing firms.

1.6 Scope of the Study

The study examined the effect of GSCM practices on the performance of manufacturing firms in Kenya. According to Klassen and Johnson (2004); and Christopher and Peck (2004), GSCM practices fall into four primary dimensions of supply chain management: green purchasing (in- bound greening), green manufacturing, green distribution (out-bound greening) and environmentally-oriented reverse logistics. These four dimensions of SCM capture key dimensions of Green SCM practices (Zhu *et al*., 2008) and formed the depth of Green Supply Chain Management practices for this study. The effect of supply chain ecocentricity as a moderating factor on the combined practices of GSCM was also tested. Supply chain ecocentricity is defined in this study to include; partnering with external stakeholders for environmental research, getting sponsorship for implementation of environmental management practices from the external stakeholders, participation in external stakeholders' eco-oriented workshops, environment fit through engagement with external stakeholders, environmental benchmarking with external stake holders and advance knowledge for environmental management practices from external stakeholders (Tate *et al*., 2011).

Fugate, Mentzer and Stank, (2010); Christopher and Peck (2004) all used cost efficiency and environmental differentiation as two dimensions of measuring firm performance. Shepherd and Gunter (2006) singled out the two as some of the reliable dimensions of looking at firm performance. Therefore, for this study, firm performance was measured through cost efficiency and environmental differentiation. The study was confined to the manufacturing firms which were members of Kenya Association of Manufacturers, (KAM, 2014). The Kenya Association of Manufacturers directory listed a total of five hundred and sixty six (566) manufacturing firms as members across the country. The study was limited to the manufacturing industry because it is believed to be the main cause of the emerging environmental problems due to the nature of its traditional business operations (Lee, 2008).

1.7 Limitations of the Study

All research designs and methods are flawed and limited in their validity (McGrath & Brinberg, 1983). It is desirable for researchers to maximize generalizability, precision in control, and realism of the context in any research project; all other things being equal or held constant (McGrath & Brinberg, 1983). In reality, however, research is plagued by the "three-horned dilemma" that arises with the very choice researchers make: as one desirable trait is maximized, the other two are diminished (McGrath & Brinberg, 1983).

Survey methodology, in particular, is strong in its ability to maximize the generalizability of the findings. It is weaker in the areas of precision in control and realism of the context. Precautions were taken in this research to ensure participants answered the questions based on their understanding of their positions and the firms where they work. The wordings of the survey questions were carefully undertaken before and after the pre-test to ensure the questions were relevant and applicable to the participants. Both actions were used to improve control and realism.

Despite these precautions, key limitations in the empirical study were present. These include the weaknesses associated with cross-sectional surveys (Saunders, Lewis & Thornhill, 2000), and constraints on the depth of information provided in survey

ISSN 2320-9186

methodology research (Lilien & Kacker, 2002). The use of a cross-sectional survey limited the investigation of GSCM to a point in-time assessment. A single cross-section survey restricted this study's ability to capture long term effects and changes. By contrast, longitudinal research designs might have captured changing phenomena without relying on static assessments.

Related to survey methodology, the depth and breadth that can be obtained through the Likert-scale type surveys is limited. Survey items are designed to measure properties of a latent variable. To that extent, the variance obtained from Likert-scales answers is the only additional information that can be captured from participants' responses. Thus, this study might have been unable to capture any additional information that might have related to the phenomenon under investigation. For example, it would have been interesting to understand participants' views on other types of green practices in SCM, additional ways in which green SCM benefits the firm and constraints to the implementation of green SCM practices. Answers to all of these questions might have provided additional information about the relationships among the constructs in the theoretical model. However, there was an attempt to solve these through open ended questions in the data collection instrument.

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CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section reviewed literature on the effect of GSCM practices on the performance of the manufacturing firms. The theoretical literature broadly relating to green supply chain management and literature relating to firm performance was reviewed. Various dimensions of GSCM practices were considered in terms of the understanding offered by Klassen and Johnson (2004); green procurement, green manufacturing, green distribution and environmentally-oriented reverse logistics. Supply chain ecocentricity literature was reviewed according to Pagell and Wu (2009) view. This was followed by a consideration of the dimensions of firm performance of cost efficiency and environmental differentiation. A conceptual model was formulated from the theoretical review and empirical literature was reviewed on different aspects of the study. A critique of the reviewed literature is presented. This is followed by identification of the research gaps and finally, the chapter's summary.

2.1 Theoretical Framework

Klassen and Johnson (2004) define GSCM as the intra- and inter-firm management of the upstream and downstream supply chain aimed at minimizing the overall environmental impact of both the forward and reverse. Zhu *et al.* (2008a) highlighted that GSCM is about greening basic supply chain management practices; purchasing, manufacturing, distribution and reverse logistics. Other theorists have defined green supply chain management as the planning and coordination of basic business practices or processes in a manner that reduce or eliminate waste and pollution, eliminate hazardous materials, consider product life-cycles, review supplier environmental performance, emphasize environmental compliance, minimize the environmental impact of the firm's operations, and remediate environmental problems (Rao 2002; Klassen & Johnson 2004; Handfield *et al*. 2005; Zhu *et al*. 2008a; Stock, Boyer & Harmon 2010). Sarkis, Zhu and Lai (2010) define it as integrating environmental concerns into the inter-organizational practices of

SCM including reverse logistics. Complimentary to the above definition, Zhu and Sarkis (2004) present the four dimensions of GSCM as green procurement, green manufacturing, green distribution and environmentally oriented reverse logistics. Seuring (2004) asserts that in spite the huge interest in the subject of green SCM, a definition of the subject is hard to pin down because of the diverse descriptions used by a host of researchers. Whatever the definition of green SCM is adopted by various authors, this study espouses the concept that green SCM is about integrating environmental concerns into the inter-organizational practices of SCM including reverse logistics (Sarkis *et al*. 2010).

According to Ketchen and Hult (2007), the selection of the right theory for defining and understanding green SCM concept creates puzzling problem for researchers. According to Cooper and Schindler (2011), a theory is a set of systematic interrelated concepts, definitions and propositions that are advanced to explain and predict a phenomenon However, Connelly, Ketchen and Slater (2010), advocate for the advancement of organizational theory in defining and understanding green SCM concept. Organizational theory is defined as a management insight that can help explain or describe organizational behaviors, designs, or structures (Connelly *et al*., 2010). Green supply chain management literature is therefore reviewed in this section according to theorists that focus on the ecological modernization, resource based view, stakeholder, corporate environmental responsibility and social network. These theories are used as the theoretical ground for this study as discussed in the next section.

2.1.1 Ecological Modernization Theory

Ecological modernization theory (EMT) has its underpinnings in sociological theory and has been further developed into policy and organizational theories (Spaargaren & Mol, 1992). As a systematic eco-innovation theory, EMT is geared towards jointly achieving industrial development and environmental protection through innovation and technological development, or 'modernity' (Jänicke, 2008; Murphy & Gouldson, 2000).

EMT has been widely used to explain environmental planning by firms and the restructuring of production in a way that lessen environmental impact by major manufacturers (Murphy, 2000). Jänicke (2008) explains that firms that decided to ecologically modernize their business practices in Germany benefited from improved performance both economically and environmentally. Murphy and Gouldson (2000) offer a conceptual model of GSCM with ecological modernization (EM) as core to GSCM research which considers eco-design, modernize machines, collaboration with vendors and ISO14001 certification of vendors as latent variables. Gibbs (2000) offers green procurement and green manufacturing as elements of eco- supply chain modernization by firms in improving both environmental and economic performance.

EMT suggests that ecological regulations and policies can motivate GSCM practices amongst manufacturers (Jänicke (2008). To promote GSCM related practices, proper institutional arrangements and legal frameworks by governments are needed (Kassolis, 2007). Some researchers have argued that EMT is the basis of environmental policy integration by manufacturing firms (Gibbs, 2000), and such environmental policy is necessary for GSCM development (Berger et al., 2001).

The practice of GSCM is consistent with the concept of environmental innovation from the EMT view, that is, manufacturers implement GSCM through hard (e.g., cleaner production equipment) and soft (e.g., increased supplier collaboration in eco-design) technological innovations (Zhu et al., 2010c). Industrial ecology, of which GSCM is an important aspect, can help to achieve sustainable development as an important ecological modernization concept (Huber, 2000).

Practical proof that GSCM is related to EMT has included a study of the Danish textile industry with observations that environmental innovation among enterprises builds new competencies with their enterprises as well as in their supply chains (Søndergård et al., 2004). Using EMT as an explanatory theory, an empirical study among German companies shows that technological environmental innovation most often occurs at the upstream of a supply chain, but not the downstream side (Huber, 2008b). Thus, an

enterprise should mainly work with suppliers rather than customers to improve its performance.

EMT-based GSCM studies explain how environmental policy can promote the adoption of GSCM and demonstrate that GSCM can bring both economic and environmental performance (Hall, 2001). Revell (2007) uses EMT in explaining the association between ecological improvement of manufacturing processes by firms and their performance. He explains that through eco-modernization of machines and processes, firms are able to reduce solid waste, lower hazardous material, conserve energy and increase customer loyalty thus improving firm's performance. EMT stresses on eco-modernization of machines and processes as a cornerstone for understanding and defining GSCM practices.

2.1.2 Resource Based View

The resource-based view of competitive advantage suggests that competitive advantage may be sustained by harnessing unique resources that are rare, valuable, non-substitutable and imperfectly imitable (Hart & Dowel, 2010). Helfat and Peteraf (2003) define a firm's resources as ''all assets, capabilities, organizational processes, firm attributes, information, and knowledge controlled by an enterprise that enable the firm to conceive of and implement strategies with the goal to improve its efficiency and effectiveness (competitiveness)''.

Helfat and Peteraf (2003) and Hart and Dowel (2010) extended the resource based view to include the integration of dynamic capabilities and natural resources. In contrast with EMT, which explains and defines GSCM in terms of eco-modernization of machines and processes, the RBV projects GSCM as a resource with the capability of offering customers' quality, flexibility, and environmental performance (Vachon & Klassen 2006b). Creating these operational capabilities through greening of supply chains supports the value, rarity, inimitability, and non-substitutability facets of the RBV (Helfat & Peteraf, 2003).

Vachon & Klassen (2006b) avers that business management practices tagged with ecological thinking is a potential source for unique resources with capability of

ISSN 2320-9186

improving the overall performance with a positively significant effect on environment. Vachon & Klassen (2006b) offers a model of GSCM with firm performance as the dependent variable, with clearly defined explanatory variables relating to green practices. Lai, Cheng & Tang (2010) list green procurement, green manufacturing and green distribution as some of the key strategic resources that firms may use to gain competitive advantage. Using RBV lens, Sarkis (2009) defines GSCM as a strategic resource capable of improving reputation, image and economic performance of a firm.

Interestingly, when considering the values associated with greening the supply chain, the competitive advantages are not necessarily in the upstream (vendor management) stages of the supply chain (read EMT) as they could even be larger in the downstream (customer) stages within green distribution, green marketing capabilities and resources (Shang, Lu &Li, 2010; Lai *et al*., 2010). Hart and Dowel (2010); Lambert & Burduroglu (2000); Stock *et al*. (2002); Cheng & Tang (2010) while using RBV, considered environmentally-oriented reverse logistics practices as an important intangible asset of the firm capable of improving firm performance through image enhancement, improved efficiency and effectiveness in management of returned materials, reduction of regulatory compliance costs and getting new profits from sale or recycling of recovered products. According to them, eco labeling of products, reduction of packaging, recycling and reuse of wastes and collaborating with suppliers for eco-design are used as indicators of green practices within supply chain.

Lai *et al.* (2010); Gold et al. (2010); Sarkis *et al.* (2010) consider green procurement practices such as preferences to recycled products, environmental audit of supply base, consideration of ISO 14001 as criteria for selecting vendors, preferences to products which consume fewer natural resources and collaboration with vendors in solving environmental issues as unique firm resources with the ability to promote cost efficiency and environmental differentiation of an enterprise.

Environmentally-leaning reverse logistics dimensions of greening supply chains have also seen inquiry of how internal organizational resources mediate the relationship to

external forces (Sarkis, Gonzalez & Adenso, 2010). For example, it is difficult to substitute and imitate training which is an important investment in internal capabilities that allow organizations to respond to various supply chain pressures (Lai et al., 2010). On the other hand, a lack of capabilities and resources make the realization of environmentally-oriented reverse logistics practices difficult (Sarkis *et al*., 2010; González-Torre, Álvarez, Sarkis & Adenso-Díaz, 2009). According to González-Torre *et al*. (2009) these resources are difficult to come by and thus may be strategically advantageous to firms that have implemented these GSCM practices.

2.1.3 Stakeholder Theory

Freeman (2005) defines a stakeholder as "any group or individual who can affect or is affected by the activities of an organization's objectives". Stakeholder theory suggests that companies produce externalities that affect many parties (stakeholders) which are both internal and external to the firm (Maignan & Mcalister, 2003). Externalities often cause stakeholders to increase pressures on companies to reduce negative impacts and increase positive ones (Björklund, 2010).

Gunther & Scheibe (2005) provided statutory requirement by governments and stakeholder demands as a forms of pressure on firms to reduce negative impacts on ecosystem. They noted that even though they are the common forms of pressure, they have been less effective compared to internal directives such as motivation to increase performance.

Björklund (2010) uses the following categorizations to group stakeholders: direct or indirect, primary and secondary, or based on multiple dimensions of legitimacy, urgency, and power. Thus, many developments and directions for stakeholder theory do exist, but the basic premise is that internal and external groups will influence organizational practices (Maignan & Mcalister, 2003). Environmental externalities may be internalized through these stakeholder pressures within and between supply chain members (Gunther & Scheibe, 2005). Thus Wuyts *et al*. (2004) look at GSCM as a strategy of managing companies or firms externalities that may affect stakeholders. Zhu *et al*. (2008) suggest

an association between GSCM practices and the performance of firms as a result of a fit between stakeholders' and such firms. By managing externalities, these firms are able to gain acceptability within the various stakeholders thereby gaining customer loyalty.

Stakeholder analysis for GSCM is especially pertinent as there are views that not all GSCM practices are conducive for generating competitive advantages for enterprises and are absolutely necessary due to pressures from stakeholders (Gunther & Scheibe, 2005). Stakeholder theory is introduced as an explanatory theory related to an association between GSCM practices and firm performance. Specific stakeholder influences green purchasing (Björklund, 2010; Maignan & Mcalister, 2003); green manufacturing in the supply chain (Sarkis et al., 2010); environmentally-oriented reverse logistics (Sarkis et al., 2010); greening the distribution in supply chains (Zhu *et al*., 2008), and in general, GSCM practices have received research attention under the stakeholders' theory lens (Chien & Shih, 2007; González *et al*., 2008).

Maignan & Mcalister (2003) argue that firms that fail to gain acceptance from the relevant stakeholders due to negative externalities are likely to perform poorly compared to those that gain acceptance as a result of deliberate strategic implementation of GSCM practices. Identifying and investigating the roles of various stakeholders within GSCM practices has also been an application approach by researchers utilizing stakeholder theory (Gunther & Scheibe, 2005). Sarkis *et al*. (2010); Tate, Ellram and Kirchoff (2010) all use stakeholders theory to explain the adoption of GSCM practices by firms as a result of pressure from various stakeholders as a way of managing the effects of their externalities.

2.1.4 Corporate Environmental Responsibility Theory

Understanding the evolution of the relationship between the business environment and the natural environment is important to better understand the nature of the research questions and the proposed theoretical framework in this study. A review of the literature in this section lays the foundation for the current scholarly thoughts on corporate environmental responsibility.

ISSN 2320-9186

The relationship between business and the natural environment has its origins in the concept of Corporate Social Responsibility (CSR). CSR is broadly defined as the responsibility expected of businesses to maintain the social norms of the communities in which they operate and behave at a level that is "congruent with prevailing social values and expectations of performance" (Rao & Holt, 2005). Thus according to Davis (2009) and Lacroix & Stamatiou, (2007), the society concurrently expects businesses to work for the betterment of society while remaining a profitable business entity.

Research suggests that a corporation's social responsibility, responsiveness to demands from the communities in which they operate, and performance are all related (Rao & Holt, 2005; Lacroix and Stamatiou, 2007). Rao & Holt (2005) identify environmental management as a key indicator of CSR. Firms that take steps such as; collection of used packages for proper disposal, eco labeling of products, accept recycling and re-use of packages, use organic packages and educate customers on proper disposal of used packages as a mechanism of reducing the impact of their operations on the natural environment are generally viewed positively by the society (Lacroix & Stamatiou, 2007), resulting in increase on market share and customer loyalty which in turn positively contribute to firm performance (Rao & Holt, 2005).

In essence; firms can succeed financially when they focus on social responsibility (Hoffman, 2000). This occurs because focusing on CSR not only lowers the potential for costly litigation and helps firms' reputations, but also helps firms identify wasteful activities that, if eliminated, would make the firm more efficient (Hoffman, 2000).

The social performance demands on businesses have expanded to include environmental values and responsibilities, as concerns over the negative environmental impact of commercial and manufacturing activities have grown (Preuss, 2005; Rugman & Verbeke, 1998). Thus Preuss (2005) offers a model of GSCM with corporate environmental responsibility as central to the implementation of GSCM practices.

Harris (2007) defines GSCM practices as firm practices geared towards internalizing firms' environmental responsibility to the society. He singled out green procurement, green manufacturing and green distribution as some of the practices with the potential of responding to the society environmental demands and at the same time improves the performance of the firm. It is important to mention here that the intersection of social, economic, and environmental responsibility in the firm is what Elkington (1997) as sited in Harris (2007) calls the triple bottom line.

The concept of the triple bottom line, and sustainability, while no less important than environmental and economic responsibility, is not included in the concepts under investigation in this proposal. The scope of this study concentrated on environmental and economic responsibility in the supply chain and in supply chain management, and their potential impact on firm performance.

2.1.5 Social Network Theory

Social network theory (SNT) has been suggested by Connelly *et al*. (2010) as a suitable theory to help understand general sustainability developments by firms. SNT considers organizational outcomes as a function of the social relationships between firms or individuals in a firm (Wuyts, Stremersch, Van Den Bulte & Franses, 2004). Firms make decisions according to information and influence from their social networks (Wuyts *et al*., 2004). According to Connelly *et al*. (2010), SNT examines the network structures and its role in the diffusion of management practices. An organization can gain benefits by bridging structural holes in a social network (Wuyts *et al*., 2004).

Wuyts *et al*., (2004) outlines density and centrality as two major elements in SNT. Density measures the relative number of ties in the network that link players' together (Wuyts et al., 2004). Network centrality refers to the position of an individual organization in the social network and its ability to control the flow of information (Wuyts *et al*., 2004). There are two issues related to managing external pressures that arise from these characteristics. As density increases, the ability to resist external

pressures from network members decreases. As network centrality increases, the ability to resist external pressures increases.

Few studies within the GSCM research stream have explicitly utilized SNT (Connelly *et al*., 2010). However, GSCM studies on buyer-supplier relationships for performance improvement can be explained or constructed around using an SNT lens (Connelly *et al*., 2010). For example, Green *et al*. (1996) as quoted in Connelly et al. (2010) establish that at least three types of environmentally related dimensions between customer and supplier relationships have been studied. One is the environmental requirements in industrial buyer-supplier relationships such as purchasing requirements, employee training, and certification under the ISO 14000 series requirements. Consumers' requirements are also SNT-related such as requirements for organic foods which can green the whole supply chain (Wuyts *et al*., 2004).

A second dimension is investigation concerning environmental information sharing for organizational practices such as new product development (Zhu & Liu, 2010). A third dimension is more cooperatively focused, such as environmental collaboration for co-developing recyclable products and cleaner processes (Maignan & Mcalister, 2003). Social networks are multidimensional since organizations that cooperate with customers tend to cooperate with suppliers, showing greater potential for achieving environmental success (Wuyts *et al*., 2004).

Using the notion of density from SNT, it is observed that firms with a greater number of locations, customers, suppliers, and general awareness in the public are likely to be under greater pressures to adopt GSCM practices and have less control on whether to adopt or not to adopt (Maignan & Mcalister, 2003). Using the notion of centrality, it is observed that firms can control pressures to adopt GSCM practices much more effectively, leaving the choices of adoption more in the control of the firm. Thus, Wuyts *et al*. (2004) posit that SNT explains the behavior of organizations in responding to social preferences for organic food, clean air, water and clean environment through green supplier development, eco-design. Zhu and Liu (2010) use SNT in understanding the diffusion of

GSCM from proactive firms to lagging firms. For example, the diffusion of eco-design from the experienced parent firm in a developed country to a subsidiary firm in a developing country. Table 2.1 summarises the theories related to the study.

Table 2. 1 Summary of Theories Related to the Study

Theory	General conceptualization	Theory application
Ecological Modernization (EMT)	EMT is concerned with jointly achieving industrial development and environmental protection through innovation or 'modernity' (Jänicke, 2008)	• EMT is applied in this study to explain restructuring of production in a way that lessens environmental impact by manufacturers through GSCM related practices (Kassolis, 2007). • The practice of GSCM is consistent with the concept of environmental innovation from the EMT view (Zhu, Sarkis et al., 2010).
Resource Based View (RBV)	The resource-based model suggests that competitive advantage may be sustained by harnessing resources that are valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991).	• Extension of RBV to the competitive advantages across the supply chain can also be applied to greening of supply chains (Gold et al., 2010). • Internal organizational resources mediate the relationship to external forces (institutional forces) and GSCM practices adoption (Sarkis et al., 2010).
Stakeholder Theory	Stakeholder theory suggests that companies	• Specific stakeholder influences green-purchasing (Maignan & Mcalister,

	produce externalities that affect many parties (stakeholders) which are both internal and external to the firm (Matos & Hall, 2007). Externalities often cause stakeholders to increase pressures on companies to reduce negative impacts and increase positive ones (Chien & Shih, 2007)	2003); green-distribution (Matos & Hall, 2007); environmentally oriented reverse logistics (Sarkis et al., 2010); 'green-manufacturing (Zhu, Sarkis, & Lai, 2008) and general GSCM practices (Chien & Shih, 2007). • Identifying and investigating roles of various stakeholders within GSCM practices has also been studied (Gunther & Scheibe, 2005).
Corporate Environmental Responsibility Theory	The social performance demands by society on businesses have expanded to include environmental values and responsibilities (Preuss, 2005; Rugman & Verbeke 1998).	• Society concerns over the negative environmental impact of commercial and manufacturing activities have grown (Preuss, 2005). As such, firms are increasingly embracing GSCM practices as a way of addressing the environmental concerns of the society (Rugman &Verbeke 1998). • Firms have made it their responsibility of ensuring their activities do not negatively impact on the environment (Preuss, 2005).
Social Network Theory (SNT	SNT considers organizational outcomes as a function of the social relationships	• GSCM studies on buyer-supplier relationships for performance improvement can be explained or constructed around using a SNT lens

between organizations or individuals in an organization (Jones *et al*., 1997). SNT has been described as having two major elements, namely density and centrality (Rowley, 1997).

(Maignan & Mcalister, 2003).

- Using the notion of density from SNT, it is observed that organizations with a greater number of locations, customers, suppliers, and general awareness in the public are likely to be under greater pressures to adopt GSCM practices and have less control on whether to adopt or not to adopt (Maignan & Mcalister, 2003).

2.2.1 Green Procurement and Firms' Performance

Many organizations worldwide are making an effort to purchase products and services that are less harmful to local and global environments (Lacroix & Stamatiou, 2007). Both public and private sector organizations are implementing purchasing practices that include environmental and social considerations—green procurement (Taylor, David & Walley, 2003). "Green Procurement" (formerly known as Affirmative Procurement) is the purchase of environmentally preferable products and services in accordance with one or more of the established "green" procurement preference programs (Vershuren, 2002). Green procurement is the purchasing of products or services which have a lower impact on the environment over their whole life cycle than the standard equivalent. It involves the integration of environmental issues into purchasing decisions based on price, performance and quality (Zisis, 2003).

This means that products or services that consume fewer natural resources should be given preference over competing products or services exerting a greater environmental impact. To prevent waste and pollution, these programs require considering environmental impacts, along with price, performance, and other traditional factors, when making purchasing decisions (Lacroix, 2008). For this study, the typical green procurement programs are: using machines or tools which consume less energy, water, and fuel, impact and life cycle assessment tools for manufacturing, risk assessment for

energy and resource use, environmental friendly raw material, efficient processes to reduce solid waste, air emissions and conserve energy and environmental management system (ems) (Lacroix 2008; Zhu *et al*. 2008; Melnyk *et al*. 2003; Newbold, 2006)

According to Lacroix and Stamatiou (2007), Japanese and European leading companies that decided to go along with green procurement activities are experiencing tangible benefits. Strategic sourcing can create value through increased overall cost efficiency, enhanced reputation through product differentiation, market share, and reduced environmental risks and liabilities (Lacroix & Stamatiou, 2007). Lacroix (2008) established that by reducing supplier-generated wastes and surpluses, firms decrease handling expenses and risks associated with waste disposal. In addition, a supplier's savings from improved efficiencies may be passed along to buyers in the form of reduced prices.

Lacroix and Stamatiou (2007) and Lacroix (2008) all agree that green procurement practices help firms to be cost efficient through lowering waste management fees, lowering hazardous material management fees, less time and costs for reporting; savings from conserving energy, water, fuel and other resources. Environmental considerations in procurement decisions enable firms to produce products with minimal impact to the natural environment thus differentiating the products from the rest (Lacroix, 2008). Cost efficiency is the extent to which a firm is able to convert or transform resources / inputs (such as raw material, funds, expertise, time, etc.) economically into results in order to achieve the maximum possible outputs, outcomes, and impacts with the minimum possible inputs (Lacroix, 2008). Handfield *et al*. (2005) also find firms that implement green procurement practices are able to improve efficiency by reducing landed costs of products, reducing disposal costs, reducing costs of complying with hazardous materials regulation and producing products which are unique.

Green procurement has also been linked to cost, a measure of efficiency in performance. Support for green practices from top management and employee commitment to green operations conveys a sense of importance to meeting customer expectations thereby

ISSN 2320-9186

improving the public image, brand and goodwill of the firm (Zhu *et al*. 2008). Management and employee commitment to green procurement practices encourages innovation and technological advancement in processes and practices in the supply chain that ultimately help reduce the cost of operations due reduced cycle times, product development, and environmentally-oriented reverse logistics programs (Krikke, Blanc & Van de Velde, 2003). Moreover, empirical research has found evidence that speed and delivery, which are traits of efficiency, positively impact on the cost of production of firms that prioritize green procurement practices (Vachon & Klassen 2006a; Zhu *et al*. 2008). Using RBV, Hart and Dowel, (2010) suggest firms that move to practice green procurement as a strategic resource will have higher chances of minimizing the cost of production through lowering waste management fees, lowering hazardous material management fees, less time and costs for reporting; savings from conserving energy, water, fuel and other resources which will positively impact on performance. Therefore, the following hypothesis was tested:

> *H_0: Green procurement does not significantly influence performance of manufacturing firms…… Hypothesis 1*

2.2.2 Green Manufacturing and Firms' Performance

"Sustainable manufacturing (Green Manufacturing) or Green Production is defined as the creation of manufactured products that use materials and processes that minimize negative environmental impacts, conserve energy and natural resources, are safe for employees, communities, and consumers and are economically sound " (Phungrassami, 2008). Green Manufacturing is part of a continuous improvement strategy helping manufacturers improve their productivity, profitability and competitiveness (Lacroix, 2008). Green seamlessly integrates with Lean Manufacturing practices to optimize processes resulting in improved environment, worker health, waste reduction and reduction of disposal costs, optimization of the use of raw material and maximization of safety, water and energy performance, and the reduction of the costs of complying with hazardous materials regulation (Lacroix & Stamatiou, 2007).

ISSN 2320-9186

In the words of Phungrassami (2008), green manufacturing practices include: material and resources selection, optimization of resources, process improvements, energy conservation, water conservation, assessments and audits, regulatory compliance, ISO 14001, environmental management system (EMS), and OHSAS 18001 (Occupational Health And Safety Management System). However, Newbold (2006) mentions design for sustainability, green machine tools, sustainable packaging, impact and life cycle assessment tools for manufacturing (including embedded energy, materials, water, consumables), risk assessment for energy and resource use and enterprise carbon accounting as practices for green manufacturing. Nevertheless, this study will follow Newbolt's (2006) view on green manufacturing indicators.

Generating waste costs money through payment for it three times over - when buying it, when processing it and when disposing it (Christmann, 2000). Green Manufacturing program improves environmental performance and increases profitability of a firm by minimizing waste throughout transformation processes (Banerjee, 2003). Using environmental best practices to eliminate the "other wastes" is the next logical step in improving firms' performance (Banerjee, 2003). Lacroix and Stamatiou, (2007) outline the benefits of green manufacturing to include: reduction of scrap and rework, reduction of hazardous wastes, improvement of environmental performance, prevention of compliance and liability costs, reduction of quantity of raw materials, resource and energy required to realize cost effective products. According to Lacroix and Stamatiou (2007), firms in both sectors are realizing the benefits of green manufacturing practices such as customer loyalty due to health consideration, competitive price as a result of cost savings from reduced energy consumption, resource use, and material management. They also reap more qualitative benefits such as improved image and achieve general acceptability due to response to society concerns.

Leading private sector organizations have demonstrated significant movement towards greening manufacturing practices. Many private firms are working to improve the environmental performance of their operations and products and green manufacturing has

been a logical extension of this work (Banerjee, 2003). Both public and private sector organizations have in the last two decades adopted green manufacturing practices such as environmentally-friendly raw materials; substitution of environmentally questionable materials; taking environmental criteria into consideration; environmental design considerations; optimization of process to reduce solid waste and emissions; use of cleaner technology processes to make savings in energy, water, and waste; internal recycling of materials within the production phase; and incorporating environmental total quality management principles such as worker empowerment (Banerjee, 2003).

Mentzer *et al*. (2001), Min and Mentzer (2004), and Min *et al*. (2007) establish a critical relationship between GM and environmental differentiation. They explain that the process of managing strategic resources can be a key factor of differentiation. As competitors may hold similar types of resources, the management and use of the resources can ultimately create a competitive difference among organizations. Firms that most effectively manage their resources to differentiate themselves can gain a competitive advantage and potentially improve the financial performance of the firm (Zott, 2003). According to Mentzer *et al*. (2001), Min and Mentzer (2004), and Min *et al*. (2007), firms which have embraced GM practices have higher potential to improve their performance through provision of the overall value to the end customer that differentiates them from the competition. Thus the study tested the following hypothesis:

> *H_0: Green manufacturing does not significantly influence performance of manufacturing firms…… Hypothesis 2*

2.2.3 Green Distribution and Firms' Performance

On the outbound side of the green supply chain (green distribution), green marketing, environment-friendly packaging, and environment-friendly transportation, are all initiatives that might improve the environmental performance of an organization and its supply chain. Management of wastes in the distribution processes such as re-usable packaging can lead to cost savings and enhanced competitiveness (Rao & Holt, 2005). Many of these initiatives involve compromises between various logistics functions and

environmental consideration in order to improve the environmental performance of an organization (Wu and Dunn, 2008).

The RBV paradigm explains that firms create strategies through bundling strategic resources that are based on efficiency-advantages in the firm that can be used to improve a firm's supply chain processes (Sirmon *et al*., 2007). To be successful, these bundled resources need to have dynamic qualities and to be adaptable to the ever-changing business environment (Sirmon *et al*., 2007). Strategic resources that are identified and used to create environmental strategies are the product of a firm's culture of environmental responsibility and the recognition that combining environmental and economic concerns can create value for the firm (Rao & Holt, 2005). Wu and Dunn (2008) identify warehousing and packaging design as the two most important issues in distribution. They argue that strategic green distribution practices such as standardized reusable containers, minimize use of packages, good warehousing layouts, and easy eco-information access reduce storage and retrieval delay which leads to savings in operating costs with an ultimate effect of improved firms' performance whilst being environmentally sound.

As part of outbound logistics, green distribution has an important part to play in the link between environmental innovation and competitive advantage (Preuss, 2005). The impact of green distribution on customer relationships has been narrowly investigated (Zhu and Sarkis, 2006). Encouraging suppliers to use re-usable packages is a form of green initiative that can be an important consideration in greening the distribution function, with a study by Rao and Holt, (2005) identifying an increase in market share amongst companies that implemented an environmentally-friendly packaging scheme. Wu and Dunn (2008) establish an increase in customer loyalty amongst companies that eco-labeled products. According to Ninlawan et al. (2011), firms which packaged their products with re-usable packages in Thailand registered high degree of customer satisfaction in terms of customer service and loyalty in terms of the brand.

Currently, most products in the market come in a form of packaging that prevents the product from damage and makes the product easy to handle (Ninlawan *et al*., 2011). The use of packaging, whether it is made of glass, metal, paper or plastic, contributes heavily to the solid waste stream to the environment (Rao & Holt, 2005). In order to address these environmental impacts from packaging, many countries now have programs and legislation with heavy penalties that aim to minimize the amount of packaging that enters the waste stream, such as the Packaging Directive in the EU (Christmann, 2000). Recycling and re-use are key strategies that are adopted and several organizations in South East Asia actively participate in packaging reduction programs (Rao & Holt, 2005). For instance, Amway (Thailand) delivers its detergent and other house cleaning products to customers in plastic containers. After their use, these plastic containers are collected by the Amway sales force, brought back to the company and recycled. The empty paper cartons in which the suppliers deliver the raw materials to the company are given back to the suppliers for re-use (Rao & Holt, 2005). Ninlawan *et al*. (2011) establish that firms that have recycled packages accrue benefits such as minimized waste disposal cost, save money by not buying new packages and eliminate incidental costs associated with new packages (branding ,storage). These have a quantum effect of reducing operating cost, increasing the brand loyalty, hence improving firms' performance. Thus, the following hypothesis was tested:

> *H_0: Green distribution does not significantly influence the performance of manufacturing firms…… Hypothesis 3*

2.2.4 Environmentally-oriented Reverse Logistics and Firms' Performance

In recent years, environmentally-oriented Reverse Logistics has become a major issue for scholars and companies (Lambert & Burduroglu, 2000; Srivastava & Srivastava, 2006). Environmentally-oriented Reverse Logistics or Green Reverse Logistics refers to the process of planning, implementation and efficiently controlling the flow of raw materials, in-process inventory, finished goods, wastes and related information from the point of consumption to the point of origin with the purpose of recovering the primary value or

ISSN 2320-9186

dispose of them properly to minimize environmental impact (Umeda *et al*, 2003). It involves such indicators as waste collection for proper disposal and recycling of used products (re-processing or re-use), recovery of hazardous parts for proper disposal, returning of faulty products for replacement or correction, collection of expired products for proper disposal, accepting exchange of expired products (Umeda *et al*, 2003).

Indeed, several scholars have considered environmentally-oriented Reverse Logistics to be a practice within green supply chain management (Rao & Holt, 2005; Hines and Johns; 2001; Zhu & Sarkis 2004). Gradually, firms give more importance to this aspect, mainly due to three reasons (Srivastava & Srivastava, 2006): the first one is the growing importance of environmental issues and their impact on public opinion (Rao & Holt, 2005), the second reason is benefits that the company gains by improving their return processes such as image enhancement, improved efficiency and effectiveness in management of returned materials, it allows getting new profits (Lambert & Burduroglu, 2000; Stock *et al*., 2002) the third one is new and growing environmental regulations (Stock *et al*., 2002). Thus, environmentally-oriented Reverse Logistics is termed as Green Reverse Logistics (Guth & Ginsberg, 2001). GRL is essential because of its potential in improving the organization's overall performance (Guth & Ginsberg, 2001)

Many research works have demonstrated that environmentally-oriented Reverse Logistics is important to enhance organizational performance (Umeda *et al*, 2003; Lambert & Burduroglu, 2000; Stock *et al*., 2002). Environmentally-oriented Reverse Logistics could be considered as an important intangible asset of the firm (Hart and Dowel, 2010). Thus organizations that have been taking account of these assets have obtained benefits that could support competitive advantage (Stock et al., 2002). Through this intangible, the firm is able to increase value of its products and service, a much more meaningful interaction with customers, develop new skills in workers to recover the economic value of life products and all of this is reflected on performance (Umeda *et al*, 2003). Developing an environmentally-oriented Reverse Logistics programme is also extremely important for increasing organizational performance (Umeda *et al*, 2003).

Furthermore, the growing importance of environmentally-oriented Reverse Logistics programs is related to the supposed advantages or benefits for the organization, for example, it develops and maintains a beneficial customer service policy and reduces costs, it improves the return processes, it improves the image of the firm, it improves the efficiency and effectiveness in the management of returned materials (Krikke *et al*., 2003), it provides direct and indirect economic benefits such as decreasing costs, reduced use of materials, or obtaining valuable from spare parts (Lambert & Burduroglu, 2000). Consequently, environmentally-oriented Reverse Logistics improves organizational performance (Lambert & Burduroglu, 2000; Krikke *et al*. 2003). Thus the following hypothesis was tested;

> *H_0: Environmentally–oriented reverse Logistics does not significantly affect performance of manufacturing firms…….. Hypothesis 4*

2.2.5 Supply Chain Ecocentricity, Green SCM Practices and Firms' Performance

Pagell and Wu's (2009) case studies' findings suggest that firms which have a proclivity toward environmental sustainability will "reconceptualize who is in the supply chain" such that they will leverage the expertise and skills of environmental external stakeholders. This notion of reconceptualizing the supply chain stems from literature on ecocentricity (Seuring, 2004; Tate *et al.*, 2011), which suggests that firms should consider the well-being and potential benefits gained from learning from their broader constituents in the environment (social, ecological, and industrial). As noted by Pagell and Wu (2009), ecocentricity has been discussed in the literature from a theoretical or conceptual perspective, but has not been the subject of empirical research. Accordingly, this study examines the moderating effect of supply chain ecocentricity on the performance impacts of cumulative practices of green supply chain management. For this study, supply chain ecocentricity is defined as a firm's tendency to engage and learn from environmental external stakeholders (Tate *et al*., 2011)

The importance of supply chain ecocentricity is evident since treating environmental stakeholders as adversaries and responding to their pressures reactively may result in

negative long-term consequences (Pagell & Wu 2009). Firms are pressured by a number of environmentally focused external stakeholders, such as regulatory bodies, government, nongovernmental organizations, and trade associations. Firms that lack supply chain ecocentricity will view these environmental external stakeholders as adversaries (Pagell & Wu 2009). They may regard regulatory bodies and government as coercive pressures (Zhu & Sarkis, 2006) and feel threatened by regulators levying legal penalties and fines if they do not comply with environmental regulation (Sarkis , Gonzalez-Torre & Adenso-Diaz, 2010). They may attempt to satisfy the institutional forces in their social context (Tate et al., 2011) to gain legitimacy with environmental external stakeholders (Bansal & Clelland, 2004) instead of engaging and learning from their latest research.

Thus, their practices to improve environmental performance may be out-of-date with the most current, innovative green supply chain management concepts. If ineffective, such green practices may even be viewed as superficial, "Green Washing" approaches (Bansal & Clelland, 2004). Ignoring the expertise, such as recently revised standards of environmental conduct and compliance (Tate *et al.*, 2011), from environmental external stakeholders may even result in conducting GSCM practices that damage rather than improves the environment. According to Tate *et al.*, (2011), supply chain ecocentricity includes measures such as partnering with external stakeholders for environmental research, getting sponsorship for implementation of environmental management practices from the external stakeholders, participation in external stakeholders' eco-oriented workshops, environment fit through engagement with external stakeholders, environmental benchmarking with external stake holders and advance knowledge for environmental management practices.

Other business organizations, however, actively seek those capabilities embedded in external stakeholders that can enable substantive environmental improvements (Tate et al., 2011). These partnerships reflect an integrative arrangement in which actors across sectors engage in nonhierarchical processes to achieve mutual goals (Visseren-Hamakers, Arts & Glasbergen, 2011). Engaging environmental stakeholders may result in obtaining

insights about cleaner transportation methods or ecological packaging materials of which the firm was previously unaware. Learning from environmental external stakeholders may facilitate more accurate definitions and measurement of standards for green product purchasing and environmental criteria for supplier selection (Tate *et al*., 2011). Thus, firms with a high level of supply chain ecocentricity will proactively engage environmental stakeholders in these efforts to implement practices that are real, measureable environmental performance improvements, which collectively enhance GSCM practices and impact on the firm performance (Banerjee, 2003).

Similarly, engaging and learning from environmental stakeholders should enhance the cost improvements resulting from GSCM efforts. Firms with higher levels of supply chain ecocentricity will be more prone to pay attention to and engage with a broader set of environmental stakeholders. Nontraditional supply chain members such as NGOs, nonprofits, and local governments can offer the newest and most trustworthy expertise in environmental technologies and processes that are most economical (Tate *et al*., 2011). Such expertise should facilitate planning and operational practices that become embedded in organizational routines, improving efficiencies, whereas in less proactive firms they might be nonexistent (Sarkis *et al.*, 2010). Additionally, gaining access to recent environmental technologies and processes will enable reduced conflicts and confusion among managers implementing GSCM, which in turn, decrease costs because those environmental supply chain practices that are selected and implemented should be better aligned with more relevant environmental issues (Sarkis *et al*., 2011). Approaches that foster cooperation and environmental learning from environmental stakeholders should also result in helpful knowledge that mitigates risks in potential legal costs, penalties, and fines associated with GSCM implementation (Banerjee, 2003). Supply chain ecocentricity may even facilitate partnerships with nontraditional environmental supply chain, members who assist in off-setting costs of GSCM investments (Pagell & Wu 2009). Thus, the following hypothesis was tested:

H_0: Supply chain ecocentricity does not significantly moderate the relationship between GSCM practices and firm performance …… Hypothesis 5

2.2.6 Green Supply Chain Management Practices and Firms' Performance

The resource based view (RBV) explains that identification and employment of strategic resources can improve firm performance. The impact of green SCM on firm performance is measured through cost efficiency and environmental differentiation in this study (Fugate *et al*., 2010; Phungrassami, 2008). GSCM practices include assessing suppliers' environmental performance, requiring suppliers to undertake environmental measures, tracking the cost of waste, informing buyers of ways to reduce environmental impact, designing for environment, using green energy, using energy efficient machines, recycling packaging, reducing quantity of packaging, bio-degradable material for packaging, packaging returns, collecting used items for proper disposal, recycling raw material and environmental consideration on buying (Phungrassami, 2008).

Hines and Johns (2001) identify the mentoring role within green supply chain management as an emerging concept that promotes a more significant relationship between the customer and the supplier. According to them, this mentoring culture goes beyond mere product promotion and after sales services but extends towards guiding and supporting customers and requires a substantial change in the attitude of the lead corporations in a supply chain. Indeed they outline specific operational initiatives involved in the mentoring process to be; environment-friendly waste management; 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.

Researchers have identified green strategies and practices that are theorized to create value, are a source of competitive advantage, and improve the bottom line of the firm (Porter & van der Linde 1995; Banerjee, 2003). In addition, research has found that poor environmental performance can actually impair firm performance (Corbett & Klassen,

ISSN 2320-9186

2006). Improving performance may therefore be one of the important motivators for firms that seek to implement green supply chain management practices and processes (Zhu & Sarkis 2006). Fugate et al. (2010) establish a relationship between the four green supply chain management practices (GP, GM, GD and EORL) and firm performance. The cost saving nature of greening initiatives and improved ability to satisfy customer demand for environmentally sustainable products implicit in green supply chain practices should lead to improvement in the overall financial and environmental performance of the organization (Zhu & Sarkis, 2006). Rao and Holt, (2005) demonstrate a significant link between green practices and firm performance. They find that green practices lead to competitiveness and better economic performance. Corbett and Klassen, (2006) were of the view that GSCM dimensions have significant contribution to firm performance. Banerjee, (2003) supported their findings but doubted whether implementation of green distribution practices by firms might provide any significant change on performance. However, Corbett and Klassen, (2006) study the effect of announcements of winning environmental awards by the organizations on stock prices and establish an increase in stock prices of the firms which won the environmental awards. Thus the following hypothesis was tested:

> *H_0: Green Supply Chain Management practices do not significantly influence the performance of manufacturing firms.*

2.2.7 Firm Performance

Stephens (2000) states that "If you cannot measure it, you cannot control it. If you cannot control it, you cannot manage it. If you cannot manage it, you cannot improve it". In fact, the lack of relevant performance measures has been recognized as one of the major problems in process management and the management of supply chain strategies (Lai, Ngai, & Cheng, 2002). Performance measurement is the process of quantifying the value of differentiation and efficiency of various actions of a firm (Williamson, Spitzer and Bloomberg, 2000). Differentiation is when a firm does something unique from competitors in ways that are discernible to the customer (Williamson *et al*., 2000) and

efficiency measures how economically a firm's resources are utilized when providing a pre-specified level of customer satisfaction (Shepherd & Gunte, 2006). Shepherd and Gunter (2006) describe performance measurement of a firm as the overall set of metrics used to quantify both the efficiency and differentiated action. The overall firm performance (P) will be the weighted mean of cost efficiency and environmental differentiation (Frederick, 2006). Indeed the resource based view (RBV) theory explains why some firms are able to create a competitive advantage and superior performance (Ketchen & Hult, 2007). The RBV has also been leveraged to explain the impact of SCM practices on firm performance outcomes. In fact, the motive behind SCM is to improve supply chain competitiveness in order to create value for firms (Ketchen & Hult, 2007) through enhanced efficiency and differentiation (Fugate *et al*., 2010).

Efficiency focuses on reductions to the total cost of supply chain operations, necessary to provide a target level of customer value (Christopher and Peck, 2004) that enhance customer service and customer satisfaction (Cooper & Schindler, 2006). In addition, firm managers are finding that they must work to create value beyond the performance of efficiency in the highly competitive global business environment (Fugate *et al*., 2010).Value can be found through differentiating functions to perform better than the competition (Christopher & Peck 2004). Differentiation, therefore, focuses on creating value for the firm through benchmarking and adherence to best practices to differentiate their supply chains from the competition (Fugate *et al*., 2010). Thus for this study, firm performance will be viewed in two dimensions; cost efficiency and environmental differentiation (Christopher & Peck 2004; Fugate *et al*. 2010). Shepherd and Gunter, (2006) singled out the two as some of the reliable dimensions of looking at firm performance. The two firm performance dimensions of efficiency and differentiation are discussed in more detail in the next sections.

2.2.8.1 Cost Efficiency

Efficiency is defined as a measure of how well resources are employed (Mentzer *et al*., 2001). A key step in value generation for the firm is based on cost reductions and

efficiency improvements (Lambert & Burduroglu, 2000). Measuring firms' efficiency is the comparison of the resources that are used for operations, against the outcomes that are derived and expected from the resource usage (Mentzer *et al*., 2001). Improving efficiency is a primary performance objective of firms (Mentzer *et al*. 2001; Lee, 2002). This is accomplished through the reduction of operating expenses, the efficient use of fixed capital, and the efficient use of working capital, while meeting or exceeding a necessary level of customer service (Lambert & Burduroglu, 2000). These are achieved to a large extent through reduction of cost of inputs, lowering of cost of energy and water, reduction of waste management cost and reduction of hazardous material management cost reduction of environmental related liability cost, reduction of cost of storage, improvement of delivery time, reduction of cost of transportation and reduction product cycle time in the manufacturing firms (Lambert & Burduroglu, 2000).

In essence, efficiency may result when wastes are reduced or eliminated; ideally resulting in reduced costs (Lee, 2002). Therefore, for the purposes of this study, the dimension of efficiency as an indicator of firm performance and a consequence of green SCM practices is defined as cost efficiency in this study.

2.2.8.2 Environmental Differentiation

Supply chain management activities improve performance beyond that of efficiency to be competitive (Fugate *et al*., 2010). Another way that value can be created is through differentiation, or when a firm does something unique from competitors in ways that are discernible to the customer (Williamson *et al*., 2000).

Differentiation can be applied to green aspects of performance (Christmann, 2000). Firms which are able to provide products that are designed, manufactured and supplied to the end customer through processes that are less impactful on the environment can differentiate themselves from the competition (Reinhardt, 2003). Environmental differentiation is defined as environmental management that focuses on environmental product characteristics and environmental product markets (Christmann, 2000). Ultimately, environmental differentiation equates to the ability of managers to create a

unique image of environmentally friendly products and processes that translate to higher demand (Banerjee, 2003).

According to Reinhardt, (1998), environmental differentiation is the degree to which managers find or create a demand for environmental quality in products, establish credible information about environmental claims, and create inimitability of environmental products and supply chain operations. Environmental differentiation can be created via take-back services, recycled materials in products and packaging, the use of non-hazardous materials in manufacturing and packaging, and durable, high quality products (Handfield *et al*. 2005; Preuss 2005). Reinhardt, (2003) added increase of eco-friendly reputation, higher price (premium) compared to competitors, increment in sales from eco-products, expansion of eco- market share, improvement of conservation of energy and water , increment in production of echo-unique products, improvement of echo-management of hazardous material and increment of brand loyalty from eco-branding as critical features of environmental differentiation by firms. Therefore, differentiation, as an indicator of firm performance and as an outcome of green supply chain management practices, is defined as environmental differentiation in this study.

2.3 Conceptual Framework

The objective of this study was to test the hypotheses that relates to GSCM practices, supply chain ecocentricity and relate them to firm performance. The framework of the associations tested is presented in Figure 2.1. According to this model, the association of individual GSCM practices with firm performance was tested. The association of GSCM practices cumulatively with firm performance was tested. Lastly, a test was done to determine the moderating effect of supply chain ecocentricity on the association of GSCM practices cumulatively with firm performance.

Firm performance in this study was taken from Williamson, Spitzer and Bloomberg (1990) view of performance measure. They view performance as a combination of cost efficiency and environmental differentiation. Cost efficiency represents reduction of operation costs and environmental differentiation represents improved reputation and

ISSN 2320-9186

tagging eco-premium on products. Connelly *et al* (2010) suggest that GSCM theories should be tested in terms of their association with performance. Theories relating to GSCM practices were extended into and tested in the context of Kenya.

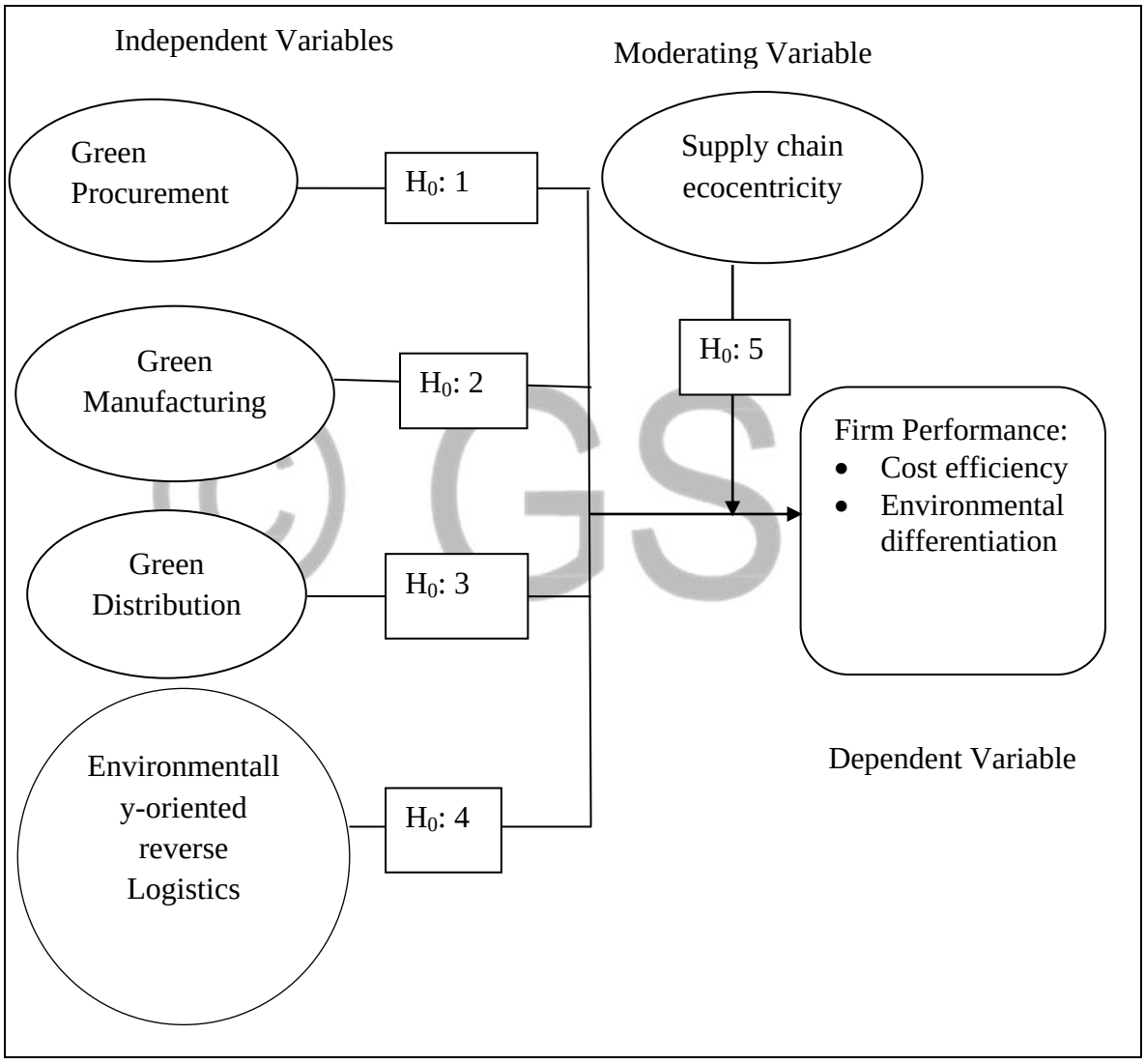

Figure 2. 1 Model of Hypothesized Relationships

2.3.1 Operationalization of the Constructs

In order to test the relationships among the constructs in a theoretical model, the constructs must be operationalized (Dillman, 2000). The theoretical and operational definitions of the main constructs in the model of this study are shown in Table 2.2.These definitions enabled the quantitative measurement of the variables for testing of the formulated hypotheses. Brief explanations of the measurements of these variables are as follows:

2.3.1.1 Firm's Performance

In this study, firm's performance was measured in terms of efficiency and differentiation. For this study, performance measurement is the process of quantifying the weighted mean value of differentiation and cost efficiency of various actions of a firm (Frederick 2006; Shepherd & Gunter 2006). The extent to which each of the measures of efficiency/ differentiation was fulfilled was captured using a 5-point likert type scale.

a. Environmental Differentiation

The degree to which managers find or create a demand for environmental quality in products, establish credible information about environmental claims, and create inimitability of environmental products and supply chain operations. Environmental differentiation is characterized by increase in eco-friendly reputation, higher prices (premium) compared to competitors, increase in sales from eco-products, expansion of eco- market share and increment of brand loyalty from eco-branding (Reinhardt, 2003). The fulfillment of these indicators was captured using an interval scale (Malhotra, 2004)

b. Cost Efficiency

The extent to which a firm achieves reduction of waste management fees, lowering of hazardous material management fees , lowering of energy and water costs, elimination of statutory fines for non-environmental compliant and reduced input costs due to recycle/re-use of material Shepherd & Gunter, 2006). The fulfillment of these indicators was captured using an interval scale (Malhotra, 2004)

2.3.1.2 Green Procurement

Lacroix, (2008) outline specific programs that support the green procurement practices as; providing specification to suppliers that includes environmental requirements, environmental audits of supply base, cooperation with suppliers for environmental objectives, ISO14001 certification of supply base, Second-tier supplier's environmentally friendly practices evaluations. These programs, according to Zhu *et al*., (2008); Melnyk *et al*., (2003) measure the extent to which a firm practices green procurement. The fulfillment of these indicators was captured using multiple choices questions and a 5-point likert type scale (Norman, 2010).

2.3.1.3 Supply Chain Eco-centricity

Supply chain ecocentricity will be measured in terms of partnering with external stakeholders for environmental research, getting sponsorship for implementation of environmental management practices from the external stakeholders, participation in external stakeholders' eco-oriented workshops, environment fit through engagement with external stakeholders, environmental benchmarking with external stake holders and advance knowledge for environmental management practices (Tate *et al*., 2011). The fulfillment of these indicators was captured using multiple choices questions and a 5-point likert type scale (Norman, 2010).

2.3.1.4 Green Manufacturing

Newbold (2006); Lacroix (2008); Zhu *et al*. (2008); Melnyk *et al*. (2003) provide the following as the indicators for green manufacturing: design for sustainability, green machine tools, sustainable packaging, impact and life cycle assessment tools for manufacturing (including embedded energy, materials, water, and consumables), and risk assessment for energy and resource use is used as green manufacturing indicators. The extent to which each of these programs was fulfilled was captured using multiple choices questions and a 5-point likert type scale (Norman, 2010).

2.3.1.5 Green Distribution

Rao & Holt, (2005) and Sarkis, (2009) define green distribution as the distribution activities and processes which minimize negative impact on the natural environment. The activities are presumed to be environmentally safe. According to Rao & Holt, (2005) and Sarkis, (2009), it incorporates several indicators: eco labeling of products, environment-friendly packaging, environment-friendly transportation, providing information to customers on environment friendly products, re-using packages. The fulfillment of these indicators was captured using multiple choices questions and a 5-point likert type scale (Norman, 2010).

2.3.1.6 Environmentally Oriented Reverse logistics

Umeda *et al.,* (2003) outline the following as the indicators of environmentally-oriented reverse logistics; waste collection for proper disposal, recycling of used products (re-processing), re- use of the products, recovery of useful parts and proper disposal of useless parts and recovery of hazardous parts for proper disposal. The extent to which each of these indicators was fulfilled was captured through multiple choices questions and a 5-point likert type scales (Norman, 2010). Table 2.2 summarizes the operationalization of the constructs.

Table 2. 2 Operationalization of Constructs

Construct	Theoretical Definition	Operational Definition	Data Capturing
Firm Performance –Cost Efficiency	An assessment of how economically a firm's resources are utilized when providing a pre-specified level of customer satisfaction (Shepherd & Gunter	The extent to which the firm achieves: • reduction of waste management fees • lowering of hazardous material management fees	Interval scale (Malhotra, 2004).

		2006)	• Lowering of energy and water costs • elimination of statutory fines for non-environmental compliant and • reduction of input costs due to recycle/re-use of material (Shepherd & Gunter 2006)
-Environmental differentiation	An environmental management that focuses on environmental product characteristics and environmental product markets (Christmann 2000)	The extent to which the firm achieves: • Increment of eco-friendly reputation of the firm • Higher price (premium) compared to competitors • Increment in sales from eco-products • Expansion of eco-market share • Increment of eco-brand loyalty (Reinhardt, 1998)	Interval scale (Malhotra, 2004).
Green Procurement	The purchase of environmentally	The extent to which the firm achieves:	Multiple choices

	preferable products and services in accordance with one or more of the established “green" procurement preference programs (Vershuren, 2002)	• providing specification to suppliers that includes environmental requirements, • environmental audits of supply base, • iso14001 certification of supply base, • cooperation with suppliers for environmental objectives, • Second-tier suppliers’ environmentally friendly practices evaluation (Lacroix, 2008)	questions and a five point Likert type scale (Norman, 2010)
Green Manufacturing	The creation of manufacturing products that use materials and processes that: • minimize negative environmental impacts, • are safe for employees,	The extent to which the firm achieves: • design for sustainability • green machine tools • Sustainable packaging risk assessment for energy and resource use • impact and life cycle assessment tools for	Multiple choices questions and a five point Likert type scale (Norman, 2010)

	communities, and consumers • are economically sound (Phungrassami, 2008)	manufacturing • Risk assessment for energy and resource use	
Green distribution of products	The distribution activities and processes which minimize negative impact on the natural environment (Rao & Holt, 2005; Sarkis, 2009)	The degree to which the firm achieves: • Eco labeling of products, • environment-friendly packaging, • environment-friendly transportation • Re-usable packaging • Providing information to customers on environment friendly products	Multiple choices questions and a five point Likert type scale (Norman, 2010)
Environmentally-oriented reverse logistics	The process of planning, implementing and efficiently controlling the flow of raw materials, in-process inventory, finished goods, wastes and	The extent to which the firm achieves: • waste collection for proper disposal, • Recycling of used products (re-processing) • recovering of useful	Multiple choices questions and a five point Likert type scale (Norman,

	related information from the point of consumption to the point of origin with the purpose of recovering the primary value or dispose of them properly to minimize environmental impact " (Umeda *et al*., 2003)	parts • Re- use of the products • Recovery of hazardous parts for proper disposal (Umeda *et al*, 2003)	2010)
GSCM practices	The intra- and inter-firm management practices of the upstream and downstream supply chain aimed at minimizing the overall environmental impact of both the forward and reverse flows (Klassen & Johnson 2004)	The extent to which the firm achieves: • green purchasing • green manufacturing • green distribution and • environmentally-oriented reverse logistics (Zhu *et al.*, 2008)	Multiple choices questions and a five point Likert type scale (Norman, 2010)
Supply chain ecocentricity	The firm's tendency to engage and learn from environmental external stakeholders (Tate *et al*., 2011)	The extent to which the firm achieves: • partner with external stakeholders for environmental research • sponsorship for	Multiple choices questions and a five point Likert type

	implementation of environmental management practices by the external stakeholders • Participation in external stakeholders eco-oriented workshops • Environment fit through engagement with external stakeholders • Advance knowledge for environmental management practices (Tate *et al*., 2011) • Benchmarking environmental practices with external stakeholders' • Co-investment with external stakeholders on environmental management related issues • Use environmental management experts from external stakeholders • Allow environmental audit by external stakeholders	scale (Norman, 2010)

2.4 Empirical Framework

The Green Supply Chain Management (GSCM) emerges as a new systematic environmental approach in supply chain management and as such is attracting the interest of supply chain managers and researchers (Zhu & Sarkis, 2006).The integration of the 'green concept to the supply chain' concept, has created a new research agenda where the supply chain will have a direct relation to the environment and performance (Thomsen, 2011). Thus, it becomes an interesting issue to researchers in both developed and developing countries (Srivastava, 2007). Most researches have been conducted in Europe and Asia regions to examine the integration of environmental concept and supply chain management (Thomsen, 2011).

One study from Germany conducted by Large and Thomsen, (2011) identifies five potential drivers of green supply chain management performance: green supply management capabilities, the strategic level of purchasing department, the level of environmental commitment, the degree of green supplier assessment, and the degree of green collaboration with suppliers. Hsu and Hu, (2008) examine the links between green practices of supply chain management and supply chain performance in the context of the Portuguese automotive supply chain. This study obtains the conceptual model from data analysis that provides evidence as to which green practices have positive effects on quality, customer satisfaction and efficiency as well as negative effects on supply chain performance.

Shang *et al.*, (2010) in Taiwan have explored the correlation between greening the supplier and green innovation in the Taiwan industry by using Structural Equation Modeling. They conclude that greening the supplier through green innovation leads to significant benefits to the environmental performance and competitive advantage of the firm. Cagno, Guido, Perotti, and Zorzini, (2011) also examine the Green Supply Chain Practices (GSCP) adopted by Third Party Logistics (3PLs) service providers such as specific practices implemented and level of adoption of each practices. They also examine the relationship between various GSCP implementation and company

performance. In this study, the work offers an in-depth understanding of potential effects of GSCP on company performance.

From Japan, Arimura, Darnalln and Katayama, (2011) determine the influence of ISO 14001 certification on the green supply chain management (GSCM) by using Japanese facility level data. The study proves that ISO 14001 and voluntary EMS government program significantly influence GSCM practices. Another study from Japan by Zhu, Geng, Fujita, and Hashimoto, (2010) seeks to introduce environmental / green supply chain management experiences of large Japanese manufactures. This work shows that the large companies can green their supply chain by creating win-win relationships with their partners, and hence realize the sustainable growth for the entire supply chains. Besides, it also indicates that suitable regulations and policies set by the government can help GSCM circulation from larger leading companies to smaller companies.

Hsu and Hu, (2008) investigate the consistency approaches by factor analysis that determines the adoption and implementation of GSCM in Taiwanese electronic industry. The fuzzy analytic hierarchy process method is applied to prioritize the relative importance of four dimensions and 20 approaches among nine firms in the electronic industry. Meanwhile, Shang et al., (2010) explore key green supply chain management (GSCM) capability dimensions and firm performance based on electronics-related manufacturing firms in Taiwan. On the basis of a factor analysis, four green supply chain management dimensions are identified: green manufacturing, green distribution, green procurement, and environmentally- oriented reverse logistics.

Holt and Ghobadian, (2009) investigate the level and nature of greening the supply chain in the UK manufacturing sector. This study explores the driving forces behind environmental management, the specific management practices that result, and the relationship between them. The study by Nawrocka, Brorson, and Lindhqvist, (2009) in Sweden, has concentrated on the role of ISO 14001 in environmental supply management practices in Swedish companies. The study describes the existing and potential role of ISO 14001 for three key operational tasks of environmental supply chain management: to

ISSN 2320-9186

communicate the requirements to the supplier, to motivate and enable the supplier, and to verify that the supplier follows the requirements.

Moreover, the study from South Korea carried out by Lee, (2008) has identified the drivers of participation in green supply chain initiatives by considering small and medium-sized suppliers and their most important stakeholders, including buyers and the government. Raymond, Lopez, Marche, Perron, and Wright, (2008) examine the relationship between supply chains and environmental performance of SMEs in Canada. This study proves that time and financial resources are the most limiting factors in dealing with solid waste and energy issues.

In addition, Chen, (2008) looks into the relationship between green innovation and green image of companies in Taiwan. The study proposes a new concept of green core competence. Chien and Shih, (2007) examine the adoption of GSCM practices among the electrical and electronic industry in Taiwan. They suggest an empirical study on the relationship between green supply chain management practices and environmental performance, as well as financial performance. One study from Australia, conducted by Simpson, Power, and Samson, (2007) explores the moderating impact of relationship conditions existing between a customer and its suppliers and the effectiveness of the customer's environmental performance requirements (otherwise known as "green-supply"). Simpson et al (2007) propose further research on the moderating effect of supply chain ecocentricity on the performance of green supply chain management practices.

In the context of developing countries, little research attention has been devoted to the concern of GSCM especially in African region. The GSCM concept is a relatively new concept in the South East Asian and African regions and probably only a few companies are actually able to implement it (Rao & Holt, 2005). However, as claimed by Rao & Holt, (2005) in their study on green supply chain in South East Asian region (Philippines, Indonesia, Malaysia, Thailand, and Singapore) environmental supply chain practices had started to take place. Thus, the findings from those researches in the Asian region can be

useful for manufacturing in developing countries in order to develop the appropriate GSCM practices and reducing the environmental problems.

Recent literature shows that most researchers are starting to investigate GSCM in the East Asian region, especially China as developing country. The issues related to GSCM have become even more critical in China. Although China gains more opportunities as a major manufacturing country, she also deals with huge environmental problems with this opportunity (Rao & Holt, 2005). Zhu, Geng, Sarkis, and Lai, (2011) investigate whether different Chinese manufacturer clusters varying in their extent of implementing GSCM exist from the ecological modernization perspective. The study also examines whether Chinese manufacturers' awareness of local and international environmental ESPR-oriented (enhancing energy savings and pollution reduction) compliance is related to GSCM implementation and also if a mediating effect of regulatory pressure plays a major role.

The study by Liu, Yang, Qu, Wang, Shishime, and Bao, (2011) in China has analyzed the relationship between green supply chain management level (GSCML) and the classified determinant factors. The study confirms that a company's environmental management capacities will be strongly enhanced by frequent internal training of employees to increase its involvement in GSCM practices. Another research from China by Li, (2011) examines the adoption levels of GSCM practices in China and explores the performance measurement for GSCM. The findings have demonstrated that GSCM is strongly balancing to other advanced management practices, and contributes to the improvement of environmental performance. A study of Ninlawan et al., (2011) in Thailand analyzed the recent green activities in computer parts' manufacturers and also measured the level of green supply chain management

The concept of GSCM is relatively new in developing countries. Recent literature has established that there are still limited research studies on GSCM adoption and implementation based on the developing country context. A study of Diabat and Govindan, (2011) in India analyze the green activities in computer parts' manufacturers

and also measures the level of green supply chain management. The study conducted in India by Diabat and Govindan, (2011) identifies the drivers influencing the implementation of GSCM using an Interpretive Structural Modeling (ISM) methodology and extracts eleven drivers collected through past literature: Certification of suppliers' environmental management system; environmental collaboration with suppliers; collaboration between product designers and suppliers to reduce and eliminate product environmental impacts; government regulation and legislation; green design; ISO 14001 certification; integrating quality environmental management into planning and operation process; reducing energy consumption; reusing and recycling materials and packaging; environmental collaboration with customers; and reverse logistics.

Most researchers use the manufacturing industry as their sample of study in order to investigate the GSCM adoption and implementation either in developed or developing countries. Manufacturing is believed to be the main cause of the emerging environmental problems due to its traditional business operations' nature (Lee, 2008). Traditional polluting industries such as manufacturers in chemical, electrical and paper industries generally experience higher environmental pressure. Therefore, the manufacturing industry as traditional polluters tend to be the potential sample of study as they tend to implement GSCM practices (Lee, 2008). Table 2.3 provides a summary of the past studies.

Table 2. 3 Summary of the Previous Studies on Various Manufacturing Industries

Author/Year	Title/Design	Findings	Variables	Context
Large & Thomsen, 2011	Drivers of GSCM Performance: Evidence from Germany • Survey study	• Green Supplier assessment and green collaboration has direct influence on Environmental performance. • These two	• GSCM capabilities • The strategic level of Purchasing department • The level of	Germany: developed country-Europe

		practices are driven by the strategic level of the purchasing department and the level of environmental commitment of the firm. • Environmental practices has a positive impact on financial performance	environment commitment • Green supplier assessment • Green Collaboration with suppliers Performance: Cost efficiency, customer effectiveness	
Arimura *et al.* 2011	Is ISO 14001 a gateway to more advanced voluntary action? The case of green supply chain management • Case Study	• ISO 14001 positively contribute to implementation of GSCM practices by firms • Government program of encouraging EMS adoption directly influences ISO 14001 adopters to implement GSCM practices.	• ISO 14001 • GSCM practices: green purchasing, green manufacturing, green distribution	Japan: developed country-Asia
Shang *et al*.	The Influence of	• Greening the	• Greening the	Taiwan:

2010	Greening the Suppliers and Green Innovation on environmental Performance and competitive Advantage in Taiwan • Descriptive research	suppliers leads to green innovation and competitive advantage. • The finding also support that the intervening variables of green innovation contribute to competitive advantage.	suppliers • Green innovation • Environmental performance (environmental differentiation) • Competitive advantage (cost efficiency, customer effectiveness)	developed-Asia
Liu *et al*. 2011	Sustainable Production: Practices and Determinant Factors of Green Supply Chain Management of Chinese Companies •Exploratory research	• Chinese companies are still at a preliminary stage of GSCM practices. • The cooperation with external members of the GSC issues is very marginal. • A company's GSCM is significantly and positively associated with	• External pressures • Internal factors • GSCM practices • Controls (company's size, industrial sector)	China: developing country-Asia

		external pressures from regulatory, domestic clients and business competitors.		
Zhu *et al*. 2011	Evaluating Green Supply Chain Management among Chinese Manufacturers from the Ecological modernization Perspective • Descriptive research	• The findings s highlight the varying pace of Chinese manufacturers to ecological modernization with GSCM practices • Positive relationship between regulatory pressure and adoption of GSCM practices by Chinese manufacturing industry	• Environmental regulations/ policies • Green Supply Chain Management •Ecological Modernization	China: developing country - Asia
Cagno *et al*. 2011	The impact of green supply chain practices on company performance: the case of 3PLs • Case study	• There is still limited adoption of GSCP among the 3PLs service providers • Some participant have shown a pro-	• Green supply chain practices • 3PLs performance: cost efficiency, environmental differentiation,	Italy: developed country- Europe

		active attitude and gained significant benefit from the adoption of GSCP.	customer effectiveness	
Zhu *et al*. 2010	Green Supply Chain Management in Leading Manufacturers: Case Studies of Japanese Large Companies •Case study	• It was found that large Japanese companies have made significant improvements for environmental and financial performance but not for operational performance.	• GSCM drivers: Normative pressure, Coercive pressure and Mimetic pressure • GSCM practices • GSCM Performance :Economic, financial, operational	Japan: developed country - Asia
Holt & Ghobadian, 2009	An Empirical Study of Green Supply Chain Management Practices Amongst UK manufacturers • Descriptive research	• legislation and internal drivers (IDs) provide greatest pressure to the adoption of GSCM practices • Environmental attitude (EA) is a key predictor of GSCM activity and those organizations that have progressive attitude	• External drivers (Legislation, competitive, supply chain, societal) • Internal drivers	UK: developed country - Europe

		are also operationally very active.		
Nawrocka *et al*. 2009	The role of ISO 14001 in an environmentally-oriented supply chain practices • exploratory research	• ISO 14001 has a facilitating role in the environmental activities between a customer and a supplier. • Closer relationship with suppliers was seen as beneficial both for the successful outcomes of projects and as a facilitator for environmental work.	• Communication of environmental requirements between a customer and a supplier. • Motivation and enabling of suppliers to comply with the requirements.	Sweden: developed country-Europe
Lee, S. 2008	Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives •Descriptive research	• Buyer environmental requirements and support have positive effect to their suppliers' willingness to participate in green supply chain initiatives.	Buyer GSC practices, Government involvement, GSC readiness, GSC participation	South Korea: developed country-Asia

		• The government regulatory requirement.		
Raymond *et al.* 2008	Influences, practices and opportunities for environmental supply chain management: A case of Nova Scotia SMEs • Case study	• SMEs have difficulties in allocating resources to initiatives that are not viewed as directly related to their core function, namely manufacturing the product or providing the service.	• Environmental performance • Environmental issues	Canada: developed country-North America

Meanwhile, Table 2.4 also presents a summary of the previous studies among manufacturing industry (but it only study certain industries from the various type of industries). These researchers had focused to specific industry in order to get depth understanding of GSCM practices without comparing to different industries.

Table 2. 4 Summary of the Previous Studies on Focused Manufacturing Industries

Author/Year	Title/R. Design	Findings	Variables	Context
Hsu and Hu, (2008)	The Influence of Green Practices on Supply Chain Performance: A Case Study	• The most widely adopted green practices: (ISO 140001, minimizing waste, decreasing the	• Green practices: green purchasing, green manufacturing, green distribution • SC performance:	Portuguese; Automotive Sector

	Approach • Case Study	consumption of hazardous and toxic materials and reverse logistic) • GPs positively influence SC performance	Cost efficiency, Customer effectiveness, Environmental differentiation	
Ninlawan *et al.*, (2011)	The implementation of GSCM Practices in Electronics Industry in Thailand •Descriptive research	• Both environmental and positive economic were relatively significant in GSCM performance • Pressure from environmental regulations is the highest driver, followed by export pressure for GSCM practices implementation	• GSCM practices: green purchasing, green production, and reverse logistics • GSCM performance: cost efficiency, customer effectiveness, environmental differentiation • GSCM pressure: market, regulatory, competition	Thailand; Electronic (Computer Part) sector
Diabat and Govindan, 2011	An Analysis of the Drivers Affecting the Implementation	• Government regulation and legislation and reverse logistics are significant drivers for GSC	Drivers of GSCM (market, regulatory, competition)	India; Aluminum sector

	of Green Supply Chain Management: A case of Aluminum sector in India • Case study	management		
Shang *et al*. 2010	A taxonomy of green SCM capability among electronics-related manufacturing firms •Descriptive research	• The green marketing oriented group performed best. • The competitive capability of the green marketing oriented group was higher than those of competitors	• Green packaging • Environmental participation • Green marketing • Green Purchasing	Taiwan; Electronic Industry
Hsu and Hu, 2008	Green Supply Chain Management in the Electronic Industry • Case study	• The most important approaches included establishing an environmental database of products, asking for products with environmental consideration and top management	Approach for implementing GSCM: Supplier management, product recycling, life cycle management	Taiwan; Electronic Industry

		support		
Chen, 2008	The Driver of Green Innovation and Green Image – Green Core Competence • Correlation research	• Green core competences of firms were positively linked to their green innovation performance and green images	• Green core competence • Green innovation • Green image	Taiwan; SMEs electronics industry
Chien and Shih, 2007	An empirical study of the implementation of green SCM practices in relation to organizational Performances •Descriptive research	Green procurement and green manufacturing practices were found to positively influence environmental and financial performances for the respective companies.	• GSCM practices organizational performances •Environmental Performance (cost efficiency, customer effectiveness)	Taiwan; Electrical and electronic industry
Simpson *et al*. 2007	Greening the automotive supply chain: a relationship perspective • Correlation	• Suppliers were found to be more responsive to their customers' environmental performance requirements	• Customer environmental performance requirements • Supplier environmental commitment	Australia; Automotive industry

research	where increasing levels of relationship-specific investment occurred.

2.5 Critique of the Literature

Although there have been some developments in this area, most of the research is skewed towards Europe, Asia and Canada and largely narrowed to a specific industry. A study by Large and Thomsen, (2011), on the Drivers of green SCM Performance: Evidence from Germany only surveys the manufacturing firms in Germany and is limited to factors such as green supply management capabilities, the strategic level of purchasing department, the level of environment commitment, the degree of green supplier assessment and the degree of green collaboration with suppliers. They fail to recognize other factors such as technology, organization structure and market structure which have been projected as key drivers of green SCM Performance (Cagno *et al.*, 2011).

A study by Arimura *et al*. (2011) titled "Is ISO 14001 a gateway to more advanced voluntary action? The case of green supply chain management in Japan" establishes that ISO 14001 contribute to voluntary GSCM practices. However, the same study contradicts this finding by concluding that government regulatory requirement of EMS adoption directly influences ISO 14001 adopters to implement GSCM practices. This therefore means that ISO 14001 is not a voluntary initiative to the adoption of GSCM practices. This study also falls short of tagging the voluntary adoption of GSCM practices with economic befits as explained by Large and Thomsen (2011). Hsu and Hu (2008) examine the links between green practices of supply chain management and supply chain performance in the context of the Portuguese automotive supply chain. This study provides evidence that some green practices have negative effects on supply chain

performance. This contradicts the findings by a number of researchers that green practices positively impact on supply chain performance (Hart & Dowell, 2010).

The study of Shang *et al*. (2010) in Taiwan explores the correlation between greening the supplier and green innovation in Taiwan industry by using Structural Equation Modeling. They conclude that greening the supplier through green innovation leads to significant benefits to the environmental performance and competitive advantage of the firm. However, their study fails to recognize the key moderating variable of organization strategy as having a bearing on environmental performance and competitive advantage as advocated by Banerjee, (2003). A study in Italy by Cagno *et al.* (2011) examines the GSCP adopted by Third Party Logistics (3PLs) service providers such as specific practices implemented and level of adoption of each practices and also examines the relationship between various GSCP implementation and company performance. This study offers an in-depth understanding of potential effects of GSCP on company performance but falls short of tying specific performance to a particular practice.

Hsu and Hu (2008) investigate factors that determine the adoption and implementation of GSCM in the Taiwanese electronic industry. This study uses only nine firms to represent the whole industry. The population size may not be sizeable enough for generalization of the findings. Meanwhile, Shang et al. (2010) explore key green supply chain management (GSCM) capability dimensions and firm performance based on electronics-related manufacturing firms in Taiwan. On the basis of a factor analysis, four green supply chain management dimensions are identified: green manufacturing, green distribution, green procurement and environmentally-oriented reverse logistics. Nevertheless, the study is silent on environmental attitude which according to Holt and Ghobadian (2009) is a key predictor of GSCM activity.

Holt and Ghobadian (2009) investigate the level and nature of greening the supply chain in the UK manufacturing sector. In this study, the work explores the driving forces behind environmental conservation, the resultant specific management practices, and the relationship between them but fails to quantify the relationships between these variables.

ISSN 2320-9186

The study by Nawrocka *et al.* (2009) in Sweden, has concentrated on the role of ISO 14001 in environmental supply management practices in Swedish companies. The study describes the existing and potential role of ISO 14001 for three key operational tasks of environmental supply chain management: to communicate the requirements to the supplier, to motivate and enable the supplier, and to verify that the supplier follows the requirements. Their study does not go far enough to address what happens at the production stage or at the distribution stage of supply chain management. How will the firm handle environmental issues at the transformation point and the distribution point of the supply chain? This study fails to provide answers to these questions. But according to Hart and Dowell (2010), an effective GSCM must address environmental issues in totality within a given supply chain.

Indeed in the existing literature, most studies suffer from small sample sizes, one-tier investigation, lack of theoretical foundation, lack of longitudinal studies, and limited global green supply chain view. For example: a study by Holt and Ghobadian (2009) only samples manufacturing firms in the UK and cannot be used to reflect on the global trend of green supply chain practices. The study is also not hankered on any theoretical base; Zhu *et al*. (2008) only focuses on the manufacturing firms to look into green supply chain management implications rather than across various sectors; Raymond *et al*. (2008) is narrowed to Nova Scotia in Canada. The study focuses only on one of the SMEs which cannot be said to represent all the sectors; and the Diabat and Govindan (2011) study in India is focused on the manufacturing sector and more specifically on the aluminum firms and uses a case of a firm to draw conclusions on the drivers of green supply chain implementations. The small sample size makes the findings lack the generalizability feature. According to Lenth (2001), a sample size should be of adequate size, relative to the goals of the study. It should be big enough that an effect of such magnitude is of scientific and statistical significance. The one-tier investigation restricts the application of the findings of these studies across the sphere of industries. Being cross-sectional, most of the studies are not able to report the trends in the theoretical development of GSCM

and since most of them are country specific, they fail to capture the global view of GSCM.

Within the existing literature, very few researchers have taken an empirical approach on the green SCM practices – performance link. Most of the studies have focused almost exclusively on the firm's external business environment, such as regulatory and stakeholder demands, as direct motivators on firms to adopt green practices (Bansal and Clelland, 2004) and most of them have been in the developed countries in Europe and America (Diabat and Govindan, 2011). A few which have been undertaken in the developing countries are skewed towards Asia leaving African countries behind (Zhu *et al*., 2008; Diabat and Govindan, 2011; Simpson *et al*., 2007).None of these studies has focused in Kenya (Ondiso, 2012; Kamande, 2011; Mukiri, 2012). Therefore this study tried to fill this void by attempting to establish the effect of green SCM practices – firm performance link in the African context and more specifically in Kenya.

2.6 Research Gaps

There were three major reasons driving this study; lack of empirical evidence on GSCM concept–performance link targeting manufacturing firms in Kenya, low performance by manufacturing firms' in Kenya in terms of cost and environment and finally the current literature largely focusing outside Africa.

2.6.1 Lack of empirical evidence on GSCM concept and firm performance link in Kenyan context

There are at least two reasons why the extant research has not provided empirical evidence on the green SCM concept-firm performance relationship in Kenya. The first reason is that the focus in the literature has been almost exclusively on the firm's external business environment, such as regulatory and stakeholder demands, as direct motivators on firms to adopt green practices (Ondiso, 2012; Mukiri, 2012; Bansal and Clelland, 2004). While evidence abounds that external motivators play a role in the development of green practices in the firm, there is lack of focus in the literature on internal directives such as performance and resources (Mukiri, 2012).

The second reason is that the discussion and investigation of GSCM in the literature is based on the European, American and Asian context and is still limited, and considered to be in the development stage (Kamande, 2011; Bansal and Clelland, 2004; Zhu *et al*. 2008a; Stock *et al*. 2002, Vachon & Klassen 2008). Furthermore, the consideration of the performance outcomes from reducing the environmental impact of firms' supply chain operations is a concept that has only recently gained momentum (Srivastava, 2007). This view is supported by Kamande (2011) which concludes that the research linking firm performance and GSCM is still minimal in Kenya. The lack of research implies that linkages between green practices in SCM and firm performance have not been thoroughly examined and that more empirical testing is necessary to investigate additional areas of the topic (Vachon & Klassen, 2008). Indeed, researchers assert that the attention given to the potential benefits of GSCM practices has actually raised more questions than answers (Srivastava, 2007; Harris, 2007). Given the inconclusive and conflicting empirical results of research into the effects of green supply chain management practices on firm performance, it was important to investigate these previously unexplored factors that may impact the GSCM -performance relationship.

2.6.2 Inadequate Performance by the Manufacturing Firms' in Kenya.

Manufacturing industry in Kenya is believed to be a key pillar in promoting economic and social development of the country (Yamfya *et al*., 2002). However Kamande (2011) establishes that manufacturing firms in Kenya exhibit low performance tendencies in terms of cost and environmental management raising doubt about the sector's capacity to drive the country towards Vision 2030 (GOK,2007). This therefore calls for a search for new management practices that have the potential of improving firm performance and environmental management. Hence the advancement of GSCM concept in this study with an intension of solving performance issues and environmental problems associated with the manufacturing firms in Kenya.

ISSN 2320-9186

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Research methodology refers to the overall approach to the research process. It deals with the theoretical background of the research to the collection and analysis of data on the one hand. On the other hand, research methodology refers to the means of data collection and analysis. This chapter therefore presents the research philosophy, approach, design and methods used to address the research problem as outlined in Chapter 1. It provides highlights on the research design, data collection procedures and analysis techniques which were applied in this study.

3.2 Research Design

There has been debate on the choice of research design centered on varied philosophical issues. For this study, the choice of the design was centered between two primary philosophical alternatives: a positivist or a phenomenological philosophy as represented in Fig. 3.1

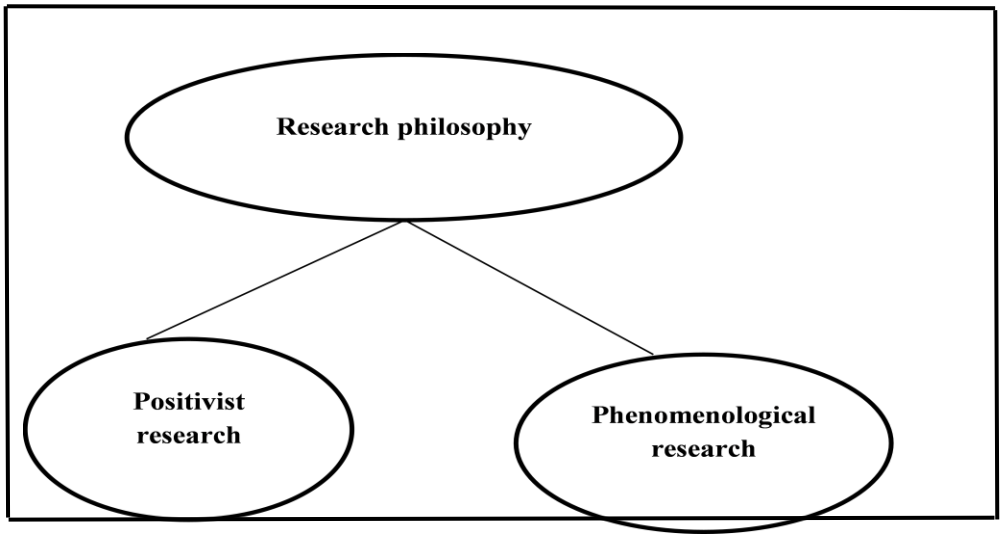

Figure 3. 1 Research Philosophy Alternatives

Source: (Hussey and Hussey, 1997).

Positivists believe that reality is stable and can be observed and described from an objective viewpoint (Hirschheim, 2003), i.e. without interfering with the phenomena being studied. They contend that phenomena should be isolated and that observations should be repeatable. This often involves manipulation of reality with variations in only a single independent variable so as to identify regularities in, and to form relationships between some of the constituent elements of the social world. Predictions can be made on the basis of the previously observed and explained realities and their inter-relationships. "Positivism has a long and rich historical tradition. It is so embedded in our society that knowledge claims not grounded in positivist thought are simply dismissed as unscientific and therefore invalid" (Hirschheim, 2003). This view is indirectly supported by Alavi and Carlson (2001) who, in a review of 902 IS research articles; found that all the empirical studies were positivist in approach.

There has, however, been much debate on the issue of whether or not this positivist paradigm is entirely suitable for the social sciences (Hirschheim, 2003); some authors (Interpretivists/ phenomenologists) have favored for a more pluralistic attitude towards social research methodologies (Shuttleworth, 2008). Interpretivists contend that only through the subjective interpretation of and intervention in reality can that reality be fully understood. The study of phenomena in their natural environment is key to the Interpretivists philosophy, together with the acknowledgement that scientists cannot avoid affecting those phenomena they study. They admit that there may be many interpretations of reality, but maintain that these interpretations are in themselves a part of the scientific knowledge they are pursuing.

A number of authors (Shuttleworth, 2008; Saunders, Lewis & Thornhill 2000) have highlighted the main elements of this choice involving research philosophy. In particular, Easterby-Smith *et al.* (2003) as quoted in Shuttleworth, (2008) offer these key features of the two philosophy paradigm alternatives, Table 3.1.

Table 3. 1 Research Paradigms

Dimensions	Positivist paradigm	Phenomenological paradigm
Basic beliefs	The world is external and objective	The world is socially constructed and subjective
	Observer is independent	Observer is part of what is observed
	Science is value-free	Science is driven by human interests
Researcher should	Focus on facts	Focus on meanings
	Look for causality and fundamental laws	Try to understand what is happening
	Reduce phenomenon to simplest elements	Look at the totality of each situation
	Formulate hypotheses and then test them	Develop ideas through induction from data
Preferred methods include	Operationalizing concepts so that they can be measured	Using multiple methods to establish different views of phenomena
	Taking large samples	Small samples investigated in depth or over time

Source: (Easterby - Smith *et al*., 2003)

Indeed a large number of research methodologies have been identified under the two philosophies; Galliers (2002) for example lists fourteen, while Alavi and Carlson (2001) use a hierarchical taxonomy with three levels and eighteen categories. For this study, methodologies as identified by Galliers (2002), Table 3.2 were considered.

Table 3. 2 Taxonomy of Research Methodologies

Scientific/Positivist		Interpretivist/Anti-positivist
Laboratory Experiments	☐	Subjective/Argumentative
Field Experiments	☐	Reviews
Descriptive/Surveys	☑	Action Research
Case Studies	☐	Case Studies
Theorem Proof	☐	Descriptive/Interpretive
Forecasting	☐	Futures Research
Simulation	☐	Role/Game Playing

Source: (Galliers ,2002)

Given the research problem and research objectives as outlined in Chapter 1, the study used Positivist paradigm. The choice of this approach was based on the argument that to empirically establish the relationships between the variables of interest, formulation and testing of appropriate hypotheses and generalize findings are necessary (Hirschheim, 2003; Alavi & Carlson, 2001). Further, there was need to translate the underlying concepts into measurable forms to facilitate testing of the formulated hypotheses (Galliers, 2002). A quantitative analytical approach was employed in an attempt to empirically determine the relationship between the variables of interest by applying appropriate statistical data analysis techniques (Hirschheim, 2003).

As a result, the study adopted descriptive cross-sectional survey research design. A cross-sectional survey is a data-gathering and analysis approach in which respondents answer questions or respond to statements that were developed in advance at a point in time (Kasunic, 2005). According to Shuttleworth, (2008), cross-sectional survey approach is used when a great deal of information is required from a large population at a point in time as in this study. Creswell (2003) advocates for its application in positivists research paradigms because of its ability to collect quantitative data which are analyzable. According to Alavi & Carlson, (2001), cross-sectional surveys are relatively economical

with high accuracy, especially when good sampling procedures are followed. Another reason for the adoption of survey design in this study was its unique advantage among scientific methods of checking the reliability and validity of survey data, using various statistical methods (Alavi & Carlson, 2001). Positivists such as Hirschheim (2003); Alavi and Carlson (2001) hold that the validity of assertions of a quantitative study is enhanced through a survey approach.

In this study, descriptive cross-sectional survey was used to obtain information from a sample of respondents for testing of hypotheses on the effect of GSCM dimensions on the performance manufacturing firms in Kenya. Descriptive cross-sectional survey was flexible enough to provide opportunity for considering different aspects of the study problem (Delgado-Rodriquez & Llorca, 2004). The design was appropriate for this study as advised by Shuttleworth, (2008) that descriptive cross-sectional survey design produces quality statistical information about aspects of the study that may interest policy makers, industry players and academicians.

3.3 Population

Saunders, Lewis & Thornhill (2003); Schidler & Cooper (2006); and Kothari and Warner (2008) all describe a population as the total collection of elements about which one wishes to make inferences while the sample size is a representative of a population. The target population of the study was the manufacturing firms in Kenya. The study population comprised five hundred and sixty six (566) manufacturing firms registered by Kenya Association of Manufacturers under the following categories (sectors): Building, Construction and Mining, 14 firms; Chemical and Allied, 65 firms; Energy, Electricals and Electronics, 34 firms; Food and Beverages, 145 firms; Leather and Footwear,6 firms; Metal and Allied ,60 firms; Motor Vehicle and Accessories ,24 firms; Paper and Board ,64 firms; Pharmaceutical and Medical Equipment, 22 firms; Plastic and Rubber, 63 firms; Textile and Apparel ,52 firms and Timber, Wood and Furniture, 17 firms (KAM, 2014). The unit of analysis for this study consisted of the manufacturing firms who are members of KAM (KAM, 2014).

The choice of unit of observation for the study was based on the following attributes; knowledge of strategic SCM practices and processes, knowledge of aspects of GSCM, an understanding of corporate green attitudes and culture and knowledge of main competitors and their behavior. Given these desired attributes, all supply chain management designate senior officers (heads from logistics /procurement/ operations, general managers, and directors) were targeted as the ideal unit of observations.

Saunders *et al.* (2003) propose that for any probability sample, the sampling frame is a complete list of all the cases in the population from which the sample is to be drawn. According to the American Association for Public Opinion Research (AAPOR), (2007) a sample frame is the list from which a sample is chosen that contains all of the elements in the population. The sample frame for this study was the entire list of five hundred and sixty six (566) manufacturing firms as listed in the Kenya Association of Manufacturers directory, (2014).

3.4 Sample and Sampling Technique

The study used two steps sampling approaches. It used stratified random sampling to sample the unit of analysis and purposive sampling to sample the unit of observation. Stratified random sampling approach was chosen to ensure all categories (sectors) of the manufacturing firms were proportionally represented in the sample (Black, 2004). The purposive sampling approach helped in selecting experts in SCM and GSCM who were well placed to advance the study interests. This approach can also be termed as expert sampling (Black, 2004).

Under random sampling approach, the population was divided into twelve (12) relevant and significant stratum based on the type of the products firms were dealing in and grouped under various sectors as in Table 3.3. From each stratum (sector), a sample of pre-specified size (41%) – obtained from Yamane, 1967 formula for sample size; was drawn independently using simple random sampling table. The collection of these samples constituted stratified sample for the study (Saunders *et al.*, 2003). The stratification of the study population is presented in Table 3.3.

Table 3. 3 Number of Manufacturing Firms per Sector

Sector	Number of manufacturing Firms
Building, Construction and Mining	14
Chemical and Allied	65
Energy, Electricals and Electronics	34
Food and Beverages	145
Leather and Footwear	6
Metal and Allied	60
Motor Vehicle and Accessories	24
Paper and Board	64
Pharmaceutical and Medical Equipment	22
Plastic and Rubber	63
Textile and Apparel	52
Timber, Wood and Furniture	17
Grand Total	**566**

Source: (Kenya Association of Manufacturers, 2014)

According to Lenth (2001), the sample size should be of adequate size, relative to the goals of the study. It should be big enough so that an effect of such magnitude is of scientific and statistical significance. Sample size is important for economic reasons: An under-sized study can be a waste of resources for not having the capability to produce useful results, while an over-sized one uses more resources than are necessary (Lenth, 2001). This research used the sample size formula developed by Yamane (1967) to calculate the actual sample size of 234 firms from a population of 566 firms at a confidence level of 95 percent and a precision or error of 5 percent as in Equation 3.1

ISSN 2320-9186

$$n = \frac{N}{1+N(e)^2} \Rightarrow n = \frac{566}{1+566(0.05)^2} = 234.36853 \cong 234.$$

Equation 3. 1 Computation of Sample Size

Source: (Yamane, 1967)

Where *n* is the sample size, *N* is the population size, and *e* is the level of precision desired, where *e* =1- Confidence level (Yamane, 1967). This formula was preferred in this study because of its simplicity in usage, scientific and applicability in large populations (Yamane, 1967). Table 3.4 shows the sample size in each category arrived at through stratified sampling, with sampling fraction of ≅ 0.41. Sample fraction = actual sample size /total population.

Table 3. 4 Stratified Sample

Sectors	No. of Firms	Proportions	Stratified Sample
Building, Construction and Mining	14	2.47%	6
Chemical and Allied	65	11.48%	27
Energy, Electricals and Electronics	34	6.01%	14
Food and Beverages	145	25.62%	60
Leather and Footwear	6	1.06%	2
Metal and Allied	60	10.60%	25
Motor Vehicle and Accessories	24	4.24%	10
Paper and Board	64	11.31%	26
Pharmaceutical and Medical Equipment	22	3.89%	9
Plastic and Rubber	63	11.13%	26
Textile and Apparel	52	9.19%	22
Timber, Wood and Furniture	17	3.00%	7
Grand Total	566	100%	≅234
Sample size (Yamane, 1967 formula)	234		
Sampling fraction	≅0.41		

(KAM, 2014)

ISSN 2320-9186

3.5 Data Collection Methods

3.5.1 Type and nature of data

Both primary and secondary data were obtained and utilized for purposes of addressing the research objectives. Secondary data was sourced from both published and unpublished records such as the National Environmental Management Authority, Kenya Association of Manufacturer and Ministry of Environment annual reports, journals and books. Primary data was collected on GSCM practices (green procurement, green manufacturing, green distribution and environmentally-oriented reverse logistics), supply chain ecocentricity (moderating variable) and also on firm performance indicators as shown in Table 2.2.

3.5.2 Data collection instrument

The main primary data collection instrument was a survey questionnaire consisting of structured closed and open-ended questions (see appendix I). The questionnaire consisted of six key parts, all aimed towards capturing the relevant information in respect of the study objectives. Part 1 dealt with general information about the respondent and the firm, Part 2 facilitated capturing of data on various green SCM practices adopted by firms, Part 3 facilitated recording of data on the moderating variable (supply chain ecocentricity), Part 4 dealt with performance of firms, Part 5 facilitated capturing of data on the realization of green SCM practices benefits, lastly, Part 6 dealt with the number of years of practicing GSCM by the manufacturing firms. The primary data was captured using multiple choices questions and a five point likert type scale. In applied management studies, the likert type scale is one of the acceptable techniques for measurement of attitudes in a "scientific" way which allows the use of statistical tools to analyze data (Blaikie, 2003).

3.5.3 Instrument Administration

The study used an e-mail survey to collect primary data to test the hypotheses generated in Chapter 2. E-mail surveys are employed extensively in research due to their ease of use, flexibility of responding, confidentiality and relatively low-cost (Dillman, 2000). Online surveys are easily quantifiable and suitable for statistical testing, as the results are

typically collected in a file that is easily manipulated for analysis. In addition, e-mail surveys reduce the degree of interviewer bias and are appropriate for collecting a large number of geographically dispersed respondents in a cost-effective manner (Dillman, 2000)

The challenge of e-mail survey in this study was gaining the trust of potential respondents. With the deluge of e-mail traffic that most business professionals receive, potential respondents were reluctant in taking part in the survey, believing it to be an internet marketing promotion. A second challenge was of a survey methodology in general. Researchers often find that business professionals do not have time to complete a survey and/or are over-surveyed, resulting in "survey fatigue" (Cooper & Schindler, 2006). These challenges were addressed through employing a two-phased approach to reaching potential participants. The first phase consisted of sending out a mass e-mail to a list of potential participants using the outlook e-mail program. Outlook allowed sending of individualized e-mails to each potential participant containing a reminder alarm of a completion date of two weeks from the send date of the e-mail. The program was automatically activated to send reminder alarm at the end of the two weeks window to the respondents. However, a polite reminder e-mail was sent to those who may have not responded at the end of the two weeks window.

The second phase started after the final reminder e-mail. Once the results of the personalized e-mails and reminders were collected, the remaining valid contact information for participants that had not responded to the survey, a follow-up contact was made as reminders until the completed survey was received. Follow-up contact included additional reminder phone calls and e-mails.

3.5.4 Data Retrieval and Response Rate

The returned questionnaires were checked for consistency and validity of the respondents' answers. An effort was further made to control the research process through the installation of anti-sperm software on the outlook system to prevent e-mails from un-recognized sources from finding their way into the questionnaire file. A random double

checking for authenticity of the data was conducted to ensure the officers who were the unit of observations did not delegate the filling of the questionnaires to their assistants. This was however established to be not an issue in this study. To improve the response rate, a continuous follow up were made by phones and e-emails after the initial e-mail contact which resulted in receiving back a total of 179 out of 234 responses. However, 18 were found to be incomplete and therefore were not analyzed. This left 161 valid responses or 69 percent which is considered high rate of returns for a survey research (Keeter, Scott, Kennedy, Dimock, Best & Craighill. 2006). According to Richardson (2005), 50 percent response rate is regarded as an acceptable in a social research survey. Baruch (2007) established that the average response rate in social research surveys is 55.6 percent. Therefore, the study valid response rate of 69 percent was considered high and acceptable for this study.

The study is a wake to the fact that data is ordinarily received in different forms. Cooper and Schindler (2006) suggested two of the formats to be textual and numeric data. This study collected both for addressing the study objectives. Malhotra (2004) explains that data preparation precedes data analysis. The process of data preparation imparts on data accuracy and enforces a conversion from raw to classified data that can benefit analysis and interpretation. Therefore the study applied coding, editing and tabulation as forms of data preparation (Malhotra, 2004).

3.6 Pilot Study

To ascertain reliability, validity and reduce measurement error, a pilot test was conducted (Dillman, 2000). The objective of the pretest was to establish any potential problems with the design and instrumentation and to provide proxy data for selection of a probability sample (Billé, 2010). The researcher used the pretest to assess the clarity, complexity and the face validity of the measure. As a result, revisions were made that improved the overall look and content of the final data collection instrument in terms of readability, wording and arrangement (Teijlingen& Hundley, 2001)

A total of 20 respondents (manufacturing firms) were used in the pretest as recommended by Monette, Sullivan and DeJong, (2002) for a survey study. The respondents were drawn from the same population frame that was similar to the one used for the actual survey in terms of background features and familiarity with the study topic. The reactions received were instrumental in refining the questionnaire before it was finalized for the study. Background information obtained through pretesting process provided insights into the simplification and strengthening of the process in this regard, and allowed for greater understanding of the specific context and the respondents as individuals to the extent that the process was tailored to the specific context.

3.6.1 Scale Construction

The questionnaire was abridged after pretesting to attain a balance between data required and the time needed to collect the data and to decrease the chance of lethargy for the respondents. The final questionnaire was profoundly composed of simple and un-ambiguous closed and open ended questions designed for multiple linear regression analysis.

3.6.2 Reliability

The measurement of human behavior belongs to the widely accepted positivist view, or empirical analytic approach, to discern reality (Smallbone & Quinton, 2004). Because most behavioral research takes place within this paradigm, measurement instruments must be reliable. Reliability refers to the consistency of measurement (Bollen, 1989), or stability of measurement over a variety of conditions in which basically the same results should be obtained (Ritter, 2010). According to Smallbone and Quinton, (2004), a reliable measure is characterized by stability over time, and internal consistency. A measure would exhibit stability if little variation over time was found when the measure was re-administered and would exhibit internal consistency if the "indicators that make up the scale" are dependable (Shadish, Cook, and Campbell, 2001).

The most popular method of testing for internal consistency in the behavioural sciences is coefficient alpha. Coefficient alpha was popularised by Cronbach (1951), who recognized its general usefulness. As a result, it is often referred to as Cronbach's alpha. According

to Smallbone and Quinton, (2004), the coefficient alpha is suitable in measuring variance attributable to the subject and variance attributable to the interaction between subjects and items. Zikmund, (2003); Ritter, (2010) provided a measuring scale for acceptable alpha as 0.60 and above. According to them, above 0.60 is considered as an indicator of a good internal reliability. This study therefore used the Cronbach's alpha to test the internal reliability of the measures. For the specific tests of internal reliability for the dimensions of GSCM, the Cronbach's alpha results are presented in section 4.3.

3.6.3 Validity

According to Knapp (1998); Carter and Porter (2000); Peat (2002), validity is defined as the extent to which the instrument measures what it purports to measure. It is a direct check on how the instrument fulfills its function. A test of validity is therefore whether the measure of a concept really measures that concept (Peat, 2002). There are several measures of validity that provide evidence of the quality of a study. Internal and external validity relate to the overall study design. Internal validity relates to the extent to which the design of a research study is a good test of the hypothesis or is appropriate for the research question (Carter & Porter, 2000). External validity, meanwhile, relates to whether or not research findings can be generalized beyond the immediate study sample and setting (Carter & Porter, 2000). Therefore this study used Peat (2002) measures to assess the validity of data collection tool as follows:

(a) Content validity

Content validity is a qualitative type of validity where the domain of the concept is made clear and the analyst judges whether the measures fully represent the domain. It is whether a tool appears to others to be measuring what it says it does. Face validity is a simple form of content validity. The researcher built content validity into the measures through the derivation of the scales from theories related to GSCM practices and firm performance (Carter & Porter, 2000) and also by incorporating comments from experts in GSCM in the content of the instrument (Peat, 2002). As such, the study considered the

content of the instrument to be valid implying that the study instrument measured what it was supposed to measure i.e. the measure fully represented the domain of the study.

(b) Criterion validity

Concurrent or predictive validity are both measures of criterion validity (Trochim, 2006). Concurrent validity uses an already existing and well-accepted measure against which the new measure can be compared. Predictive validity refers to the ability of a test to predict an event in the future (Smallbone & Quinton, 2004). Criterion validation therefore refers to the effectiveness of a measure in terms of being able to predict an event related to relevant criteria (Trochim, 2006). This was not however considered to be an issue with respect to the surveying of the respondents in the study.

(c) Construct validity

Construct validity is the degree to which an instrument measures the trait or theoretical construct that it is intended to measure (Shadish, Cook & Campbell, 2001). Construct validity was ensured in this study through derivation of the measures from GSCM theories which were to be tested in the study. To confirm construct validity of the measures, factor analysis was performed and the results of Eigen values is presented in Table 3.5

ISSN 2320-9186

Table 3. 5 Result of Eigen values

	Exploratory Factor Analysis (validity)		
Variables Question	Number of Eigen Values of 1 or higher	Total variance explained h^2	Interpretation
Green procurement	1	63%	Unidimensional
Green manufacturing	1	62.52%	Unidimensional
Green distribution	1	70.32%	Unidimensional
Environmentally oriented reverse logistics	2	79.14%	Unidimensional

Eigen values are used to establish the construct validity of the instrument (Brown, 2001). According to Hair, Andrson, Tatham & Black. (2006) a factor with an Eigenvalue of 1 or higher and a minimum variance of 60 percent signify unidimensionality or communality of the scale. These findings confirm the unidimensionality of the scale used in the study and therefore the scale measures the traits of the constructs (Brown, 2001).

3.7 Data Analysis and Presentation

Once the data was captured from the completed survey instruments, the process of analyzing the data commenced. The items in the likert scale were measured using mean index values. Descriptive statistics were generated in the form of frequency data and statistical testing performed. Other statistical testing processes considered in this section are: the confidence levels applied; the use of Cronbach's alphas; Shapiro Wilk test; Breusch-Pagan test; correlation matrix; confirmatory factor analysis and the multiple linear regression process for testing of the hypotheses. Statistical Package for Social Sciences (SPSS) program version 22 and the Analysis of Moment Structures (AMOS) version 18 facilitated data analysis. SPSS version 22 was chosen because it has Automated Data Preparation feature (ADPF), allows table customization and was

accessible to the researcher. The SPSS- Analysis of Moment Structures (SPSS-AMOS) version 18 was chosen because it allows specification, estimation, assessment and presentation of models to show hypothesized relationships among variables. The software allows building of models more accurately than with standard multivariate statistics techniques. Users can choose either the graphical user interface or non-graphical, programmatic interface. It is capable of building attitudinal and behavioral models that reflect complex relationships in any given study.

3.7.1 Confidence Levels for Statistical Testing

In testing the null hypothesis for significance, the significance of 5 percent, or $\alpha = 0.05$ was chosen for the study. In line with this, the chance that a Type I error would not be made where a true null hypothesis is rejected in accordance with Frankfort-Nachmias and Leon-Guerrero (2006) would be equal to: $1 - \alpha = 0.95$

The confidence level in this study was determined from a normal probability density function (Hazewinkel, 2001) as follows;

$$Prob(x_- \leq x \leq x_+) = \int_{x_-}^{x_+} P(x) = C$$

Which shows that x lies in the interval $[x_-, x_+]$ with confidence C. C is a probability according to the frequency limit.

If $P(X)$ is a normal distribution with mean μ and variance σ^2, then the $C = 95\%$ confidence interval will be given by;

$$x_\pm = \mu \pm 1.96 \times \sigma$$

In other words, the lower and the upper endpoint of the 95% confidence interval is:

ISSN 2320-9186

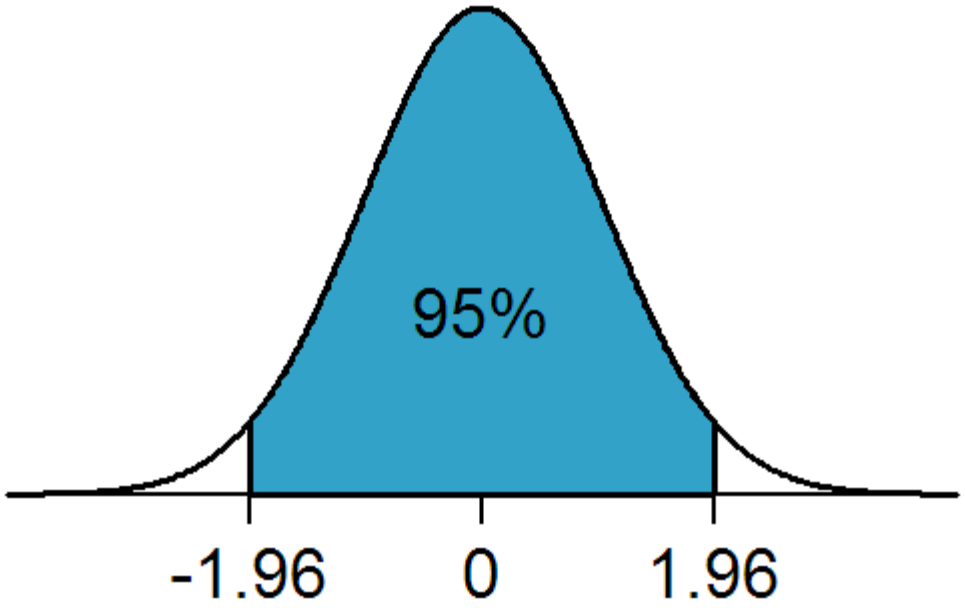

Figure 3. 2 The lower and the upper endpoint of the 95% confidence interval

95% of the area under the normal distribution lies within 1.96 standard deviations of the mean.

Although a more stringent level of significant such as 1 percent level could have been used, the 5 percent level was chosen due to large range of variables tested and the potential for greater insight provided through the interpretation of marginal associations of various constructs of the study. The choice of 5 percent level of significant for social studies is supported by Bland (2000).

3.7.2 Shapiro Wilk test

The study used Shapiro Wilk test of normality to test the normality of the data. The Shapiro–Wilk test utilizes the null hypothesis principle to check whether a sample $x_1 ... x_n$ came from a normally distributed population. The test statistic is:

ISSN 2320-9186

$$W = \frac{\left(\sum_{i=1}^{n} a_i x_{(i)}\right)^2}{\sum_{i=1}^{n}(x_i - \overline{x})^2}$$

Where

- $x_{(i)}$ (with parentheses enclosing the subscript index i) is the i^{th} order statistic, i.e., the i^{th} is the smallest number in the sample;
- $\overline{x} = (x_1 + \cdots + x_n)/n$ is the sample mean;
- the constants a_i are given by[1]

$$(a_1, \ldots, a_n) = \frac{m^{\mathsf{T}} V^{-1}}{(m^{\mathsf{T}} V^{-1} V^{-1} m)^{1/2}}$$

Where

$$m = (m_1, \ldots, m_n)^{\mathsf{T}}$$

and $m_1, \ldots, m_n$ are the expected values of the order statistics of independent and identically distributed random variables sampled from the standard normal distribution, and V is the covariance matrix of those order statistics. The null hypothesis is rejected if W is below a predetermined threshold (Shapiro; Wilk, 1965) - in this study the chosen alpha value of 0.05. The null-hypothesis of this test was that the population is normally distributed. Thus if the p-value was less than the chosen alpha level, then the null hypothesis would be rejected and the implication of the test would be that the data tested would not be from a normally distributed population (Field, Andy, 2009; Razali, Nornadiah; Wah, Yap Bee, 2011). In other words, the data would not be normal. On the contrary, if the p-value was greater than the chosen alpha level, then the null hypothesis that the data came from a normally distributed population would be accepted, implying that the data would be normally distributed E.g. for an alpha level of 0.05, a data set with a p-value of 0.02 would rejects the null hypothesis that the data would be from a

ISSN 2320-9186

normally distributed population (Field, Andy, 2009; Razali, Nornadiah; Wah, Yap Bee, 2011).

3.7.3 Breusch-Pagan test

The study applied Breusch-Pagan test of post-estimation to test the assumption of constancy of variance for fitting a linear regression model in data analysis. In statistics, the Breusch–Pagan test (named after Trevor Breusch and Adrian Pagan) is used to test for heteroscedasticity in a linear regression model (Gujarati, Damodar; Porter, Dawn, 2009). It tests whether the estimated variance of the residuals from a regression are dependent on the values of the independent variables.

The test statistic for the Breusch-Pagan test is;

$$bp = \frac{1}{v}(u - \overline{u}i)'Z(Z'Z)^{-1}Z'(u - \overline{u}i)$$

where $u = (e_1^2, e_2^2, \dots, e_n^2)$ i is a $n \times 1$ vector of ones, Z is a matrix composed of the values of the variables and

$$v = \frac{1}{n}\sum_{i=1}^{n}\left(e_i^2 - \frac{e'e}{n}\right)^2$$

According to Breusch-Pagan (1979), if the p-value of the test is greater than the chosen alpha value, in this study 0.05, then the H_0 of constant variance (homoscedasticity) is accepted. This would indicate that heteroskedasticity was probably not a problem (or at least that if it was a problem, it wasn't a multiplicative function of the predicted values) implying that the study rightfully fitted the regression model in the data analysis. However, if the p-value of the test is smaller than the critical value, the H_0 of constant variance is rejected. This would signify the presence of heteroscedasticity meaning that fitting a regression model for data analysis would not be appropriate (Heij; de Boer, 2004)

3.7.4 Correlation matrix

The study used correlation matrix to ascertain that one predictor variable could not be linearly predicted from the others (non-multi-collinearity) as a condition for applying multiple regression model in analyzing the study data. According to Pedace (2013), small correlation values less than 0.4 between the predictor variables means no multi-collinearity between the predictor variables. This would imply that one predictor variable would not be linearly predicted from the others. Therefore, the assumption for application of the linear regression model in data analysis would be observed.

3.7.5 Measurement Development : Confirmatory factor analysis

The study sought to develop measures for the study constructs. Therefore, the study used Structural Equation Modeling (SEM) to test the internal consistency (reliability) of the items in the measure to determine the retention of each item as a measure of the observed factor (variable) or any exclusion of the item from the measure should be done. Consequently, the study developed individual measurement model for each construct measure to confirmatory factor analysis (CAF) and the overall measurement model to check the dimensionality of the construct and the validity of the measures.

SEM is a quantitative data analytical method which specifies, estimates, and tests hypothetical relationships between observed endogenous factors (variables) and latent, unobserved exogenous factors (Byrne,2001). SEM is not a title for a single statistical procedure but a family of relevant procedures including analysis of covariance structure which combines factor analysis and regression analysis as well (Diamantopoulos and Siguaw,2000). The approach started with model specification which linked the items hypothesized to affect the individual study constructs and the directionalities of their effects (Kline, 2005). Model specification is a visual representation of hypothesized relationships between various factors (Diamantopoulos and Siguaw, 2000). In the estimation process, SEM produced regression weights, variances, covariances and correlations which converged on a set of parameters estimates on iteration (Holmes-Smith *et al*., 2004).

Through the process of estimation, fit statistics was evaluated to check whether the proposed model was a fit to the data or not, or whether any modification was required to increase the fit. The model fit statistics is divided into absolute fit indices, incremental fit or comparative fit indices and indices of model parsimony (Holmes-Smith *et al*., 2004). In each of these types, there are different fit indices and rule of thumb about the required minimum level of score/value for good fit propagated by different authors (Arbuckle, 199; Byrne, 2001). However, this study, in consideration of sample sensitivity and model complexity effect, used $\chi 2$/df (chi-square mean -CMIN/ degree of freedom-Df), incremental fit index (IFI), tucker lewis index (TLI), component fit index (CFI) and root mean square error of approximation (RMSEA) fit statistics to assess the degree of overall fitness of the measurement model and the structural model (Truxillo, 2003). Additional reason for the choice of these model fit measures was because they have been commonly used and reported in the literature (Truxillo, 2003). The scale for measuring model fitness in this study according to Byrne (2001); Holmes-Smith *et al.,* (2004); Truxillo, (2003); and Kline (2005) is presented in Table 3.6.

Table 3. 6 Scale for SEM Fit Indices

Level of Model Fit	**Overall Model Fit**				
	Model Fit		**Model Comparison**		
Fit Measures	CMIN/DF	RMSEA	IFI	TLI	CFI
Recommended for Further Analysis if	>2	>0.08	0.90	<0.90	<0.90
Acceptable Scale for Good as well as Adequate Fit	≤2	<0.06 (Reasonable fit up to 0.08)	≥0.90	≥0.90	≥0.90

Source: Adopted from Byrne (2001), Holmes-Smith *et al*. (2004), and Kline (2005)

Holmes-Smith *et al*. (2004) observed that in a large sample size, χ^2 test may show that the data are significantly different from those expected on a given theory even though the difference may be negligible or unimportant on other criteria. Based on this, Holmes-

Smith *et al.*, (2004) preferred the use of "normed" χ^2 where χ^2 is divided by the degree of freedom. The normed χ^2 is given by χ^2/df. Accordingly, a value of normed χ^2 greater than 1 and smaller than 2 indicates a very good model fit (Byrne, 2001; Hair et al. 2006). However, given the limitation of χ^2 statistics for assessing structural model fit (Bentler, 1990), CIF, TLI and IFI were preferred for baseline comparison and were used to evaluate and report the model fit in this study. IFI, TLI and CFI were used to evaluate the relative improvement in fit to the model based on the baseline model. IFI, TLI and CFI values range from zero to one. Values close to one (e.g. 0.90 to 0.95) suggests adequate fit and more than 0.95 suggests a very well fit model (Truxillo, 2003). Thus this study considered values between 0.90 and 1.00 as adequate to evaluate the incremental fitness of the model (Holmes-Smith et al., 2004; Kline, 2005). RMSEA values less than 0.05 indicates good fit and values between 0.06 and 0.08 are considered reasonable fit (Byrne, 2001). These model fit indices were used in assessing the initial measurement models for the construct measures and the final structural model for the variable measures reported in the section four of this study.

Confirmatory factor analysis (CFA) incorporates the testing of unidimensionality and evaluation of data set by confirming the underlying structure on the basis of theoretical ground (Kline, 2005). It further proposes adjustment, simplification, and/or any required improvement in the measurement model for hypothesis testing and probing the level of fit (Truxillo, 2003). Even though model identification is the requirement of CFA, modification and standardized loadings (standardized regression weights) in the SPSS-Amos output were the options to verify the dimensionality of the measurement or verify the model fit. Modification indices (MIs) comprised of variances, covariance, and regression weights. These indices were examined during evaluation of model fit to get the direction of adjustment, for example, whether freeing or incorporating parameters either between or among unobserved factors is required in attaining better model fit (Holmes-Smith *et al.*, 2004; Kline, 2005). Holmes-Smith *et al.*, (2004) suggested deletion and adding a new path indicator as best ways to get better fitting model. A change or deletion

of item in iterative processes results in changes in parameters and model fit statistics (Holmes-Smith *et al.*, 2004).

3.7.6 Regression Analysis

The study used multiple regression analysis to evaluate and establish relationships between dependent (Firm Performance), moderating factor (Supply Chain Ecocentricity) and multiple independent factors (Green Procurement, Green Manufacturing, Green Distribution, and Environmentally Oriented Reverse Logistics) and the causal effects. This was made possible through testing of the study hypothesises formulated to address the research objectives. Multiple linear regression attempts to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation to the observed data, where every value of the independent variable X is associated with a value of the dependent variable *y* (Hesketh & Skrondal, 2008). Since the observed values for *y* vary about their means μ_y, the multiple regression model (MRM) includes a term for this variation. In words, the model is expressed as DATA = FIT + RESIDUAL, where the "FIT" term represents the expression $\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots\ldots \beta_p X_p$. The "RESIDUAL" term represents the deviations of the observed values *y* from their means μ y, and is denoted by ε. Therefore, the multiple regression equation for this study which represent the relationship between the dependent variable (P) as a linear function of the independent variables (Green Procurement-GP, Green Manufacturing-GM, Green Distribution-GD and Environmentally Oriented Reverse Logistics-EORL), with ε representing the model deviations (error term) (Cooper & Schindler, 2006; Hesketh & Skrondal, 2008) is given by :

$$P = \beta_0 + \beta_1 GP + \beta_2 GM + \beta_3 GD + \beta_4 EORL + \varepsilon \quad \ldots\ldots\ldots\ldots (3.2)$$

Equation 3. 2 MRM for dependent and independent variables association

To establish the effect of the moderating variable in the study, an additional term was added to the multiple regression equation to incorporate the influence of the moderating variable (SCEC) on Equation 3.2. Thus the regression model:

$$P = \beta_0 + \beta_1 GP + \beta_2 GM + \beta_3 GD + \beta_4 EORL + \beta_5 SCEC + \varepsilon \quad \ldots\ldots (3.3)$$

Equation 3. 3 MRM for the dependent, independent and moderating variable

Where P=Performance (dependent variable), P=Green Procurement, GM=Green Manufacturing, GD=Green Distribution, and EORL=Environmentally-oriented Reverse Logistics are respective independent variables; SCEC= supply chain ecocentricity (moderating variable); β_0 (Alpha) is constant or P intercept, β_1 = slope or the coefficient of GP, β_2 = coefficient of GM, β_3 = coefficient of GD, β_4 = coefficient of EORL, β_5 = coefficient of SCEC and ε = error term (Hesketh & Skrondal, 2008). In this case the role of SCEC as a moderating variable is accomplished by evaluating β_5, the parameter estimate for the modarating term.

The measure of how well the model as a whole "fits the data" or, put differently, to what extent the model explains the variability of the dependent variable is a function of R^2, which varies conveniently between zero and one. A value of $\mathbf{R^2}$ = 0 means that the regression does not explain any of the variability of the dependent variable, while a value $\mathbf{R^2}$ = 1 means that the regression explain all such variability (if the $\mathbf{R^2}$ = 1, all data points lie on the regression line or all the data values are on the regression line i.e. explained) and the $\mathbf{R^2}_{Adj}$ is used to describe the relationship for parent (study) population (Hesketh & Skrondal, 2008). **F** and **t** values of the data output explain the relationship between the variables; **F** explains the overall relationship between the variables. The significance of F tests the hypothesis of the relationships, while 't' explains the relationships between the individual variables and its significance tests the hypothesis for the individual variables.

ISSN 2320-9186

The smaller the **F**, the more likely it is that the null hypothesis is rejected. In the case of 't', the levels of significance tests the hypothesis for individual variables.

Multiple regression analysis offers a more accurate explanation of the performance (dependent variable) since more explanatory variables, in this case, green procurement, green manufacturing, green distribution, environmentally oriented reverse logistics and supply chain ecocentricity can be fitted into the model for analysis. Certainty of the effect of individual independent variable eliminates the possibility of the distorting influence from other independent variables (Hesketh & Skrondal, 2008). According to Cooper and Schindler (2006), the multiple regression technique has the capability of analyzing virtually any set of quantitative data. This capability fits the analysis of a range of associations between performance, supply chain ecocentricity and GSCM practices in this study. However, the following assumptions are made under the multiple regression model: that all variables are included in the equation, that multicollinearity is not an issue, that no change in regime has occurred and that errors have the same variance throughout.

ISSN 2320-9186

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

The study aimed to establish the link between GSCM dimensions and firm performance. As a result, the chapter reports in terms of summary statistics, the results of respondents' responses, pilot study and descriptive statistics for the characteristics of each tested factor. The mean, standard deviation, percentages and frequencies are reported for some tested variables. Tables and bar chats illustrate the frequency distributions for each tested factor. The results of diagnostic statistics tests for the regression model are reported including the diagnostic procedures. The findings for the tested hypotheses are reported according to each study hypothesis for addressing each of the study objectives. The statistical procedures followed in terms of testing and reporting on the diagnostic statistics and regression analysis are reported.

4.2 Results of the Pilot Study

In reference to reliability test section, the alpha test was done on the items on the instrument to ascertain their reliability. A total of 20 respondents (manufacturing firms) were used in the pretest as recommended by Monette, Sullivan and DeJong, (2002) for a survey study. Coefficient alpha was used for reliability test (Cronbach, 1951).The data findings indicate the highest alpha value of 0.894 for the green manufacturing and the least alpha value of 0.67 for green distribution.

In this study, the items in the instrument which had Cronbach's alpha score of less than 0.6 were to be rejected according to Zikmund, (2003); and Nunnally and Bernstein, (2004). However, all the factors had Cronbach's alphas of above 0.6 with the least being alpha value of 0.67 (green distribution), signifying that all factors were within the threshold of acceptable alphas (Zikmund, 2003; Ritter, 2010). These imply that the study survey instrument was reliable and met the requirement of an acceptable data collection

instrument in a survey study (Zikmund, 2003). The alpha scores of the GSCM dimensions are exemplified in Table 4.1.

Table 4. 1: Scale Reliability Coefficient (Cronbach Alpha) for GSCM Dimension

GSCM dimension	Number of items	Alpha value	Interpretation (Zikmund, 2003; Ritter, 2010)
Green procurement	5	0.85	Good
Green manufacturing	6	0.894	Acceptable
Green distribution	5	0.67	Good
Environmentally oriented reverse logistics	5	0.763	Good
Supply Chain Ecocentricity	5	0.697	Good

4.3 Response Rate

This section sought to ascertain the response rate of the respondents. The researcher distributed a total of 234 questionnaires. Out of these, 179 (76 percent) questionnaires were returned filled and 55 (24 percent) respondents declined participation. Out of 179 filled questionnaires returned, 18 (8 percent) were incompletely filled leaving 161 valid questionnaires which were analyzed. This translated to 69 percent respondents' response rate for the study.

The response rate of 69 percent was considered acceptable for the study. This is supported by Richardson (2005) which regarded 50 percent response rate as an acceptable in a social research survey. Baruch (2007) established that the average response rate in social research surveys is 55.6 %. Therefore, the study response rate of 69 percent is considered high and acceptable in this study. Table 4.2 illustrates the study response rate.

ISSN 2320-9186

Table 4. 2: Response rate

Particulars	Respondents' Responses		None-Responses	Questionnaire Distributed
	Responsive Responses	None-Responsive responses		
Frequencies	161	18	55	234
Percentages	69%	8%	23%	100

4.4 Background of the Respondents

4.4.1 Classification of the Respondents' Firms

To establish the sectors of the respondents firms, the respondents were required to indicate the sector which best described their firms. The data findings indicate that 2 percent of the respondents were best described as belonging to building, construction and mining sector; 13 percent to chemical and allied sector; 6 percent to energy, electrical and electronics sector; 26 percent to food and beverages sector; 1 percent to leather and footwear sector; 12 percent to metal and allied sector; 4 percent to motor vehicle and accessories sector; 11 percent to paper and boards sector; 4 percent to pharmaceutical and medical equipment sector; 10 percent to plastic and rubber sector; 9 percent to textile and apparel sector; and 3 percent to timber, wood and furniture sector. These data findings mean that majority of the manufacturing firms in Kenya are producing food and beverages, the common characteristic of manufacturing sectors in the third world countries (Kaliraja *et al.*, 2010). This implies that a policy initiative aimed at improvement of green practices in the manufacturing sector in the country should target food and beverages sub-sector in order to achieve a significant impact. The comparative frequencies of the above statistical findings are presented in Table 4.3.

Table 4. 3 Sectors of the respondents Firm

ISSN 2320-9186

Sectors of the Firm, N=161	Stratified Sampled Population	Questionnaires Distributed	Valid Questionnaires Returned	Sector wise valid responses in %
Building, Construction and Mining	6	6	4	2
Chemical and Allied	27	27	21	13
Energy, Electricals and Electronics	14	14	9	6
Food and Beverages	60	60	42	26
Leather and Footwear	2	2	2	1
Metal and Allied	25	25	19	12
Motor Vehicle and Accessories	10	10	6	4
Paper and Boards	26	26	17	11
Pharmaceutical and Medical Equipment	9	9	6	4
Plastic and Rubber	26	26	16	10
Textile and apparel	22	22	14	9
Timber, Wood and Furniture	7	7	5	3
Total	**234**	**234**	**161**	**100**

4.4.2 Size of firms

The study sought to use the number of employees to establish the sizes of the manufacturing firms in Kenya. As a result, the respondents were asked to indicate the number of employees in their firms. The results indicate that majority of the firms at 32

percent had employees ranging from 50 to 100 employees and the least number of the firms at 3 percent had above 250 employees. The data results imply that most manufacturing firms in Kenya are medium enterprises, employing between 51-100 paid employees. According to William and Litabingwa (2005), medium enterprises are defined in Kenya as those enterprises employing between 51-100 paid employees. These findings are presented in Fig.4.1.

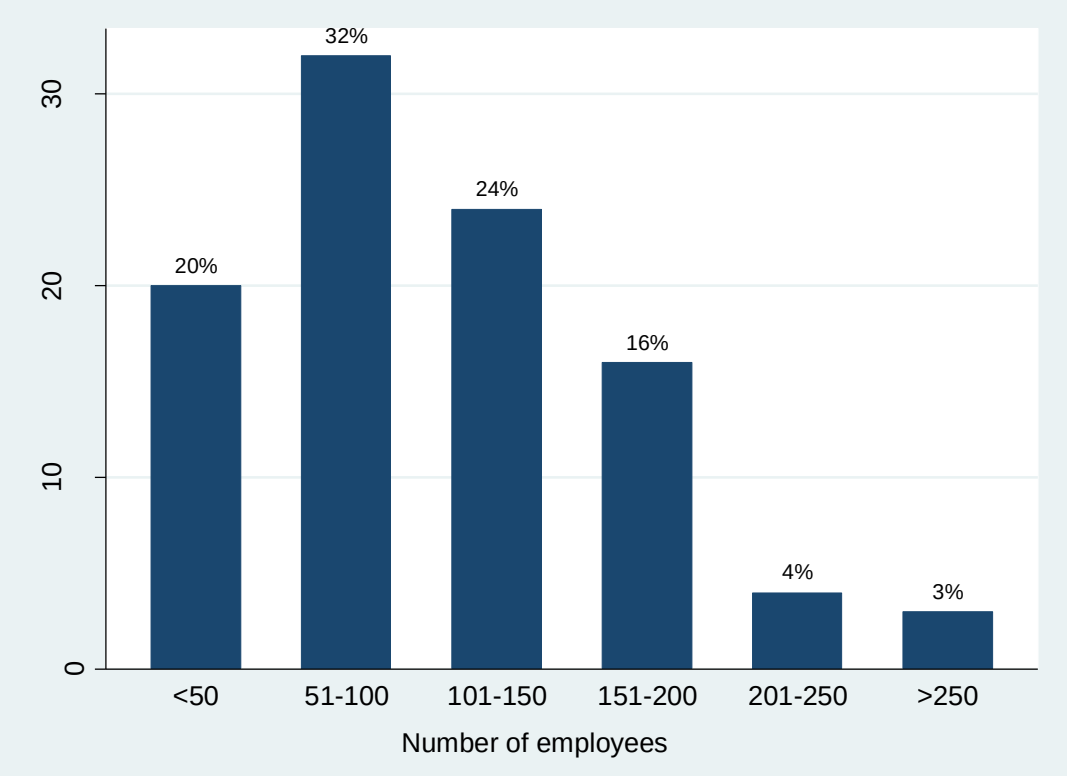

Figure 4. 1 Number of employees in the respondents firms

4.4.3 Positions held by the respondents in their firms

In gauging the respondents' capacity to respond effectively to the study survey questions, the respondents were required to indicate the position they hold in their firms. The study targeted all supply chain management designate senior officers (heads from logistics /procurement/ operations, general managers, and directors) as the study unit of observations. However, in some firms, other categories such as brand manager and

occupational safety, health and environment officers answered the questionnaire. This could be as a result of lack of the supply chain management related designate in such firms (Lacroix, 2008).Consequently, the study established that 6.2 percent were occupational safety, health and environment officers; 1.2 percent brand managers; 9.9 percent managing directors; 7.5 percent head of supply chain management; 27.3 percent operations managers; 35.4 percent procurement managers; and production managers accounted for 12.4 percent.

The results indicate that about 94 percent of respondents occupying the positions of manager and above ranks. This could mean that the information obtained from the study survey instruments were robust enough to address the study objectives since majority of the respondents had access to relevant information to the study due to their positions in the firms. Additional finding was that most firms have not embraced the title of "Head of Supply Chain Management" within their operations since it accounted for only 7.6 percent compared to operation and procurement heads at 27.8 and 35.4 percent respectively. This implies that not many firms in Kenya have changed the way they name their supply chain managers even though they have embraced the concept of supply chain management within their operations. These confirm the notion propounded by Ondiso, (2012) that in Kenya, most organizations regards procurement function and operation function as key elements in supply chain management. These statistical findings are shown in Table 4.4 in terms of frequencies and percentages.

Table 4. 4 Respondents Positions

Positions held by the respondents	Frequency	Percent (%)
Occupational Safety Health and Environment officer	10	6.2
Brand Manager	2	1.2
Managing Director	16	9.9
Head of SCM	12	7.5
Operations Manager	44	27.3
Procurement Manager	57	35.4
Production Manager	20	12.4
Total	**161**	**100**

4.5 Descriptive Analysis

4.5.1 Green Procurement

The study aimed to establish firm practices that constitute green procurement in the manufacturing industry. The respondents were required to indicate the level of these practices within their firms and the results were as follows: use specifications with environmental requirement (mean 4.24, SD 0.679), preference to products that consumed fewer natural resources (mean 4.24, SD 0.612), collaboration with vendors to address environmental problems (mean 4.16, SD 0.672), environmental audit (mean 4.01, SD 0.541) and ISO14001 certification of supply base as a criteria for selecting vendor (mean 3.80, SD 1.319) .

The data findings indicate that using environmental requirements as specification for purchases, environmental audits of supply base, preference to products that consumed fewer natural resources, and working with suppliers to address environmental problems were explicit across the firms surveyed having an overall scores of mean 4.24, SD 0.679; mean 4.01, SD 0.541; mean 4.24, SD 0.612; and 4.16, SD 0.672 respectively out of the maximum possible score of 5 points. These imply that manufacturing firms in Kenya

have embraced similar green procurement practices as the rest of the world (Handfield et al., 2005; Newbold, 2006).These results are presented in table 4.5.

Table 4. 5 Green Procurement Indicators

	Percent (%)						
	1	2	3	4	5		Standard
Item	NA	SE	A	LE	VLE	Mean	Deviation
Using environmental requirements as specification for purchases	3.1	2.5	3.1	49.7	41.6	4.24	0.679
Environmental audits of supply base	4.4	7.5	8.1	42.9	37.3	4.01	0.541
ISO14001 Certification of supply base as a criteria for selecting vendor	13.7	3.7	5.6	43.5	33.5	3.80	1.319
Prefer products that consumed fewer natural resources	2.5	3.1	10.6	35.4	48.5	4.24	0.612
Working with suppliers to address environmental problems	1.2	6.2	8.7	43.5	40.4	4.16	0.672

Key: n=161; 1= NA=Not All; 2= SE=Small Extent; 3= A=Average; 4= LE=Large Extent; 5= VLE=Very Large Extent

4.5.2 Green Manufacturing

The study intended to establish firm practices that constitute green manufacturing. The **r**espondents were required to indicate the level of these practices within their respective firms. The findings indicate that use of efficient processes scored (mean 4.63, SD 0.586), environmental friendly raw material (mean 4.56, SD 0.531), tools which consume fewer resources (mean 4.44, SD 0.605), assessment of the life cycle of tools (mean 4.33, SD 0.734), assessment of risk for energy and resource use (mean 4.33, SD 0.686), and environmental management systems scored a mean 4.16 with an SD of 0.602.

The results indicate that use of efficient processes to reduce solid waste, air emissions and conserve energy; environmental friendly raw material ; tools which consume fewer resources; assessment of the life cycle of tools ; assessment of risk for energy and resource use ; and environmental management systems were explicit across the firms studied having an overall scores of mean 4.63, STD 0.586; mean 4.56, STD 0.531; mean 4.44, SD 0.605; mean 4.33, SD 0.734; mean 4.33, STD 0.686 ; and mean 4.16, SD 0.602 respectively out of a possible maximum 5 points. This implies that green manufacturing practices in Kenya are not unique from the rest of the world (Lacroix, 2008; Zhuet *et al*., 2008; Melnyk *et al*., 2003). The findings further confirm green manufacturing practices by firms as propounded by Vachon and Klassen (2006b) under the resource based view. These findings are presented in Table 4.6.

Table 4. 6 Green manufacturing indicators

Item	Percent (%)					Mean	Standard Deviation
	1 NA	2 SE	3 A	4 LE	5 VLE		
Using machines or tools which consume less energy, water, and fuel	1.3	1.2	8.7	29.8	59.0	4.44	0.605
Impact and life cycle assessment tools for manufacturing	3.1	1.2	9.9	31.1	54.7	4.33	0.734
Risk assessment for energy and resource use	3.1	0.6	7.5	37.9	50.9	4.33	0.686
Environmental friendly raw material	0.6	1.2	6.8	24.2	67.1	4.56	0.531
Efficient processes to reduce solid waste, air emissions and conserve energy	1.2	1.2	0.6	26.7	70.2	4.63	0.586
Environmental Management System (EMS)	5.0	5.7	4.4	38.4	46.5	4.16	0.602

Key: n=161; 1= NA=Not All; 2= SE=Small Extent; 3= A=Average; 4= LE=Large Extent; 5= VLE=Very Large Extent

4.5.3 Green Distribution

The study sought to ascertain factors which constitute green distribution in the manufacturing firms in Kenya. To achieve this, the responded were asked to rate the level of green distribution practices within their firms. These were the findings: collection of used packages for proper disposal (mean 4.57, SD 0.764), environment-friendly packaging and transportation (mean 4.36, SD 0.898), provision of information to customers on environment friendly products (mean 4.34, SD 0.712), downsize packaging (mean 4.24, SD 0.672), re-using and recycling of packages (mean 4.22, SD 0.687) and eco labeling of products (mean 4.15, SD 0.917).

ISSN 2320-9186

The data results imply that to a large extend, collection of used packages for proper disposal (mean 4.57, SD 0.764), environment-friendly packaging and transportation (mean 4.36, SD 0.898), provision of information to customers on environment friendly products (mean 4.34, SD 0.712), re-using and recycling of packages (mean 4.22, SD 0.687) and eco labeling of products (mean 4.15, SD 0.917) were used across the firms surveyed. They all have a mean score of above four out of a possible maximum 5 points indicating that green distribution practices by firms in Kenya are similar to those being practiced by firms in other countries (Rao & Holt, 2005; Preuss, 2005). The findings further concur with the theoretical view of Christmann, (2000) on the measures of green distribution. The data findings are shown in Table 4.7.

Table 4. 7 Green distribution indicators

Indicators	Percent (%)					Mean	Standard Deviation
	1 NA	2 SE	3 A	4 LE	5 VLE		
Eco labeling of products	3.1	3.7	5.6	50.3	37.3	4.15	0.917
Environment-friendly packaging and transportation	1.2	1.2	9.9	37.3	50.3	4.36	0.898
Providing information to customers on environment friendly products	6.2	1.2	9.3	19.3	64.0	4.34	0.712
Re-using and recycling of packages	6.8	3.7	9.3	21.1	59.0	4.22	0.687
Collection of used packages for proper disposal	1.2	0.6	7.5	21.1	69.6	4.57	0.764
Downsize packaging	4.2	3.8	9.6	37.9	44.5	4.24	0.672

Key: n=161; 1= NA=Not All; 2= SE=Small Extent; 3= A=Average; 4= LE=Large Extent; 5= VLE=Very Large Extent

4.5.4 Environmentally Oriented Reverse Logistics

The study intended to establish practices that constitute environmentally oriented reverse logistics in the manufacturing firms in Kenya. In this regard, the respondents were required to indicate the level of EORL practices in their firms. The mean findings are presented on Table 4.8 as follows: use waste collection for proper disposal (mean 4.57, SD 0.664), recycling, re-use and recovery of useful parts of the products (mean 4.61, SD 0.543), recovery of hazardous parts for proper disposal (mean 4.30, SD 0.728), arrangements with customers to return used packages (mean 4.06, SD 1.001), and easy availability of information about returning of products (mean 4.26, SD 0.937).

The data outcomes indicate that waste collection for proper disposal , recycling, re-use and recovery of useful parts of the products , recovery of hazardous parts for proper

disposal, arrangements with customers to return used packages , and easy availability of information about returning of products were explicit across the firms surveyed having an overall scores of mean 4.57, SD 0.664; 4.61, SD 0.543; 4.30, SD 0.728; 4.06, SD 1.001; and 4.26, SD 0.937 respectively out of possible maximum score of 5 points. This indicates that environmentally oriented reverse logistics practices by firms in Kenya are not unique to Kenyan firms but are similar to those being practiced by firms in other countries (Umeda *et al*., 2003; Zhu & Sarkis, 2004). The findings further concur with the view of Hines and Johns, (2001) on the measures of environmentally oriented reverse logistics. The study data findings are presented in Table 4.8.

Table 4. 8 Environmentally Oriented Reverse Logistics indicators

Indicators	**Percent (%)**					**Mean**	**Standard Deviation**
	1 NA	**2 SE**	**3 A**	**4 LE**	**5 VLE**		
Waste collection for proper disposal	1.2	0.6	7.5	21.1	69.6	4.57	0.664
Recycling, re-use and recovery of useful parts of the products	1.2	0.6	6.2	19.9	72.1	4.61	0.543
Recovery of hazardous parts for proper disposal	1.2	1.2	12.4	36.7	48.5	4.30	0.728
Arrangements with customers to return used packages	8.7	4.4	12.4	21.7	52.8	4.06	1.001
Easy availability of information about returning of products	4.4	3.8	6.3	32.5	53.1	4.26	0.937

Key: n=161; 1= NA=Not at All; 2= SE=Small Extent; 3= A=Average; 4= LE=Large Extent; 5= VLE=Very Large Extent

4.5.5 Supply Chain Ecocentricity

To establish the level of adoption of supply chain ecocentricity by the manufacturing firms, the respondents were required to confirm the adoption levels of various SCE

practices within their firms. The results were as follows: on average, about 40 percent of the firms have embraced some form of SCE.

This is in contrast with Seuring (2004) assertion that above 60 percent of manufacturing firms in Germany are willing to engage and learn from environmental external stakeholders' new ways of greening their supply chain. This could be due to the fact that European customers and authorities are more conscious to green issues compare to customers and authorities in the developing world (Tate et al., 2011). In connection to individual practices, use of experts from external stakeholders for implementation of eco-best practices and environmental audit by external stakeholders scored the highest at about 46 percent. This is probably because most environmental training and audit are externally facilitated by donors in Kenya (Ondiso, 2012) and therefore are largely not expenditure to individual firms. The rest of the practices scored lower than 45 percent individually and the least score being for co-investment with external stakeholders on environmental management related issues at 24.85 percent. This indicates that manufacturing firms in Kenya have not fully embraced the concept of partnering with other players in environmental management issues. In fact some view government agencies and environmentally oriented non-governmental organizations as unfriendly groups out to interfere with their operations (Jones, 2006).These results are shown in Table 4.9.

Table 4. 9 Supply chain ecocentricity

Variable, N=161	Yes
Partner with external stakeholders of environmental research	41.85%
Sponsorship for implementation of environmental management practices by the external stakeholders	36.00%
Participation in external stakeholders eco-oriented workshops	43.80%
Use of experts from external stakeholders for implementation eco-best practices	45.9%
Environmental audit by external stakeholders	45.2%
Co-investment with external stakeholders on environmental management related issues	24.85%

4.5.6 Firm Performance

The study used cost efficiency as one of the performance measure. To establish the measures which constitute cost efficiency as a performance measure in the manufacturing firms in Kenya, the respondents were asked to rank the cost efficiency measures according to their level of usage in their firms on a scale of 1 to 5. The scale respectively represent: not at all, small extent, average, large extent and very large extent. The data findings were as follows: reduction of cost of inputs due to recycle/re-use of material scored a mean 0f 4.25 with a SD of 0.522), lowering of cost of energy and water (mean 4.19, SD 0.694), reduction of waste management cost (mean 4.11, SD 0.673), reduction of statutory fines (mean 4.16, SD 0.776), and reduction of hazardous material management cost scored a mean of 4.08 with a SD of 0.538. However, reduction of cost of transport scored a mean of less than 4 at 3.60, SD 0.996.

The findings imply that reduction of cost of inputs , lowering of cost of energy and water, reduction of waste management cost, reduction of statutory fines and reduction of hazardous material management cost were explicit across all the firms surveyed with a mean score of above four out of the possible maximum points of 5. These findings are in agreement with Lambert and Burduroglu, (2000) which used them as a measure of cost efficiency in their study. The findings are presented in Table 4.10.

ISSN 2320-9186

Table 4. 10 Cost Efficiency Indicators

Item	Percent (%) 1	2	3	4	5	Mean	Standard Deviation
Cost Efficiency							
Waste management fee has been reduced	1.9	4.4	20.5	27.3	46.0	4.11	0.673
Hazardous material management fees has been lowered	2.5	7.6	12.0	35.4	42.4	4.08	0.538
Cost of energy and water has been lowered	3.1	3.8	11.3	34.4	47.5	4.19	0.694
Statutory fines for non-environmental compliant is reduced	1.9	9.3	11.8	25.5	51.6	4.16	0.776
Input cost have reduced due to recycle/re-use of material	1.2	3.7	14.3	30.4	50.3	4.25	0.522
Cost of transport has been reduced	3.7	8.7	29.2	41.0	17.4	3.60	0.996

Key: n=161: 1= NA=Not All; 2= SE=Small Extent; 3= A=Average; 4= LE=Large Extent; 5= VLE=Very Large Extent

A second performance measure used in the study is environmental differentiation. To ascertain the practices which constitute environmental differentiation as a non-financial measure of firm performance, the respondents were asked to rank the environmental differentiation measures according to their level of usage in their firms on a scale of 1 to 5. The scale respectively represent: not at all, small extent, average, large extent and very large extent. The data findings as shown in Table 4.11 were as follows: improvement of conservation of energy and water (mean 4.38, SD 0.666), improvement of eco-waste

management (mean 4.36, SD 0.584) and improvement of eco-management of hazardous material (mean 4.13, SD 0.596).

The findings indicate that improvement of conservation of energy and water, improvement of eco-waste management and improvement of eco-management of hazardous material stood out across the firms surveyed with means above four points out of the maximum possible score of five. However, improvement of eco-friendly reputation, charging higher premium price on eco-products, improvement of eco-management of hazardous material and increment in eco-brand loyalty were found to be used in an average extent scoring means ranging from three to less than four out of the maximum possible score of 5. These findings are in agreement with Christmann, (2000) which used them as a measure of environmental differentiation in their study. The findings are presented in Table 4.11.

Table 4. 11 Environmental differentiation indicators

Item	Percent (%) 1	2	3	4	5	Mean	Standard Deviation
Environmental differentiation							
Eco-friendly reputation has increased	1.2	5.0	26.7	43.5	23.6	3.83	0.889
Charge higher price (premium) compared to competitors	6.2	20.5	22.4	39.8	11.2	3.29	1.122
Eco-brand loyalty has increased	4.4	3.8	21.9	45.6	24.4	3.82	0.990
Eco-waste management has improved	1.2	3.1	10.6	28.6	56.5	4.36	0.584
Eco-management of hazardous material has improved	3.1	8.7	9.3	29.8	49.1	4.13	0.596
Conservation of energy and water has improved	1.2	1.2	14.3	24.8	58.4	4.38	0.666
Production of eco-unique products has increased	5.0	8.7	15.5	32.9	37.9	3.90	0.952

Key: n=161, 1= NA=Not All, 2= SE=Small Extent, 3= A=Average, 4= LE=Large Extent, 5= LE=Very Large Extent

4.6 Requisite Tests

4.6.1 Test of Normality of Data Distribution

The study sought to ascertain the normality of the predictor variables data in terms of the underlying distribution of the errors as a prerequisite for the application of the regression model in the study. As a result, Shapiro Wilk test for normality was used to test the underlying distribution of the errors. The statistical findings were as follows: green procurement (p = 0.827), green manufacturing (p =0.832), EORL (p = 0.727), green distribution (p = 0.623) and SCE (p = 0.635).

The results of data tests show that all the p-values are greater than the chosen alpha level of 0.05. This implies that the 'variables are normally distributed'. According to Shapiro, (1965), any value above 0.05 (chosen alpha) indicates normality of the data. Hence the data findings imply that the errors were normally distributed in the study as a prerequisite to the application of the regression model in the study. The statistical findings are presented in Table 4.12.

Table 4. 12 Shapiro Wilk test for normality results

Variable	Obs	Prob>z	Chosen alpha (0.05)
Green Procurement	161	0.827	0.05
Green Manufacturing	161	0.832	0.05
EORL	161	0.727	0.05
Green Distribution	161	0.623	0.05
Supply Ecocentricity	161	0.635	0.05

4.6.2 Test of Equal variance (homoscedasticity)

This is a post-estimation test that confirms the assumptions of constancy of variance for fitting a linear regression model in data analysis. To determine that the variances of the predictor variables are the same for all the data (homoscedasticity) as a requirement in regression model, the study used Breusch-Pagan test for heteroscedasticity. According Breusch; Pagan, (1979) if the p-value of the test is greater than critical value, in this study 0.05, then the variance is constant. The p-value of this test is 0.4485 (which is greater than 0.05) meaning the study the variation in data is uniform. This indicates homoscedasticity in the data and therefore the use of multiple regression model is supported. The results of the tests are shown in Table 4.13

Table 4. 13 Breusch-Pagan test for heteroscedasticity

Variable	Chi-square value	P-value
Fitted values of performance	0.57	0.4485

4.6.3 Test for multi-collinearity

The study sought to establish that one predictor variable could not be linearly predicted from the others (non-multi – collinearity) as a condition for applying multiple regression model in analyzing the study data. To achieve this, the study used the correlation matrix. The results indicate that the correlation values (off-diagonal elements) are all below 0.4. This comply with Pedace (2013) recommendation that small correlation values of less than 0.4 between the predictor variables signify that there was no multicollinearity between the predictor variables. This implies that one predictor variable could not be linearly predicted from the others and therefore the assumption for application of the linear regression model of "no multi-collinearity" was observed in the study. The data findings are presented on Table 4.14.

Table 4. 14 Results for test of multi-collinearity

	Green proc	Green man	Green dist	EORL prac	Supply econ
Green proc	1.0000				
Green man	0.3336	1.0000			
Green dist	0.2472	0.1019	1.0000		
EORL prac	0.1452	0.1044	0.2064	1.0000	
Supply eco	0.2088	0.3024	0.0065	0.1422	1.0000

4.7 Confirmatory Factor Analysis (Inferential Tests)

In order to address the study objectives outlined in chapter 1, this section reports the results of confirmatory factor analysis (CFA) under the Structural Equation Modeling (SEM). Confirmatory factor analysis (CFA) under the structural equation modeling (SEM) was used in this study to determine the items which could be used to measure the

study constructs. SEM is a quantitative data analysis method which specifies , estimates, and tests hypothetical relationships between observed endogenous factors (variables) and latent, unobserved exogenous factors (Byrne, 2001). SEM is not a title for a single statistical procedure but a family of relevant procedures including analysis of covariance structure which combines factor analysis and regression analysis as well (Diamantopoulos & Siguaw, 2000).

In the estimation process, SEM produces regression weights, variances, covariance and correlations which converges on a set of parameters estimates on iteration (Holmes-Smith et *al*., 2004). In this study, a scale proposed by Byrne (2001); Holmes-Smith et al. (2004); Truxillo, (2003); and Kline (2005) was used to measure model fitness of items for measuring the study constructs. According to Byrne, (2001) a measuring model with a normed degree of freedom (Chi-square mean - CMIN/ degree of freedom –DF) of ≤ 2, root mean square error of approximation – RMSEA of <0.08, incremental fit index –IFI, tucker lewis index-TLI and component fit index-CFI of ≥ 0.90 respectively are considered acceptable scale for good as well as adequate fit model for measuring a study factor, Table 4.15. Consequently, the measurement models for each factor (construct) for this study are discussed in the section to follow.

Table 4. 15 Scale for SEM Fit Indices

Level of Model Fit	**Overall Model Fit**				
	Model Fit		**Model Comparison**		
Fit Measures	CMIN/DF	RMSEA	IFI	TLI	CFI
Recommended for Further Analysis if	>2	>0.08	0.90	<0.90	<0.90
Acceptable Scale for Good as well as Adequate Fit	≤2	<0.06 (Reasonable fit up to 0.08)	≥0.90	≥0.90	≥0.90

Source: Byrne (2001); Holmes-Smith *et al.* (2004); Truxillo, (2003); and Kline (2005)

4.7.1 Green Procurement: Initial/final Findings

Green procurement was measured using seven items. Initial assessment of the inter-item correlation matrix shown that green procurement items, "GP6" (second-tier supplier environmentally friendly practice evaluation) and "GP7" (eco labeling of products) were poorly correlated with all other items in the scale. The seven "GP" items were subjected to a CFA and the results are shown in Table 4.16. The fit indices gave a poor picture with regard to the adequacy of the fit of normed χ^2 and RMSEA with values 3.342 (df=9 and p=.001) and 0.102 respectively. Examination of the loadings indicated that standardized regression weight for "GP6" and "GP7" were very low (0.44 and 0.36 respectively). GP6 item asked for the respondent's evaluation of second tier suppliers as a criteria for purchasing decision which seemed not be adequately perceived factor of green procurement. Item GP7 (eco labeling of products) was perceived to be slightly different from other items in the scale. While the other green procurement items have been adopted locally as both operational and strategic practices, eco labeling is still a new concept. It is also possible that the ambiguity of the wording of this item contributed to its lower loading of 0.36. However, upon deletion of "GP6" and "GP7" (Table 4.16) all fit indices showed significant improvement which exhibited high loadings with reduced

$\chi 2$ value from 30.08 (df =9 and p =0.001) to 6.28 (df=2 and p =0.42). The modification further resulted in a reduction of RMSEA from initial value of 0.102 to a final value of 0.097 which is within acceptable level of adequate fit (Byrne, 2001), improved incremental fit index (IFI), tucker lewis index (TLI), and component fit index (CFI) by values 0.994, 0.979, and 0.994 respectively (Table 4.16) which indicate a very well fit model (Truxillo, 2003). The composite construct reliability for this 5-item measure is 0.92 which is well above the acceptable level of 0.70 as recommended by Hair *et al.,* (2006); Nunnally and Brernstein (2004) for an adequate model fit. This implies that the retained five items are considered reliable as well as valid for measuring the factor - green procurement in this study. The use of the five items to measure green procurement as a factor in this study is in agreement with Lacroix and Stamatiou (2007) study which used a 5-item scale in measuring green procurement for a study in Japan. The results of the confirmatory factor analysis are presented in Table 4.16.

Table 4. 16 Results of CFA for green procurement measures

Quest. Items	Item wording	Initial	Final	
		Standardized Loadings	Standardized Loadings	C.R (t)
GP1	Providing specification to suppliers that includes environmental requirements	0.86	0.88	16.20
GP2	Environmental audits of supply base	0.91	0.92	17.28
GP3	ISO14001 certification of supply base as a criteria for selecting vendor	0.80	0.80	13.92
GP4	Prefer products that consumed fewer natural resources	0.82	0.79	13.81
GP5	Working with suppliers to address environmental problems	0.75	0.76	11.56
GP6	Second-tier supplier environmentally friendly practice evaluation	0.44		
GP7	Eco labeling of products	0.36		
Achieved Fit Indices				
	CMIN/DF (χ^2/df)	**RMSEA**	**IFI**	**TLI**	**CFI**
Initial	3.342 (30.08/9)	0.102	0.975	0.957	0.975
Final	3.136 (6.28/2)	0.097	0.994	0.979	0.994
Composite Construct Reliability 0.92					

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4.7.2 Green Manufacturing: Initial/final Findings

Green manufacturing was measured by seven items. The inter-item correlation matrix initial analysis established that green procurement 'item GM7' was relatively poorly correlated with all other items in the scale for measuring green manufacturing. All the seven items were subjected to a critical factor analysis (CFA). The initial CFA results are presented in Table 4.17 which indicated that the model was a poor fit to the data and required adjustment as the designated limit of fit indices are below the recommended levels with a high $\chi 2$ value of 24.325 (df=7 and p =0.003) and unreasonable root mean square approximation (RMSEA) of 0.103 implying relatively poor model fit, Table 4.17. In terms of item 'GM7' (design of products for reuse, recycle, and recovery of material and/or component parts), it appeared not to be sufficiently perceived green manufacturing factor in the present context. As a result, upon deleting of green manufacturing item 'GM7', the better fitted model was achieved with reduced χ^2 value from 24.325 to 3.60 (df =2 and p=0.164) and all the other fit indices displayed considerable improvement to the overall fit to the model (Table 4.17). Even though item GM7 covered a specific additional aspect of green manufacturing, some researchers (Saki, 2006; Phungrassami, 2008) have ignored its inclusion as a measure of green manufacturing. Consequently, deletion of item GM7 does not remove any important component that should be reserved for the measure and will not affect the content and face validity of the construct. The composite reliability score for the six measure was 0.70 which implies that the retained six items (Table 4.17) are considered reliable for measuring green manufacturing (Hair *et al.*, 2006).

Table 4. 17 Results of CFA for green manufacturing measures

Quest. Items	Item wording	Initial Standardized Loadings	Final Standardized Loadings	Final C.R (t)
GM1	Using machines or tools which consume less energy, water and fuel	0.71	0.68	10.67
GM2	Impact and life cycle assessment tools for manufacturing	0.69	0.72	11.09
GM3	Risk assessment for energy and resource use	0.80	0.82	12.98
GM4	Environmental friendly raw material	0.71	0.66	9.90
GM5	Efficient processes to reduce solid waste , air emissions and conserve energy and water	0.75	0.81	12.06
GM6	Environmental Management System	0.69	0.72	11.07
GM7	Design of products for reuse, recycle, recovery of material and/or component parts	0.63		

Achieved Fit Indices

	CMIN/DF (χ^2/df)	RMSEA	IFI	TLI	CFI
Initial	3.475 (24.325/7)	0.103	0.968	0.934	0.967
Final	1.80 (3.60/2)	0.059	0.994	0.981	0.994

Composite Construct Reliability 0.70

4.7.3 Green distribution: Initial/final Findings

Green distribution as a dimension of GSCM was measured using seven item scale. All the seven items were subjected to a critical factor analysis (CFA), the initial results are presented in Table 4.18. The findings of the CFA of the seven items showed that the model was a poor fit to the data with unacceptable high chi-square value of 50.036 (df=7, P=0.001) and unacceptable RMSEA score of 0.164 even though IFI, TLI and CFI scores were acceptable at >0.90, Table 4.18. The overall findings of the initial analysis for this construct measure suggests that item 'GD6' (distribute products together, rather than in smaller batches) was responsible for the poor fit to the model although it is one of the high loaded items (Standardized loading score of 0.77) in the model, Table 4.18. The poor fit to the model required re-specification of the measures of green distribution in order to improve the model fit. Hair, Black, Babin, Anderson and Tatham, (2006) recommended that under such circumstances, relating or deleting the indicator from the model are the preferred basic ways to re-specify the model. Therefore, on exclusion of item 'GD6', the overall model fit was significantly enriched with $\chi 2$ value reduced from 50.036 to 1.941, Table 4.18. The possible explanation for excluding item 'GD6'is that it is not clear how it relates to eco initiatives within distribution practices. Ninlawan *et al*., (2011) used six different items to measure green distribution. Therefore, for this study, the remaining six items were considered adequate for measuring green distribution. Accordingly, exclusion of one item and using six items for measuring green distribution would not impact on the content and face validity of the measurement because these items are not losing any basic element of green distribution which they are supposed to measure. The composite construct reliability for this measure was 0.80 which is well above the acceptable level as indicated in the literature (Hair et *al*., 2006). This implies that the retained six items are reliable measures of green distribution for in this study.

Table 4. 18 Results of CFA for green distribution measures

Quest. Item	Item wording	Initial Standardized Loadings	Final Standardized Loadings	Final C.R (t)
GD1	Eco labeling of products	0.71	0.67	10.69
GD2	Environment-friendly packaging and transportation	0.75	0.72	11.95
GD3	Providing information to customers on environment friendly products	0.80	0.82	12.98
GD4	Re-using and recycling of packages	0.82	0.86	15.16
GD5	Collection of packages for proper disposal	0.87	0.90	16.20
GD6	Distribute products together, rather than in smaller batches	0.77		
GD7	Downsize packaging	0.84	0.88	15.38

Achieved Fit Indices

	CMIN/DF (χ^2/df)	RMSEA	IFI	TLI	CFI
Initial	7.148 (50.036/7)	0.164	0.953	0.904	0.951
Final	0.970 (1.94/2)	0.00	1.00	1.00	1.00

Composite Construct Reliability 0.80

4.7.4 Environmentally Oriented Reverse Logistics: Initial/final Findings

Environmentally Oriented Reverse Logistics was measured by seven items. The initial verification of the inter-item correlation matrix established that items 'EORL7' and 'EORL6' are poorly correlated with other items in the scale (correlation coefficient as low as 0.12 and a high of 0.45 respectively). Notwithstanding the concerns about these items, all the seven items were subjected to a CFA, the findings of which are presented in Table 4.19. The critical factor analysis results indicated that the model was a poor fit to the data with a large $\chi 2$ value of 32.683 (df =10, p= 0.001) and with irrational normed χ^2 and RMSEA scores of 3.268 and 0.098 respectively. Scrutiny of the standardized regression weights in initial analysis revealed that 'item EORL6' and 'item EORL7'had relatively low loadings of 0.49 and 0.38 respectively. The two error covariance in the MIs with expected changes revealed misspecification affiliated with 'item EORL7' and 'item EORL6'. Further, looking at the mean scores of the items, it was evident that the items EORL7 and EORL6 were relatively low scored.

The two least correlated as well as least loading items (EORL7 = 0.38 and EORL6 =0.49) and their indicated misspecification require a justification. Environmentally oriented reverse logistics 'item EORL6' (encourage standardization of packages) was established not to be a relevant item for measuring EORL in the current industry context because manufacturers in Kenya normally produce variety of products which are distributed in several forms to different kinds of customers with different tastes that may not make it easy to standardized the packages. Again, the wording was not clear in relation to eco reverse logistics. 'Item EORL7' (provide incentives for return of used packages) on the other hand, exhibited misspecification associated with item EORL4. Such misspecification could mean that item EORL7' shares the sense of item EORL4 which measures manufacturer propensity to arrange with customers to return used packages. The poor fit of the model (Table 4.19) required modification of the measures to EORL in order to enhance the model fit. Upon deletion of the two items EORL6 and EORL7, the better fitted model was achieved with reduced χ^2 value from 32.68 to 0.323 (df =2 and p=0.00). The use of the five item construct measure in CFA is consistent with some of

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the measures used in other studies (Umeda *et al.*, 2003). Therefore, deleting the two items do not seem to remove anything that is supposed to be used to measure the factor (EORL). Furthermore, the composite construct reliability score for this measure was 0.74 which demonstrated that the retained items are thought to be reliable measures for environmentally oriented reverse logistics in this study (Hair et *al*., 2006)1). The other fit indices as displayed on this CAF analysis, Table 4.19 are good.

Table 4. 19 Results of CFA for EORL measures

Quest. Item	Item wording	Initial Standardized Loadings	Final Standardized Loadings	C.R (t)
EORL1	Waste collection for proper disposal	0.79	0.83	12.95
EORL2	Recycling, re-use and recovery of useful parts of the products	0.80	0.80	12.38
EORL3	Recovery of hazardous parts for proper disposal	0.79	0.77	13.12
EORL4	Arrangement with customers to return used packages	0.76	0.81	12.65
EORL5	Easy availability of information about returning of products	0.71	0.67	9.89
EORL6	Encourage standardization of packages	0.49		
EORL7	Provide incentives for return of used packages	0.38		

Achieved Fit Indices

	CMIN/DF (χ^2/df)	RMSEA	IFI	TLI	CFI
Initial	3.268 (32.68/10)	0.098	0.968	0.934	0.967
Final	0.1615 (0.323/2)	0.00	1.00	1.00	1.00

Composite Construct Reliability 0.74

4.7.5 Supply Chain Ecocentricity: Initial/final Findings

Supply chain ecocentricity (SEC) as the moderating factor in the hypothesized model was measured by seven items. The inter-item correlation matrix revealed that item SCE6 was poorly correlated with all the other items in the measuring scale. All seven items were subjected to a critical factor analysis (CFA), the findings are shown in Table 4.20. CAF findings of the seven items showed that the model was a poor fit to the data because the results were far from the commended levels with a very high χ^2 value of 88.89 (df=7, p=0.001), normed χ^2 =9.877 and RMSEA=0.198.

Examination of the loadings revealed that the standardized regression weights for item SCE6 (advance knowledge for environmental management practices) was relatively low (0.47). Moreover, seven associated error covariance explicitly established that at least one adjustment was necessary to enhance the model fit. To detect the directions, expected change statistics of error covariance indicated six of the seven misspecifications were connected to item SCE6. This suggested that item SCE6 is problematic as well as responsible for the poor fit to the data, hence should be omitted from the measurement to ascertain the better fitting model, Table 4.20.

The disagreement on confirming the convergent factor, however, in terms of SCE6 needs explanation. The item SCE6 (advance knowledge for environmental management practices) seems not be quite clearly stated as to relate with the factor supply chain ecocentricity in the current context thus deletion of this item is more meaningful. Upon deletion of 'item SCE6', a better model fit was estimated which reduced χ^2 value from 88.89 to 3.39 and the cut-off values achieved the recommended level of fit in the other model fit indices (Table 4.20). Although this one item was deleted, the retained six item factor for measuring SCE is in line with the literature (Tate *et al.*, 2011) and this achieved the face and content validity of the measure.

The composite reliability for this six item factor is reasonable with the score of 0.79 which is considered reliable measure. This implies that the retained six items (Table 4.20)

are reliable measures for supply chain ecocentricity and therefore their application in this study is acceptable (Hair *et al.*, 2006). Table 4.20 exemplified CA analysis results.

Table 4. 20 Results of CFA for supply chain ecocentricity measures

Quest. Item	Item wording	Initial Standardized Loadings	Final	
			Standardized Loadings	C.R (t)
SCE1	Partner with external stakeholders for environmental research	0.80	0.78	13.12
SCE2	Sponsorship for implementation of environmental management practices by the external stakeholders	0.94	0.90	15.83
SCE3	Participation in external stakeholders eco-oriented workshops	0.63	0.66	10.53
SCE4	Use of experts from external stakeholders for implementation eco-best practices	0.79	0.84	14.67
SCE5	Environmental audit by external stakeholders	0.92	0.88	15.79
SCE6	Advance knowledge for environmental management practices	0.47		
SCE7	Co-investment with external stakeholders on environmental management related issues	0.86	0.89	16.19
Achieved Fit Indices				
	CMIN/DF (χ^2/df)	**RMSEA**	**IFI**	**TLI**	**CFI**
Initial	9.877 (88.89/9)	0.198	0.916	0.853	0.912
Final	1.695 (3.39/2)	0.056	0.998	0.993	0.997
Composite Construct Reliability 0.79					

4.7.6 Performance: Initial/final Findings

Environmental differentiation as a performance measure was measured using seven items. The initial scrutiny of the inter-correlation matrix demonstrated a strong significant correlation among the items (all above 0.50). The confirmatory factor analysis (CFA) showed a good fit of the model to the data (Table 4.21). The findings confirmed the validity of the model with excellent model fit statistics (normed χ^2 =1.723, RMSEA = 0.056, IFI = 0.978, TLI 0.986 and CFI =0.992) for this factor measure as reported in Table 4.21.

The seven item factor for measuring performance in terms of environmental differentiation has been used in the existing literature (Handfield *et al*. 2005; Preuss 2005) which approved the content and face validity of the measure. Further, the composite reliability score for this construct measure is 0.79 which is considered reliable measure (Hair et *al*., 2006). This means that the retained seven items (Table 4.21) were reliable measures for environmental differentiation as a measure of firm performance. The CF analysis findings are presented on Table 4.21.

Table 4. 21 Results of CFA for environmental differentiation measures

Quest. Item	Item wording	Standardized Loadings	C.R (t)
PED1	Eco-friendly reputation has increased by	0.72	11.54
PED2	Charge higher price (premium) compared to competitors	0.92	17.96
PED3	Conservation of energy and water has improved	0.93	18.28
PED4	Production of echo-unique products has increased	0.89	15.96
PED5	Increase of eco- brand loyalty	0.77	12.69
PED6	Improvement of echo-waste management	0.81	13.93
PED7	Improvement of echo-management of hazardous material	0.84	14.75
Achieved Fit Indices			
CMIN/DF (χ^2/df)	**RMSEA**	**IFI**	**TLI**	**CFI**
1.623 (11.361/7)	0.056	0.978	0.986	0.992
Composite Construct Reliability 0. 79			

Another performance measure in this study is cost efficiency. Cost efficiency was measured using seven items. The initial analysis of the inter-correlation matrix established that 'item PC6'was relatively poorly correlated with all other items. The CFA of the seven items demonstrated that the model (Table 4.22) was a poor fit to the data because the cut-off ranges of fit indices were beyond the recommended levels (Table 4.22) with a highly scored χ^2 of 48.902 (df=7, p=000), normed χ^2 6.986 and RMSEA 0.159. The modification indices of this analysis indicated ways to improve the model fit. Modification indices with expected change statistics of error covariance denoted misspecification affiliated with 'item PC6' and showed that 'item PC6' is responsible for

the lack of fit to the data. Even though this item was loaded reasonably to the measure with score of 0.72, this item was found to be responsible for the weak fit.

Investigation of the poorly performing 'item PC6' shows that it might share the perceptual meaning as well as sense of 'item PC5' where input storage costs is part of cost of input – using cost of input caters for input storage cost hence the measure of the factor will not be affected by dropping 'item PC6'. Even though 'item PC6' showed a reasonable loading score of 0.72, removing it from this measure had a big effect on the level of overall measurement model fit, Table 4.22.

Finally, on deletion of 'item PC6', the measurement model was rerun which demonstrated significant enrichment to the overall model fit (Table 4.22) with significantly changed χ^2 value from 48.902 to 4.442. It was not a problem for the six item factor to attain content and face validity covering reduction of waste management fee, reduction of hazardous material management fees, reduction of cost of energy and water, reduction of statutory fines for non-environmental compliant, reduction of input costs due to recycle/re-use of material and efficient use of input and reduction of cost of transportation.

In terms of removing 'item PC6' (reduction of cost of storage) from the measure, Lee, (2002) used only five items in measuring cost efficiency in a different context. Additionally, the composite reliability score for this six item factor model combines scored 0.89 which is deemed to be an indication of reliability (Hair et *al*., 2006).Thus the result of the CAF (Table 4.22) indicates that the six items are reliable measure for cost efficiency in this study.

Table 4. 22 Results of CFA for cost efficiency measures

Quest. Items	Item wording	Initial Standardized Loadings	Final	
			Standardized Loadings	C.R (t)
PC1	Reduction of waste management fee	0.80	0.82	14.09
PC2	Reduction of hazardous material management fees	0.78	0.81	13.92
PC3	Reduction of cost of energy and water	0.84	0.84	14.73
PC4	Reduction of statutory fines for non-environmental compliant	0.82	0.79	13.33
PC5	Reduction of input costs due to recycle/re-use of material and efficient use of input	0.74	0.76	12.14
PC6	Reduction of cost of storage	0.72		
PC7	Reduction of cost of transportation	0.79	0.79	12.37

Achieved Fit Indices

	CMIN/DF (χ^2/df)	RMSEA	IFI	TLI	CFI
Initial	6.986 (48.902/7)	0.159	0.956	0.911	0.956
Final	2.221 (4.442/2)	0.073	0.996	0.986	0.996

Composite Construct Reliability 0.89

4.8 Regression Analysis (Inferential Tests)

In order to address the study objectives outlined in chapter 1, this section reports the results of the stepwise multiple regression analyses of tested hypothesized model in chapter 2. The regression tests were conducted to determine the relationship between firms' performance as dependent factor, the predictor factors such as green procurement, green manufacturing, green distribution, environmentally oriented reverse logistics and supply chain ecocentricity as a moderating factor. The results of the regression analyses tests are reported in the following sub-sections.

4.8.1 Green Procurement and Firm Performance

The study null hypothesis was derived from the study specific objective: "To investigate the effect of green procurement on the performance of the manufacturing firms."

Null Hypothesis 1 (H_0): Green procurement does not significantly influence the performance of the manufacturing firms.

The multiple regression analysis ($y = B_0 + B_1X_1 + E$) was run with firm performance as the dependent factor and green procurement as tested predictor factor. Data from one hundred and sixty one respondents were tested.

The value of variance R^2 = 0.3386, shows that 33.86% of the firms performance is explained by green procurement (regression line). The values of F (1, 159) = 101.36, P < 0.05, shows that green procurement is statistically significant predictor of the firms performance (the regression model is a good fit of the data).Therefore, the *null hypothesis 1*; that "green procurement does not significantly influence the performance of the manufacturing firms" was rejected and the alternative accepted. The value of green procurement is statistically significant (t=10.07, $p < .05$), it affects firm performance. The regression model explaining the results in Table 4.23 from SPSS software (version 21) is given by:

ISSN 2320-9186

$$Performance = 0.846 + 0.691 \times Green\ Procurement \ldots\ldots\ldots\ldots\ldots Model\ 1$$

The model shows that green procurement positively affects the performance (an increase in mean index of green procurement increases the performance of the company by a positive unit of mean index value of 0.691). The results are illustrated in Table 4.23.

Table 4. 23 Significant Association between Green Procurement and Firm Performance

Performance	Coefficient	Std. Error	t	P>|t|
Green Procurement	0.691	0.0687	10.07	0.000
Constant	0.846	0.3125	2.71	0.008

F (1, 159) = 101.36, P < 0.001, R-squared = 0.3386, Adj R-squared = 0.3357

4.8.2 Green Manufacturing and Firm Performance

The study null hypothesis was established from the study specific objective: "To establish the effect of green manufacturing on the performance of the manufacturing firms."
Null hypothesis 2(H_0): Green manufacturing does not significantly influence the performance of manufacturing firms.

The multiple regression analysis ($y = B_0 + B_1X_1 + \varepsilon$) was performed with firm performance as the dependent factor and green manufacturing as tested predictor factor. Data from one hundred and sixty one respondents were tested.

The value of R^2 = 0.4027, shows that 40.27% of the firms' performance is explained by green manufacturing (regression line). The values of F (1, 159) = 160.72, P < 0.05, show that green manufacturing statistically significantly predicts the firms performance (the regression model is a good fit of the data) hence the rejection of the *null hypothesis 2*; that "green manufacturing does not significantly influence the performance of manufacturing firms" and accepting the alternative hypothesis. The coefficient value of green manufacturing is statistically significant (t=13.94, p < .05), it affects firm

performance significantly (t=13.94, $p < .05$). The regression model which explains Table 4.24 is given by:

$$Performance = 0.609 + 0.744 \times Green\ Manufacturing \ldots\ldots\ldots Model\ 2$$

The model shows that green manufacturing positively affects the performance; an increase in unit of mean index of green manufacturing increases the performance of the company by a positive unit mean index value of 0.744. The results are exemplified in Table 4.24.

Table 4. 24 Significant Association between Green Manufacturing and Firm Performance

Performance	Coefficient	Std. Error	t	P>|t|
Green Manufacturing	0.744**	0.0534	13.94	0.000
Constant	0.609**	0.2438	2.50	0.013

F (1, 159) = 160.72, P<0.001, R-squared = 0.4027, Adj R-squared = 0.3996

4.8.3 Green Distribution and Firm Performance

The study null hypothesis was determined from the study specific objective: "To establish the influence of green distribution on the performance of the manufacturing firms in Kenya."

Null hypothesis 3(H_0): Green distribution does not significantly influence the performance of manufacturing firms.

The multiple regression analysis ($y = B_0 + B_1X_1 + \varepsilon$) was performed with firm performance as the dependent factor and green distribution as tested predictor factor. Data from one hundred and sixty one respondents were tested.

The value of R^2 = 0.3042, shows that 30.42% of the firms performance is explained by green distribution (regression line). The value of F (1, 159) = 117.50, P-value < 0.05,

shows that green distribution statistically significantly predicts the firms performance , *p* value is smaller than the alpha value (0.05). As a result, the null hypothesis; "green distribution does not significantly influence the performance of manufacturing firms" was rejected (p< 0.05 at p = 0.047) and the alternative hypothesis accepted. The value of green distribution is statistically significant, it affects the firm performance (t=2.31, p < .05). The multiple regression model which explains the results in Table 4.25 is given by:

$$Performance = 1.484 + 0.018 \times Green\ Distribution \dots\dots\dots Model\ 3$$

The model implies that green distribution positively affects the performance of the firm; an increase in mean index of green distribution increases the performance of the firm by a positive unit of mean index value of 0.018. The results are illustrated in Table 4.25.

Table 4. 25 Significant relationship between Green Distribution and Firm Performance

Performance	**Coefficient**	**Std. Error**	**t**	**P>|t|**
Green Distribution	0.018**	0.0672	2.31	0.047
Constant	1.484**	0.302	4.91	0.000

F (1, 159) = 117.50, P-value <0.001, R-squared = 0.3042, Adj R-squared = 0.2998

4.8.4 Environmentally Oriented Reverse Logistics and Firm Performance

The study null hypothesis was formulated from the study specific objective: "To investigate the effect of environmentally-oriented reverse logistics on the performance of the manufacturing firms."

Null hypothesis 4(H_0): Environmentally-oriented reverse Logistics does not significantly affect the performance of manufacturing firms.

The multiple regression analysis ($y = B_0 + B_1X_1 + \varepsilon$) was done with firm performance as the dependent factor and environmentally-oriented reverse logistics as tested predictor factor. Data from one hundred and sixty one respondents were tested.

The value of R^2 = 0.3893, shows that 38.93% of the firms performance is explained by EORL practices (regression line). The value of F (1, 159) = 185.59, P-value < 0.05, shows that EORL practices statistically significantly predicts the firms performance (the regression model is a good fit of the data).The null hypothesis was consequently rejected and the alternative hypothesis accepted. The EORL is statistically significant (t=11.95, p < .05), it is significantly affects firm performance (t=11.95, p < .05). The regression model which explains the results in Table 4.26 is given by:

$$Performance = 0.775 + 0.701 \times EORL\ Practices \ldots\ldots\ldots Model\ 4$$

The model shows that EORL practices positively affects the performance; an increase in mean index of EORL practices increases the performance of the company by a positive unit of mean index value of 0.701. The results are exemplified in Table 4.26.

Table 4. 26 Significant Association between Environmentally- oriented Reverse Logistics and Firm Performance

Performance	Coefficient	Std. Error	t	P>|t|
EORL Practices	0.701**	0.0586	11.95	0.000
Constant	0.775**	0.2692	2.88	0.005

F (1, 159) = 185.59, P-value <0.001, R-squared = 0.3893, Adj R-squared = 0.3855

4.8.5 Green Supply Chain Management dimensions and Firm Performance

Based on the study global objective: "To establish the effect of green supply chain management practices on the performance of the manufacturing firms," the study sought to establish the aggregate effect of green supply chain management dimensions on the performance of manufacturing firms. Consequently, a *null hypothesis* that "Green Supply Chain Management dimensions do not significantly influence the performance of manufacturing firms" was tested using multiple regression analysis:

$y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + \varepsilon$. Where firm performance is the dependent factor and the dimensions of GSCM as the tested predictor factors. Data from one hundred and sixty one respondents were analyzed.

The value of Adjusted R^2 = 0.5810, shows that 58.10% of the firms performance is explained by GSCM dimensions collectively. The value of F (4, 156) = 57.07, P-value < 0.05, shows that GSCM dimensions collectively predicts the firms performance (the regression model is a good fit of the data) thus rejection of the null hypothesis; "green supply chain management practices do not significantly influence the performance of manufacturing firms" and acceptance of alternative hypothesis.

The data findings indicate that individually, green procurement (t=2.18, $p < 0.05$), green manufacturing (t=3.81, $p < 0.05$), green distribution (t=2.11, p<0.05) and EORL practices (t=2.36, $p < 0.05$) are statistically significant values and therefore significantly affecting the performance of the manufacturing firms. The regression model is given by;

$$Performance = 0.322 + 0.154 \times Green\ Procurement + 0.481 \times Green\ Manufacturing + 0.144 \times Green\ Distribution + 0.231 \times EORL\ practices \ldots\ldots\ldots Model\ 5$$

The model shows that green procurement, green manufacturing, green distribution and EORL practices collectively (GSCM dimensions) significantly affect the firm performance positively; an increase in of each of the mean index of factors/variables increases the performance of the company by a positive unit mean index value of the respective factors. The results are presented in Table 4.27.

Table 4. 27 Significant relationship between Green Supply Chain Management dimensions and Firm Performance

Performance	Coefficient	Std. Error	t	P>|t|
Green Procurement	0.154**	0.1282	2.18	0.032
Green Manufacturing	0.481**	0.1208	3.81	0.000
Green Distribution	0.144**	0.0917	2.11	0.044
EORL Practices	0.231**	0.0977	2.36	0.019
Constant	0.322	0.2801	1.15	0.252

F (4, 156) = 57.07, P-value <0.001, R-squared = 0.5890, Adj R-squared = 0.5810

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4.8.6 Green Supply Chain Management dimensions, Supply Chain Ecocentricity and Firm Performance (F-Test comparing Model 5 and 6)

The study sought to establish the effect of supply chain ecocentricity (moderating variable) in the hypothesized model (Fig 2.1). Table 4.28 presents the findings for Model 6 as given by:

$$Performance = 0.309 + 0.155 \times Green\ Procurement + 0.478 \times Green\ Manufacturing + 0.148 \times Green\ Distribution + 0.234 \times EORL\ practices - 0.031 \times Supply\ Chain\ Ecocentricity \ldots\ldots\ldots\ldots\ldots Model\ 6$$

In order to establish the moderating effect of supply chain ecocentricity on the relationship between green SCM practices and firm performance, the study compared the model with all the factors (*Model 6*) versus the model with all the factors except supply chain ecocentricity (*Model 5*). Consequently, the study used F-Test to test the following hypothesises:

H_0: There is no significant change in model 5 by adding SC ecocentricity in the model

H_1: There is significant change in model 5 by adding SC ecocentricity in the model

From the tests, the following values were obtained;

The F-value, F (5,155) = 0.01, P-value=0.9057

This shows that the two models were not statistically significantly different ($p>0.05$). Hence the acceptance of the H_0: the moderating variable has no statistical significant effect on the model after its introduction and rejecting H_1. The data findings from the stepwise regression model show that the values of adjusted R^2 remains almost the same in the two models. These mean that supply chain ecocentricity is not a moderating factor in this study. The results of the fitted model (Model 6) with an additional factor (moderating factor) is presented in Table 4.28.

Table 4. 28 Significant Relationship between Green Supply Chain Management dimensions, Supply Chain Ecocentricity and Firm Performance

Performance	Coefficient	Std. Error	t	P>|t|
Green Procurement	0.155**	0.1380	2.09	0.048
Green Manufacturing	0.478**	0.1213	3.79	0.000
Green Distribution	0.148**	0.0926	2.16	0.045
EORL Practice	0.234**	0.1025	2.29	0.024
Supply Chain Ecocentricity	-0.031	0.2644	-0.12	0.906
Constant	0.309	0.3012	1.03	0.252

F (5,155) =45.36, P-value<0.001, R-squared=0.5886, Adj R-squared=0.5808

4.9 Optimal model

From the tested hypothesized models, the researcher sought to establish the optimal model for the study. Subsequently, a stepwise regression analysis was performed and only variables with significant values were included in the model ($p<0.05$). The value of variance Adjusted R^2 = 0.5810, shows that 58.10% of the firms performance is of green procurement, green manufacturing, green distribution and EORL practices.

The value of F (4, 156) = 57.07, P < 0.05, shows that supply chain management practices statistically significantly predicts the firms performance (the regression model is a good fit of the data).The green procurement (t=2. 18, $p < .05$), green manufacturing (t=3.81, $p < .05$), green distribution (t= 2.11) and EORL practices (t=2.36, $p < .05$) are statistically significant values; implying that they exert significant influence on firm performance. The results are presented in Table 4.29.

Table 4. 29 Results of the Optimal Model

Performance	Coefficient	Std. Error	t	P>|t|
Green Procurement	0.154**	0.1282	2. 18	0.032
Green Manufacturing	0.481**	0.1208	3.81	0.000
Green Distribution	0.144**	0.0917	2.11	0.044
EORL Practices	0.231**	0.0977	2.36	0.019
Constant	0.322	0.2801	1.15	0.157

F (4,156) =57.07, P-value <0.001, R-squared=0.5890, Adj R-squared=0.5810,

The optimal regression model is given by:

$$Performance = 0.357 + 0.154 \times Green\ Procurement + 0.481 \times Green\ Manufacturing + 0.144 \times Green\ Distribution + 0.225 \times EORL\ practices \ldots\ldots\ldots\ldots\ldots Model\ 7$$

The model shows that green procurement, green manufacturing, green distribution and EORL practices have fundamental positive effect on firm performance i.e. an increase in each of the mean index of factors/variables increases the performance of the company by a positive unit mean index value of the respective factor. Green manufacturing is the factor which increases the firm performance by higher value (0.481), followed by EORL practices (0.231) and the least is green distribution (0.144). Thus, the study optimal model is given by Fig. 4.2

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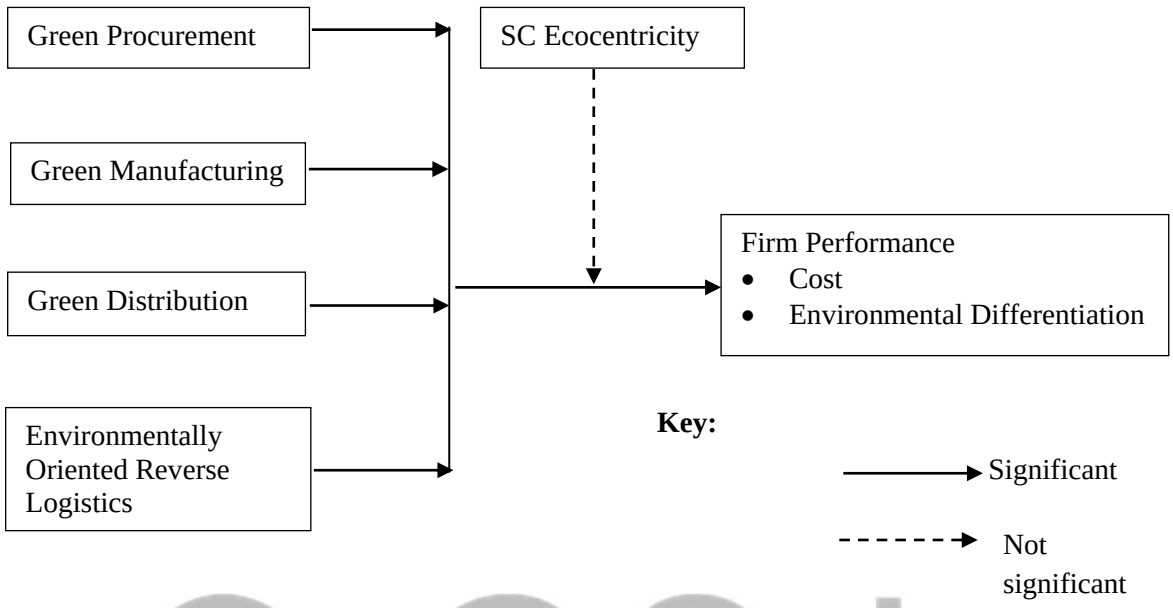

Figure 4. 2 Optimal Model

4.10 Discussion of the Results

The goal of this section is to discuss the findings of this study in line with the reviewed literature, the findings and the research hypothesises. The results of the tested null hypotheses are summarized in Table 4.30

Table 4. 30 Summary of the Results of the Tested Null Hypotheses

Null Hypothesis		Results	Implications
1	Green procurement does not significantly influence the performance of the manufacturing firms.	Null hypothesis Rejected Alternative Hypothesis Accepted	Green procurement is a significant factor in firm performance
2	Green manufacturing does not significantly influence the performance of manufacturing firms.	Null hypothesis Rejected Alternative Hypothesis Accepted	Green manufacturing significantly influence firm

			performance
3	Green distribution does not significantly influence the performance of manufacturing firms.	Null hypothesis Rejected Alternative Hypothesis Accepted	Green distribution does influence firm performance significantly
4	Environmentally-oriented reverse Logistics does not significantly affect the performance of manufacturing firms	Null hypothesis Rejected Alternative hypothesis accepted	EORL influence firm performance significantly
5	Green Supply Chain Management dimensions do not significantly influence the performance of manufacturing firms.	Null hypothesis Rejected Alternative Hypothesis Accepted	GSCM dimensions collectively significantly influence firm performance
6	Supply chain ecocentricity does not moderate the relationship between green SCM dimensions and firm performance	Null hypothesis Accepted Alternative Hypothesis Rejected	SEC does not moderate the influence of GSCM dimensions on firm performance

4.10.1 Green procurement and firm performance

The study sought to establish the effect of green procurement as a dimension of green SCM on the performance of the manufacturing firms in Kenya. Numerous studies have posited that green procurement practices lead to improvement of the performance of

firms in both financial and non-financial fronts. This study postulation was grounded on such studies in examining the effect of green procurement on the performance of manufacturing firms in Kenya.

The study findings indicate that firms that have internalized green procurement practices within their operations experience improvement in their performance outcomes. The multiple regression analysis results indicate that green procurement has a positive statistically significant effect on the performance of manufacturing firms; $p < 0.05$ $(P=0.000)$ with an explanatory power of 33.86 percent. Therefore, the null hypothesis "green procurement does not significantly influence firm performance" was rejected.

This finding agrees with Gibbs (2000) findings under ecological modernization theory which espouses the positive contribution of green procurement to economic performance of manufacturing firms. It supports Lacroix and Stamatiou, (2007) contention that Japanese and European leading companies that decided to go along with green procurement activities were experiencing improved performance through increased overall cost efficiency, enhanced reputation through product differentiation, market share, and reduced environmental risks and liabilities. The study finding on the significant effect of green procurement on firm performance conforms to Lacroix, (2008) findings that companies register improved performance once they effectively adopt ecological practices within procurement. Zhu *et al*., (2008) Melnyk et *al*., (2003) all concluded that there is a link between green procurement and firm performance.

The study results showed that, environmental requirements as a specification for purchases, preference products that consumed fewer natural resources, working with suppliers to address environmental problems and environmental audits of supply base as indicators of green procurement were explicit across the firms studied having an overall scores of mean 4.24, STD 0.679; mean 4.01, STD 0.541; mean 4.24 STD 0.612 and mean 4.16, STD 0.672 respectively out of a possible maximum 5 points. An average STD value of 0.7646 implies small variations across the firms studied. These findings conform to the theoretical arguments by Lacroix and Stamatiou, (2007) that Japanese companies' record

improved performance as a result of embracing procurement eco-practices such environmental requirements as a specification for purchases, preference products that consumed fewer natural resources, working with suppliers to address environmental problems and environmental audits. This may be due to recognition by firms that by reducing the supplier generated wastes and surpluses at source, firms essentially decrease handling expenses, risks and costs associated with waste management. In addition, a vendor's savings from improved efficiencies may be passed along to buyers in the form of reduced prices which may greatly affect the firm's bottom line in terms of reduced operation costs.

The study finding re-enforces an emerging argument within the supply chain management theory that the performance of a given firm can no longer be viewed in isolation but rather within a global network of members within a certain supply chain (Zhu *et al*., 2008). This findings, therefore, is an indication that results from preceding studies, undertaken in the context of developed countries, in different time periods, within the manufacturing firms and utilizing both financial and non-financial measures are in agreement with the ones from developing countries context. It can therefore be stated that the effect of eco practices within procurement function on firm performance does not recognize geographical or business environment of the manufacturing firms.

4.10.2 Green manufacturing and firm performance

The study pursued to establish the effect of green manufacturing on the performance of manufacturing firms in Kenya. The study outcomes indicate that injection of ecological practices to manufacturing functions positively affect the firm performance. Results of regression analysis indicate that there is a significant relationship between green manufacturing practices and firm performance; $p < 0.05$ $(P=0.000)$ with an explanatory power of 40.27 percent. Therefore, the null hypothesis "green manufacturing does not significantly influence firm performance" was rejected. Further, the study findings indicate that using machines or tools which consume less energy, water, and fuel; impact and life cycle assessment tools for manufacturing; risk assessment for energy and resource use; environmental friendly raw material; efficient processes to reduce solid

waste, air emissions and conserve energy; and environmental management system (EMS) were explicit across the firms studied having an overall scores of mean 4.44, STD 0.605; mean 4.33, STD 0.734; mean 4.33 STD 0.686; mean 4.56,STD 0.531; mean 4.63 STD 0.586; and mean 4.16, STD 0.602 respectively out of a possible maximum 5 points. An average STD value of 0.624 implies small variations across the firms studied.

The results of the analysis revealed that the influence of green manufacturing on performance is significant and is propelled by activities such as using machines or tools which consume less energy, water, and fuel; impact and life cycle assessment tools for manufacturing; risk assessment for energy and resource use; environmental friendly raw material; efficient processes to reduce solid waste, air emissions and conserve energy; and environmental management system. The results may explain the movement by the firms towards greening manufacturing practices. It can also be used to support the notion that generating waste costs money through payment for it three times over – when buying it, when processing it, and when disposing it. As such, firms which are able to drastically reduce the number of times they pay for wastes in a manufacturing process experience improved performance through cost reduction and product and processes differentiation.

These findings are in agreement with the contention by: Phungrassami, (2008) that green manufacturing is a continuous strategy used by firms in improving their performance both financially and in non-financial fronts; Lacroix, (2008) that ecological practices within manufacturing activity result in improved environment, workers' health, waste reduction and reduction of disposal costs, optimization of the use of raw material , water, energy and maximization of safety thus impacting positively on the overall performance of the firm; Banerjee, (2003) that green manufacturing program improves environmental performance and increases profitability of a firm by minimizing waste throughout transformation process thus impacting significantly on the performance of firms.

In addition, Lacroix and Stamatiou, (2008) conclusion that firms in both sectors (public and private) are realizing performance improvement as a result of green manufacturing practices is supported by the study findings. According to them, eco initiatives within

manufacturing set up improve efficiency in managing energy, water, material, and workers' health thereby positively impacting on the overall performance of firms. This findings, therefore, is an sign that results from previous studies, undertaken in the context of developed countries, in different time periods, within the manufacturing firms and utilizing both financial and non-financial measures are in agreement with the ones from developing countries context ; the influence of green manufacturing on firm performance could exist irrespective of the context of the study.

4.10.3 Green distribution and firm performance

The influence of green distribution on the performance of the manufacturing firms was examined. The study findings indicate that firms that have embraced ecological practices within their distribution activities do experience improved performance. Results of regression analysis show that green distribution statistically significantly influence the performance of firms, $p < 0.05$ (P=0.047) with an explanatory power of 30.42 percent. Therefore, the null hypothesis "green distribution does not significantly influence the performance of manufacturing" was rejected. Further the study established that green distribution practices such as; eco labeling of products, environment-friendly packaging and transportation, providing information to customers on environment friendly products, re-using and recycling of packages and collection of used packages for proper disposal were explicit across the firms studied having an overall scores of mean 4.15, STD 0.917; mean 4.36, STD 0.898; mean 4.34, STD 0.712; mean 4.22,STD 0.687; and mean 4.57, STD 0.764 respectively out of a possible maximum 5 points. An average STD value of 0.775 implies small variations across the firms studied.

The explicit use of eco labeling of products and providing information to customers on ecological friendly products within the concept of green distribution across the firms surveyed might be an indication that firms have recognized that customers prefer products with less impact to their environment and may be willing to pay premium in order to support their sustainability. The use of environment-friendly packaging and transportation, re-using and recycling of packages, and collection of used packages for

proper disposal across the surveyed firms as green distribution practices might be due to the realization by firms that organic packages or re-usable packages are cost effective and may contribute significantly to the firms' cost efficiency. The wide spread use of recycling packages across the surveyed firms might be due to compliance with environment regulations as required by various government agencies.

These findings are in agreement with the contentions by: Rao and Holt (2005) that management of wastes in the distribution processes such as re-usable packaging leads to cost savings and enhanced competitiveness of companies thereby positively influencing overall firm performance; Wu and Dunn (2008) that strategic green distribution practices such as standardized reusable containers, minimize use of packages, good warehousing layouts, and easy eco-information access reduce storage and retrieval delay which leads to savings in operating costs with an ultimate effect of improved firms' performance whilst being environmentally sound.

The study findings support Rao and Holt, (2005) contention that green distribution has a positive and significant influence on the performance of firms through an increase in market share; Sirmon *et al.* (1995) that companies that implemented an environmentally-friendly packaging schemes experience an increase in customer loyalty and increase in sales; Ninlawan et al. (2011) that firms which packaged their products with re-usable packages in Thailand registered high degree of customer satisfaction in terms of customer service and loyalty in terms of the brand; Preuss (2005) that firms that have recycled packages accrue benefits such as minimized waste disposal cost, save money by not buying new packages and eliminate incidental costs associated with new packages (branding ,storage). According to Rao and Holt (2005), these have a quantum effect of reducing operating cost, increasing the brand loyalty, hence improving firms' performance. Christmann (2000) noted that EU companies that embraced ecological practices in distributing products registered improvement in their performance. Ninlawan et al. (2011) observed that green distribution generally significantly influence the performance of firms.

4.10.4 Environmentally oriented reverse logistics and firm performance

The study was interested in finding out whether environmentally-oriented reverse logistics has any effect on the performance of the manufacturing firms. The study findings indicate that firms which have embraced ecologically oriented reverse logistics practices within their supply chain management experience improvement in their performance.

The results of regression analysis indicate that there is a strong link between environmentally oriented reverse logistics and the performance of the manufacturing firms; $p < 0.05$ $(P=0.000)$ with an explanatory power of 38.93 percent. Therefore, the null hypothesis that "environmentally-oriented reverse Logistics does not significantly affect the performance of manufacturing firms" was rejected. Additionally, the study findings indicate that waste collection for proper disposal; recycling, re-use and recovery of useful parts of the products; recovery of hazardous parts for proper disposal; arrangements with customers to return used packages; and easy availability of information about returning of products were explicit across the firms studied as indicators of EORL having an overall scores of mean 4.57, STD 0.764; mean 4.61, STD 0.743; mean 4.30 STD 0.828; mean 4.06, STD 1.271; and mean 4.26 STD 1.037 respectively out of a possible maximum 5 points.

The results of the analysis revealed that the influence of EORL on performance is significant and is pushed by activities such as waste collection for proper disposal; recycling, re-use and recovery of useful parts of the products; recovery of hazardous parts for proper disposal; arrangements with customers to return used packages; and easy availability of information about returning of products. These may explain the increased investment by firms on packages that are re-usable for the same products or for other products, used packages collection points within the major retail shops around the country and warnings and instructions on how to handle the disposal of particular items considered hazardous by the manufacturers.

These findings approve Zhu, Sarkis *et al.*, (2010) postulation under the ecological modernization theory (EMT) that environmentally oriented reverse logistics is an eco-innovative way with positive effect on the performance of firms. Lambert & Burduroglu, (2000); Stock *et al*., (2002) support these findings with their studies establishing positive relationship between environmentally oriented reverse logistics and firm performance. The findings agree with Umeda *et al*. (2003) contention that EORL constitutes indicators such as waste collection for proper disposal and recycling of used products (re-processing or re-use), recovery of hazardous parts for proper disposal, returning of faulty products for replacement or correction, collection of expired products for proper disposal, accepting exchange of expired products.

The study results support Lambert & Burduroglu (2000); Stock *et al*. (2002) that companies accrue benefits such image enhancement, improved efficiency and effectiveness in management of returned materials, and generation of new profits. The results are also in conformity with the argument by Guth & Ginsberg, (2001) that EORL activities significantly influence the performance of firms through the development and maintenance of a beneficial customer service policy and reduces costs, improvement of the return processes, improvement of the image of the firm, and improvement of the efficiency and effectiveness in the management of returned materials. Further, the study findings back Krikke *et al*., (2003) view that EORL activities to a large extend influence the performance of firm by facilitating compliance to environmental management statutory requirements thereby reducing non-compliance fines. Consequently, companies are increasingly embracing EORL as a strategic tool to performance improvement (Guth & Ginsberg, 2001).

4.10.5 Green Supply Chain Management Practices and firm performance

The study sought to establish the effect of green supply chain management dimensions on the performance of the manufacturing firms. Numerous studies have theorized that green SCM dimensions positively influence the performance of companies in both financial and non-financial fronts. This study hypothesis was grounded on such studies in examining

the effect of green SCM dimensions on the performance of manufacturing firms in Kenya. In terms of the multiple linear regression model run with green SCM dimensions as the predictor variables and performance as the dependent variable, GSCM dimensions were found to be positively significantly ($p < 0.05$) associated with firm performance. Table 4.29 gives a summary of GSCM dimensions with significant prediction power on performance.

Table 4.29 Significant predictors of performance

GSCM dimensions with positive influence	Significance
Green Procurement	*P*<0.032
Green Manufacturing	*P*<0.000
Green Distribution	*P*<0.044
EORL Practices	*P*<0.019

It is argued that GSCM dimensions contribute to firm performance. The finding of a significant relationship between green SCM dimensions and the performance of firms was found to support this conception. Examining individual green SCM dimensions and there link to performance, it was evident that no doubt there are relationship between these factors and performance. However, it appears that individually, green manufacturing was the factor with the highest influence on performance, followed by EORL practices, green procurement and the least is green distribution. Probably this is an indication of the attention the management gives to manufacturing processes since it is their core activity. The findings could be different if the target firms were to be in a different industry, for example, retail industry or transport industry.

The study finding on the relationship between green supply chain management and firm performance conforms to the theoretical contention of Fugate et al. (2010) that firms' record improved performance as a result of embracing green SCM concept. The study results are in agreement with those other studies which concluded that certainly there is a

relationship between green SCM dimensions and firm performance. These include studies by Banerjee, (2003); Corbett and Klassen, (2006); and Rao and Holt, (2005) all of which concluded that there is a relationship between green SCM dimensions and firm performance.

However, the result on green distribution contradicts Fugate et al. (2010) findings that green distribution has no significant influence on firm performance when put together with the rest of the dimensions. This is supported by Banerjee (2003) findings which doubted whether implementation of green distribution practices by firms might provide any significant change on performance. In the contrast, these findings were rubbished by Kirchoff, (2011) who criticized them for using industries with minimum distribution activities such as retail and hotel respectively to generalize their findings. According to Kirchoff, (2011) firms in the manufacturing and logistics industries experience improved performance as a result of embedding ecological thinking in distribution processes. Similarly, Corbett and Klassen (2006); and Rao and Holt (2005) asserted that green distribution has a positive significant influence as the rest of GSCM dimensions.

4.10.6 The moderating effect of Supply Chain Ecocentricity in the relationship between Green Supply Chain Management Practices and firm performance

The study sought to find out whether supply chain ecocentricity does influence the relationship between GSCM practices and firm performance. The supposition in the existing literature that the higher the level of supply chain ecocentricity the higher the influence of green SCM practices on firm performance was therefore examined. Even though this was expected to be true based on the existing literature, it was contradicted by the study findings.

The results of the stepwise multiple regression analysis revealed that there is no significant influence by the supply chain ecocentricity on the relationship between green SCM practices and the performance of the manufacturing firms, $p>0.05$ ($p=0.9057$). Therefore, the study null hypothesis that "there is no effect on the relationship between firm performances and supply chain dimensions by introducing SC ecocentricity in the

model 5" was supported. The contradiction of the existing literature by the study findings could be attributed to the differences in the context of the past studies.

The Study findings indicate that partnering with external stakeholders on environmental research, participation in external stakeholders eco-oriented workshops, environment fit through engagement with external stakeholders, environmental benchmarking with external stakeholders, advance knowledge for environmental management practices and use environmental management experts from external stakeholders were explicit across the firms surveyed having scored an average of 86 percent out possible maximum score of one hundred percent.

The previous studies heavily focused in the developed countries where the appreciation of ecological issues in buying decision making by customers has matured (Pagell & Wu 2009) making it a sticking competitiveness issue in business. Consequently, business managers in the developed countries are forced by the operation environment to be on the lookout of any emerging ecological management idea that might give them an edge over their competitors. Essentially, this allows them to freely interact with other stakeholders with a view to learning new environmental management approaches that might help them green their business processes in order to differentiate themselves from competitors. This is in contrast with developing countries where firms view external ecological stakeholders as forces out to punish them thereby eliminating learning opportunities.

These study findings contradict Banerjee (2003) assertion that firms with a high level of supply chain ecocentricity will proactively engage environmental stakeholders in effort to implement practices that are real, measureable environmental performance improvements, which collectively enhance GSCM practices and impact on the firm performance. Similarly, Tate *et al*. (2011) conclusion that engaging and learning from environmental stakeholders should enhance the cost improvements resulting from GSCM efforts was not supported by the study results. In the same line, Sarkis et al. (2010) and Sarkis *et al*. (2011) arguments that gaining access to recent environmental technologies and processes from external ecological stakeholders reduces conflicts and confusion

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among managers in implementing GSCM, which in turn, decrease costs because those environmental supply chain practices that are selected and implemented are better aligned with more relevant environmental issues were not supported by the study. The study finding, therefore, is an indication that results from past studies, undertaken in the developed world context were influenced by the geographical set up of businesses.

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CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study was based on the manufacturing sector in Kenya. It examined the influence of Green Supply Chain Management dimensions namely: green procurement, green manufacturing, green distribution and environmentally oriented reverse logistics on firm's performance. Similarly, the study investigated the moderating effect of supply chain ecocentricity on the relationship between Green Supply Chain Management dimensions and the performance of the manufacturing firms. This chapter, therefore, presents the summary of the study findings, conclusions and the recommendations for actions and directions for future studies.

5.2 Summary of Research Findings

To address the study objectives, quantitative research study was undertaken. The study objectives were to establish the e effect of green supply chain management practices on the performance of the manufacturing firms; and to establish the moderating effect of supply chain ecocentricity on the relationship between green supply chain practices and the performance of manufacturing firms.

Based on the specific objectives, research hypothesises were formulated for testing in response to the study objectives. As a result of findings from hypothesises tests, five null hypothesises were rejected and one was accepted as presented in chapter 4. The specific findings relating to the study objectives are summarized in the following section.

5.2.1 Effect of Green Procurement on the performance of manufacturing firms

This objective was built on the hypothesized statement that "green procurement does not significantly influence the performance of the manufacturing firms." The study findings rejected the null hypothesis and established that firm performance was significantly influenced by green procurement positively. Performance was measured as cost

efficiency and environmental differentiation and their positive association with green procurement as established by this study supported the resource based view as propounded by Gold *et al.,* (2010); Sarkis *et al.,* (2010); Lai *et al.,* (2010) which consider green procurement practices such as preferences to recycled products, environmental audit of supply base, consideration of ISO 14001 as criteria for selecting vendors, preferences to products which consume fewer natural resources and collaboration with vendors in solving environmental issues as unique firm resources with the ability to promote cost efficiency and environmental differentiation of an enterprise. The finding agrees with Gibbs (2000) findings under ecological modernization theory and supports Lacroix and Stamatiou, (2007) assertion that green procurement, as management best practice, positively influences firm performance.

5.2.2 Effect of Green Manufacturing on the performance of the manufacturing firms

This objective is grounded on the hypothesized statement that "green manufacturing does not significantly influence the performance of manufacturing firms." The study findings rejected the null hypothesis and established a significant positive effect of green manufacturing on firm performance. Ecological modernization theory as espoused by Revell (2007) that through eco-modernization of machines and processes; firms are able to reduce solid waste, lower hazardous material, conserve energy and increase customer loyalty thus improving firm's performance is supported in this context by the study findings. Similarly, this finding agrees with Zhu, Sarkis, & Lai, (2008) notion in stakeholders' theory that green manufacturing practices contribute positively to firm performance through increased sales and concur with Banerjee, (2003) findings that Green Manufacturing programs improves environmental performance and increases profitability of a firm by minimizing waste throughout transformation processes.

5.2.3 Influence of Green Distribution on the performance of the manufacturing firms

This study objective is founded on the hypothesised statement that "green distribution does not significantly influence the performance of manufacturing firms." The study findings rejected the null hypothesis and established that the influence of green distribution on firm performance was statistically significant. This findings corroborate the contention of Lacroix & Stamatiou, (2007); Rao & Holt, (2005); Hoffman, (2000) in the corporate environmental responsibility theory that green distribution related firm practices such as; collection of used packages for proper disposal, eco labeling of products, accept recycling and re-use of packages, use organic packages and education to customers on proper disposal of used packages as a mechanism of reducing the impact of their operations on the natural environment are generally viewed positively by the society thus increasing market share and customer loyalty which in turn positively contribute to firm performance. Correspondingly, the results in line with Wu and Dunn (2008) contention that strategic green distribution practices such as standardized reusable containers; minimize use of packages; good warehousing layouts; and easy eco-information access influence performance of firms positively.

5.2.4 Effect of Environmentally Oriented Reverse Logistics on the performance of the manufacturing firms

This objective is centered on the hypothesized statement that "environmentally-oriented reverse Logistics does not significantly affect the performance of manufacturing firms." It was discovered in this study that environmentally-oriented reverse logistics positively and significantly affect the performance of firms. As such, the null hypothesis was rejected. The study discovery supports Hart and Dowel, (2010); Lambert & Burduroglu, (2000); Stock *et al*., (2002); Cheng & Tang, (2010) argument in RBV that environmentally-oriented reverse logistics practices are important intangible resources of a firm capable of improving firm performance through image enhancement, improved efficiency and effectiveness in management of returned materials, reduction of regulatory compliance costs and getting new profits from sale or recycling of recovered products.

Equally, the findings agree with Zhu, Sarkis et al., (2010) argument under the ecological modernization theory (EMT) that environmentally oriented reverse logistics is an eco-innovative way with positive effect on the performance of firms. Lambert & Burduroglu, (2000); Stock *et al*., (2002) support these findings with their studies establishing positive relationship between environmentally oriented reverse logistics and firm performance.

5.2.5 Moderating effect of Supply Chain Ecocentricity on the relationship between Green Supply Chain Management Dimensions and the performance of manufacturing firms

This study objective is founded on the hypothesized statement that the "relationship between Green Supply Chain Management Practices and firm performance is not influenced by supply chain ecocentricity**."** The results revealed that Supply Chain ecocentricity reduces the effect of GSCM dimensions on the performance of firms though not the reduction is not statistically significant. Consequently, the study accepted the study null hypothesis. This study finding disagrees with Banerjee, (2003) notion that affinity with supply chain ecocentricity positively influences the relationship between green SCM dimensions and firm performance. Similarly, Tate *et al*., (2011) advocacy that learning environmental management best practices from the stakeholders enhances firm's performance as a result of Green Supply Chain Management Dimensions efforts was not supported.

5.2.6 Effect of GSCM practices on the performance of the manufacturing firms in Kenya

This study global objective is grounded on the general null hypothesized statement that "green supply chain management dimensions do not significantly influence the performance of manufacturing firms." It was established in this study that green manufacturing was the factor which increases the firm performance positively by highest unit index value, followed by EORL practices, green procurement and green distribution respectively. The findings established that all the four dimensions of green supply chain management statistically significantly influence firm performance. Thus the study null

hypothesis statement was rejected. Cumulatively, green SCM dimensions were found to be positively affecting the performance of the manufacturing firms. However, the study noted that a major increase in the effectiveness of green manufacturing practices will equally create a major impact on the performance as oppose to EORL, green procurement and green distribution.

5.3 Conclusion

The study aimed to establish the effect of Green Supply Chain Management dimensions on the performance of manufacturing firms. Additionally, the study sought to investigate the moderating effect of supply chain ecocentricity on the relationship between GSCM dimensions and firm performance. The study established that all the four green supply chain management dimensions significantly influenced firm performance. The study conclusion are thus discussed under the study specific objectives as follows:

5.3.1 Green Procurement and Firm Performance

The study provided evidence that green procurement significantly positively influence the performance of manufacturing firms in Kenya. This implies that an increase in performance of manufacturing firm is likely through embracing green procurement practices within the upstream of supply chain. As a result, the study concludes that green procurement initiatives positively influence firm performance.

5.3.2 Green Manufacturing and Firm Performance

The study established a significant positive relationship between green manufacturing and firm performance. A positive increase of greening initiatives within the manufacturing processes increases the performance of firms. It is therefore concluded in the study that green manufacturing practices within the operations of the firms impact positively on their performance significantly.

5.3.3 Green distribution and Firm performance

The study proven that green distribution positively impact on the performance of manufacturing firms. An increase on green activities within the distribution process results on a positive significant increase in firm performance. The study can thus conclude that green distribution has a positive influence on the performance of manufacturing firms.

5.3.4 Environmentally oriented reverse logistics and Firm performance

Environmentally oriented reverse logistics was found to have positive significant influence on the performance of manufacturing firms. As a result, the study concludes that there is a positive relationship between environmentally oriented reverse logistics and firms should adopt green practices in managing their logistics in order to improve in performance.

5.3.5 Supply Chain Ecocentricity, Green Supply Chain Management Dimensions and Firm Performance

On the other hand, the study confirmed that Supply Chain Ecocentricity does not moderate the relationship between green SCM practices and firm performance. This finding provides basis to conclude that SEC does not moderate the relationship between GSCM dimensions and firm performance. This is, however, in contradiction to some of the existing literature.

5.3.6 Green Supply Chain Management Practices and Firm Performance

In overall, Green Supply Chain management Practices were found to be collectively significantly influencing the performance of the manufacturing firms. Subsequently, the study has a basis to conclude that, aggregately, Green Supply Chain Management Practices affect the performance of the manufacturing firms in Kenya.

5.4 Recommendations

Based on the study findings, the following recommendations are given under the study specific objectives:

5.4.1 Green Procurement and firm performance

In line with Jänicke (2008) views as pronounced under the resource based view and ecological modernization theory (EMT) that procurement management practices laced with ecological thinking is a potential source for unique resources with capability of improving the overall performance with a positive significant effect on environment, the study established that green procurement positively predicts the performance of manufacturing firms; $p < 0.05$ *(P=0.000)* with an explanatory power of 33.86 percent. Therefore, the study recommends that managers in manufacturing firms in Kenya should incorporate ecological initiatives in their procurement processes such as environmental requirements as a specification for purchases, preference to products that consumed fewer natural resources, working with suppliers to address environmental problems and environmental audits of supply base in order to increase overall cost efficiency, enhanced reputation through product differentiation, market share, and reduced environmental risks and liabilities thereby impacting positively on their performance.

5.4.2 Green Manufacturing and Firm Performance

According to Phungrassami, (2008), green manufacturing is a continuous strategy with the potential of improving firms' performance both financially and in non-financial fronts. This study established a significant positive relationship between green manufacturing practices and firm performance; $p < 0.05$ *(P=0.000)* with an explanatory power of 40.27 percent. The study therefore recommends the inclusion of ecological practices in the strategic plans of the manufacturing firms in Kenya. Green practices as evidenced in this study, are capable of potentially reducing costs of litigations, minimizes usages of energy and water, reduces wastage of materials, improves innovation and

minimizes solid, gaseous and liquid discharge to the environment thus impacting positively on both financial and none financial performance of the firms.

5.4.3 Green Distribution and Firm Performance

In line with Rao and Holt (2005) hypothesis under the RBV that management of wastes in the distribution processes is a vital firm resource with capability of impacting positively on firm performance, this study established that green distribution statistically significantly influences the performance of firms; $p < 0.05$ (P=0.047) with an explanatory power of 30.42 percent. It is therefore recommended in this study that managers of the manufacturing firms in Kenya should adopt green practices such as eco labeling of products, environment-friendly packaging and transportation, providing information to customers on environment friendly products, re-using and recycling of packages and collection of used packages for proper disposal in their distribution processes as a way of managing their cost of production and creation of customer loyalty.

5.4.4 Environmentally Oriented Reverse Logistics and Firm Performance

In Support of Zhu, Sarkis et al., (2010) postulation under the ecological modernization theory (EMT) that environmentally oriented reverse logistics is an eco-innovative way with positive effect on the performance of firms, the study established that environmentally oriented reverse logistics significantly positively predict the performance of manufacturing firms with values of $p<0.000$ and an explanatory value of 38.93 percent. As a result, the study recommends that managers in the manufacturing firms in Kenya should include ecological practices such as waste collection for proper disposal and recovery of hazardous parts for proper disposal as part of their performance strategies. The two environmentally oriented reverse logistics practices are vital component of corporate social responsibility (CSR). Firms with visible CSR policies have a tendency of creating customer loyalty and also conform to government environmental regulations thereby minimizing statutory fines for none environmental management compliance. Additionally, the study recommends adoption of recycling, re-

use, recovery of useful parts of the products and arrangements with customers to return used packages as further strategies for managing cost of inputs and parts in their production process thereby increasing the profitability of the firms.

5.4.5 Moderating effect of Supply Chain Ecocentricity on the relationship between Green Supply Management Practices and Firm Performance

The study found that supply chain ecocentricity negatively moderate the relationship between green SCM dimensions and firm performance in Kenya though not significantly. Consequently, the study recommends that managers in the manufacturing industry in Kenya should not direct their firms' limited resources to supply chain ecocentricity related activities which presently may not amount to significant influence on their firms' performance. They, however, should direct their energies to GSCM practices which were found to have direct bearings on their bottom-line.

5.4.6 Green Supply Chain Management Practices and Firm Performance

In line with Vachon & Klassen (2006b); Jänicke (2008) views as pronounced under the resource based view and ecological modernization theory (EMT) that business management practices laced with ecological thinking is a potential source for unique resources with capability of improving the overall performance with a positive significant effect on environment, the study established that Green SCM management dimensions; green procurement, green manufacturing, green distribution and environmentally oriented reverse logistics significantly positively predict the performance of manufacturing firms with values of $p<0.032$, $p<0.000$, $p<0.044$ and $p<0.019$ respectively. Therefore, the study recommends that managers in manufacturing firms in Kenya should incorporate ecological initiatives such as green manufacturing, environmentally oriented reverse logistics, green procurement and green distribution within the performance strategies of their firms. This will significantly improve their firms' performance as established in this study.

The study further recommends that the government and her environmental agencies should shift from the current environment management policy strategy which focuses purely on statutory regulation as a direct motivator on firms to adopt green initiatives to a more robust mixed policy strategy which combine both statutory regulations with firms' internal directives such as improvement of performance. A government policy strategy targeting internal directives of firms such as tax rebate on eco-machines, eco-products, carbon compensation and others in the same line with a direct effect on the performance of firms, will facilitate voluntary participation of firms in environment management since firms will view the adoption of green practices as a performance improvement strategy thus help the government achieve sustainable development as envisaged in Vision 2030. This agrees with Gunther & Scheibe, (2005) assertions that internal directives as direct motivator of green practices by firms are more effective in conserving the natural environment than the external drivers such as statutory regulations and stakeholder demands

Additionally, the study established that most of the manufacturing firms in Kenya are medium enterprises employing between 51-100 paid employees. Based on this finding, the study recommends that the government should take deliberate measures that can create conducive environment for expansion of manufacturing firms beyond the current medium sizes that currently employ between 51-100 paid employees to large firms that can employ 100 plus paid employees. This will help the government bridge the un-employment gap and achieve Vision 2030 (RoK, 2007).

5.5 Areas for Further Research

Beyond addressing the limitations listed in the previous section, future research possibilities based on the findings from this study are interesting and exciting. Possible future research paths concentrate on theoretical issues, investigation of new conceptual questions, and the execution of new empirical studies to improve upon the conclusions of the findings. These future research paths are discussed in details in the next section.

5.5.1 Additional Variables

Additional variables in the model could be explained through the inclusion of other moderators to the hypothesized relationships. Uncertainty has been hypothesized to positively moderate the relationship between green practices in the firm and firm performance (Aragon-Correa and Sharma 2003). Risk factors also impact managerial decisions about the allocation of resources toward green SCM and the impact they have on sustainability and firm performance (Carter and Rogers 2008). Risk and uncertainty could both be used to moderate antecedent and outcome relationships between green SCM and firm performance. Furthermore, the interaction of risk and uncertainty could be investigated, which would lead to a greater understanding of how different combinations of risk and uncertainty impact on the effect of green SCM practices and firm performance.

Other studies could be conducted that look at firm size, industry type, and global presence to assess if there are differences among groups that make up these demographics. For example, how does the theoretical model change when the sample is split into large firms and small/medium sized and in what ways do these two groups compare? Do older or newer industries show a greater propensity toward the existence of green SCM practices? Does the impact of green SCM practices on firm performance increase or decrease in firms with a greater global presence (greater percentage of purchasing made globally) as opposed to firms with a smaller global presence?

5.5.2 External Validity

External validity cannot be ensured in a single study (Mentzer and Flint 1997). Additional empirical research is needed to test the primary components of external validity, namely statistical generalizability, conceptual replicability, and situational replicability (Ferber 1977; Lynch 1982). One way to do this is by expanding the sample to include firms within East African community block. A related study could investigate the differences between industrialized, newly industrialized, and developing countries. Another way to assess the external validity of research is to triangulate methods to see if

the findings of different research methodologies are consistent with one another (McGrath 1982). Qualitative research would be one such methodology.

5.5.3 Qualitative Research Design

Qualitative research could help improve the operationalization for the GSCM constructs through the development of a more valid and reliable scale. GSCM has been operationalized by several authors, including Zhu et al. (2008a), Rao (2002), and Zsidisin and Hendrick (1989). The scales for green SCM in this dissertation were taken from Zhu *et al.,* (2008a) because of its replication in more than one study. The findings in Zhu *et al.,* (2008a) were based on a sample of Chinese firms. An exhaustive exploratory study of interviews with managers from Kenya and other East African based firms would add to the literature by refining and better defining what it means to have green SCM practices in firms in the context this region.

Another phenomenon that could be pursued using qualitative research methodology is exploring managerial attitudes toward green SCM practices. Sustainability is an emerging issue in SCM and has been at the forefront of considerable research in recent years (Carter and Rogers 2008). However, emerging issues can become mainstream or exist only as trends, with the former becoming relevant in the literature and assimilated into practitioner's strategies and operations, and the latter eventually becoming obsolete (Pagell and Wu 2009). Understanding managers' attitudes toward the longevity of environmental and sustainability issue in SCM would give greater insight into the number and types of resources dedicated to these areas in the firm.

5.5.4 Extending the Research

Using longitudinal survey data to see how green SCM practices are evolving in firms would be another interesting and worthwhile research project. This project could be linked with qualitative studies to see how closely manager's attitudes about environmental and sustainability issues in SCM follow patterns of firm investment in green SCM practices. Longitudinal data could also be collected using secondary sources

such as annual reports, press releases, corporate sustainability reports, and other public information.

REFERENCES

Aerts, W., Cormier, D. & Magnan, M. (2006). Intra-industry Imitation in Corporate Environmental Reporting: An International Perspective. *Journal of Accounting and Public Policy*, *25*(3*)*, 299-331.

Alavi, M. & Carlson, P. (2001). A review of MIS research and disciplinary development, *Journal of Management Information Systems* (8:4), 45-62.

Arimura, T.H., Darnalln N. & Katayama, H., (2011) Is ISO 14001 a Gateway To More Advanced Voluntary Action? The Case of Green Supply Chain Management. *Journal of Environmental Economics and Management, 61*, 170–182.

Bahl, R. & Wallace, S., (2007). *Tax Reform and Economic Development: The Jamaican Case*. Kingston: Planning Institute of Jamaica.

Ball, A. & Craig, R. (2010). Using Neo-Institutionalism to Advance Social and Environmental Accounting. *Critical Perspectives on Accounting*, 21(4), 283-293.

Banerjee, S. B. (2003). Corporate Environmentalism the Construct and Its Measurement. *Journal of Business Research*, 55 (3), 177-191.

Bansal, P., & Clelland, I. (2004). Talking Trash: Legitimacy, Impression Management, and Unsystematic Risk in the Context of the Natural Environment. *Academy of Management Journal*, 47 (1), 93-103

Baruch, Y. (2007). Response rates in academic studies: a comparative analysis. *Human Relations*, 52: 421–434

Barney, J.B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Berger, G., Flynn, A., Hines, F., & Johns, R. (2001). Ecological modernization as a basis for environmental policy: Current environmental discourse and policy and the implications on environmental supply chain management. Innovation: *The European Journal of Social Science Research*, 14(1), 55 - 72.

Bidco. (2012). *Environmental Policy of Bidco Ltd*. Retrieved from http://www.bidco-oil.com/content/webcontent.aspx?PN=envpolicy&TY=page on 5/3/2014.

Billé, R. (2010) "Action without change? On the use and usefulness of pilot experiments in environmental management." S.A.P.I.EN.S. 3 (1)

Björklund, M. (2010). Influence from the business environment on environmental purchasing--Drivers and hinders of purchasing green transportation services. *Journal of Purchasing and Supply Management*, In Press, Uncorrected Proof.

Black, T. R. (2004). *Doing quantitative research in the social sciences: An integrated approach to research design, measurement, and statistics*. Thousand Oaks, CA: SAGE Publications, Inc.

Blaikie, N. (2003). *Analysing Quantitative Data*. London: Sage Publications.

Bland M. (2000). *An Introduction to Medical Statistics*. 3rd Edition. Oxford: Oxford Medical Publications.

Boiral, O. (2007). "Corporate Greening Through ISO 14001: A Rational Myth?."

*Organization Science **18**: 127*. doi:10.1287/orsc.1060.0224.

Breusch, T. S.; Pagan, A. R. (1979). A Simple Test for Heteroscedasticity and Random

Coefficient Variation. *Econometrica* 47 (5): 1287–1294.

British American Tobacco (2012). *Sustainable Business Policy of Bidco Ltd*. Retrieved

From:http://www.bat.com/group/sites/UK__9D9KCY.nsf/vwPagesWebLive/DO52AD6H?opendocument&SKN=1

BSI Press release (July, 2007). *Health and safety management systems specification*

OHSAS 18001 is now a British Standard BS OHSAS 18001:2007

Byrne, (2001). "Cutoff criteria for fit indexes in covariance structure analysis:

conventional criteria versus new alternatives," *Structural Equation Modeling*, 6, 1-55.

Cagno, E., Guido, M.J., Perotti, S., & Zorzini, M. (2011). *The impact of green supply chain practices on company performance: the case of 3PLs*, Lancaster University Management School Working Paper, 1-31.

Chen, Y. (2008*).* The Driver of Green Innovation and Green Image – Green Core Competence, *Journal of Business Ethics,* 81, 531–543.

Chien, M. K. & Shih, L. H., (2007). An empirical study of the implementation of green supply chain management practices in the electrical and electronic industry and their relation to organizational performances, *Int. J. Environ. Sci. Tech.,* 4 (3) 383-394.

Christmann, P. (2000). Effects of "Best Practices" of Environmental Management on Cost Advantage: The Role of Complimentary Assets, *Academy of Management Journal, 43*(4), 663-680.

Christopher, M., & Peck, H. (2004). Building the Resilient Supply Chain, *International Journal of Logistics Management,* 15 (2), 1-13.

Connelly, B., Ketchen, D., & Slater, S. (2010). Toward a "theoretical toolbox" for Sustainability research in marketing. *Journal of the Academy of Marketing Science.*

Cooper, D.R. & Schindler, P.S. (2006). *Business Research Methods*. McGraw Hill Companies.

Corbett, C., & Klassen, R. (2006). Extending the Horizons: Environmental Excellence as Key to Improving Operations. *Manufacturing and Service Operations Management,* 8 (1), 5-22.

Council of Supply Chain Management Professionals. (2009). *Definition of supply chain man-Agement*. Retrieved from http://www.cscmp.org on 15/7/2013.

Davis (2009). "Firm Resources and Sustained Competitive Advantage." *Journal of Management17* (1): 99-120.

Delgado-Rodriquez M, Llorca J (2004). "Bias," *Journal of Epidemiology and Community Health;* 58: 635–641

Diabat, A., & Govindan, K. (2011). An Analysis of the Drivers Affecting the Implementation of Green Supply Chain Management. *Resources, Conservation and Recycling.* 55.

Diamantopoulos & Siguaw, (2000), "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives," *Structural Equation Modeling*, 6, 1-55.

Dillman, D. (2000). *Elements of the Tailored Design Method*. New York: Wiley.

East Africa Breweries Ltd. (2012). *Sustainability approach of East Africa Breweries Ltd* .EABL, Nairobi, Kenya. Retrieved from https://www.eabl.com/sustainability on 15/7/2013.

Easterby-Smith, M. Thorpe, R., & Lowe, A. (2003). *Management Research: An Introduction*. Sage Publications, London.

Elkington, J. (1997). *Cannibals with Forks: The triple bottom line of 21st century business*. Oxford: Capstone.

Elkington, J., & Fennell, S. (1998). Partners for Sustainability. *Greener Management International*, (24), 48-60.

Field, A. (2009). *Discovering statistics using SPSS: (and sex and drugs and rock 'n' roll)* (3rd ed. ed.). Los Angeles [i.e. Thousand Oaks, Calif.]: SAGE Publications. 143. ISBN 978-1-84787-906-6.

Fiske, Donald W. (1982). *Convergent-Discriminant Validation in Measurements and Research Strategies.* New York: Wiley

Fugate, B. S., Mentzer, J. T., & Stank, T. P. (2010). Logistics Performance: Efficiency, Effectiveness, and Differentiation, *Journal of Business Logistics,* 31 (1), 43-62.

Frankfort-Nachmias, C. & Leon-Guerrero, A. (2006). Social Statistics for a Diverse Society. Thousand Oaks, CA: Pine Forge Press.

Frazer, G. (2005). Which Firms Die? A Look at Manufacturing Firm Exit in Ghana. *Economic Development and Cultural Change, 53*(3), 585-617.

Frederick, J. (2006). *Statistical Methods in Experimental Physics (2nd ed.).* Singapore: World Scientific. pp. 324. ISBN 981-270-527-9.

Freeman, R.E., (2005). *Strategic management: A stakeholder approach*. Marshfield: Pittman.

Galliers, R. J. (2002). *Choosing Appropriate Information Systems Research Approaches: A Revised Taxonomy. Information Systems Research: Contemporary Approaches & Emergent Traditions.* Amsterdam: North Holland.

Gibbs, D. (2000). Ecological Modernization, Regional Economic Development And Regional Development Agencies. *Geoforum*, 31(1), 9-19.

González, P., Sarkis, J. & Diaz, B.A. (2008). Environmental management system certification and its influence on corporate practices: Evidence from the automotive industry. *International Journal of Operations and Production Management*, 28(11), 1021-1041.

González-Torre, P., Álvarez, M., Sarkis, J. & Adenso-Díaz, B. (2009). Barriers to the implementation of environmentally oriented reverse logistics: Evidence from the automotive industry sector. *British Journal of Management, 9999* (9999).

Gouldson, A., Murphy, J. (1998). *Regulatory Realities: The Implementation and Impact of Industrial Environmental Regulation*. London: Earthscan.

Grice, J. (2001). Computing and evaluating factor scores. *Psychological Methods*, 6, 430-450.

Gujarati, Damodar N.; Porter, Dawn C. (2009). Basic Econometrics (Fifth ed.). New York: McGraw-Hill Irwin. pp. 385–86. ISBN 978-0-07-337577-9.

Guth, W. D., & Ginsberg, A. (2001). Guest editors' introduction: corporate entrepreneurship. *Strategic Management Journal*, 11, 5-15.

Hair, J.F., Andrson, R, E., Tatham R.L., & Black, W.C. (2006). *Multivariate data analysis, 6th ed*. New Jersey: Prentice Hall. USA

Hall, J. (2001). Environmental supply-chain innovations. *Greener Management International* 35, 105-119.

Handfield, R.,Sroufe, R. & Walton, S. (2005). *Integrating Environmental Management and Supply Chain Strategies.* Business Strategy and the Environment, 14 (1), 1-19.

Hair, Jr., J.F., Black, W.C., Babin, B.J., Anderson, R.E., Tatham, R.L. (2006).

Multivariate data analysis (6th Ed.), Pearson-Prentice Hall, Upper Saddle River,

NJ.

Harris, S.M. (2007). Does sustainability sell? Market responses to sustainability certification. Management of Environmental Quality: *An International Journal, 18*(1) 50-60.

Hart, S. L., & Dowell, G. (2010). A Natural-Resource-Based View of the Firm. Fifteen Years After, *Journal of Management*, Forthcoming

Hazewinkel, Michiel, ed. (2001), Normal distribution, *Encyclopedia of Mathematics, Springer, ISBN 978-1-55608-010-4*

Heij, C.; P. de Boer (2004). Econometric Methods with Applications in Business and Economics. Oxford University Press. 334–353.

Helfat, C.E., & Peteraf, M.A. (2003). The dynamic resource-based view: Capability lifecycles. *Strategic Management Journal, 24*(10), 997-1010.

Hirschheim, R. (2003). *Information systems epistemology: an historical perspective* in *Research Methods in Information Systems*, Mumford.

Hoffman, A. J. (2000). *Competitive Environmental Strategy: A Guide to the Changing Business Landscape.* Washington, D.C.: Island Press.

Holmes-Smith *et al*., (2004) A primer on maximum likelihood algorithms for use with missing data. *Structural Equation Modeling*, 8, 128-141

Holt, D., & Ghobadian, A. (2009). An Empirical Study of Green Supply Chain Management Practices amongst UK Manufacturers. *Journal of Manufacturing Technology, 20 (7*), 933-56.

Hsu, C.W., & Hu, A. H. (2008). *Green Supply Chain Management in the Electronic Industry.* International *Journal Environment Science Technology,* 5 (2), 205-216.

Huber, J., 2000. Towards industrial ecology: Sustainable development as a concept of ecological modernization. *Journal of Environmental Policy & Planning,* 2(4), 269 - 285.

Huber, J. (2008a). Pioneer countries and the global diffusion of environmental innovations: Theses from the viewpoint of ecological modernization theory. *Global Environmental Change,* 18(3), 360-367.

Hult, G., D., Ketchen Jr, & Slater S. (2004). Information Processing, Knowledge Development, and Strategic Supply Chain Performance, *The Academy of Management Journal, 47* (2), 241-253.

Hussey, J., & Hussey.R. (1997). *Business Research: A Practical Guide for Undergraduate and Postgraduate Students*. London, Macmillan. Williams, M. and T.

Jänicke, M. (2008). Ecological modernisation: New perspectives. *Journal of Cleaner Production,* 16(5), 557-565.

Jones, M. E. (2006). *A Feasibility Study for Implementation of pro-Poor Payment for environmental services in the Naivasha: Catchment, Kenya*. London, Imperial College of London, Faculty of Natural science, University of London: MSc. Thesis (Unpublished).

Kalirajan, K.P.,Shand, R.T. & Bhide, K. (2010). Frontier Production Functions and Technical Efficiency Measures. *Journal of Economic Surveys*, *13* (2), 149-172.

Kamande, M. W. (2011). "*The Impact of Clean Production on the Performance of Kenya Manufacturing Firms*.Ph.D (Economics). Dissertation .University of Dar es Salaam: Tanzania.

Kamande,M.W. (2011). *Clean production and Profitability. An Eco-Efficiency Analysis of Kenyan Manufacturing Firms.* Department of Economics, School of Finance and Banking. Kigali: Rwanda.

Kassolis, M.G. (2007). The diffusion of environmental management in Greece through rationalist approaches: Driver or product of globalisation? *Journal of Cleaner Production*, 15(18), 1886-1893.

Kasunic M. (2005). *Designing an effective survey*. Handbook, CMU/SEI- HB- 004.

Keeter, Scott, Kennedy C., Dimock M., Best J. and Craighill P. (2006). Gauging the Impact of Growing Nonresponse on Estimates from a National RDD Telephone Survey. Public Opinion Quarterly. 70(5): 759–779.

KAM, (2013), Kenya Association of Manufacturers directory. Retrieved from:

http://www.kam.co.ke/index.php/about-us/membership

Ketchen, D. J., & Hult, G. T. M. (2007). Bridging Organization Theory and Supply Chain

Management. The Case of Best Value Supply Chains, *Journal of Operations Management, 25* (2), 573-580.

Klassen, R. D., & Johnson, P. F. (2004).*The Green Supply Chain," in Understanding Supply Chains: Concepts, Critiques, and Futures*, S. New and R. Westbrook. New York: Oxford University Press.

Kline (2005). *Structural Equation Models with Latent Variables*, New York: Wiley & Sons.

Kothari, S., Warner, J., (2008), *Econometrics of Event Studies*, in Espen Eckbo, Ed.,

Handbook of Empirical Corporate Finance, Elsevier-North-Holland.

Krikke, H., Le Blanc, I. & Van de Velde, S. (2003). Creating value from returns. *Center Applied Research working paper,* 2003-02.

Lacroix, R., (2008). *Energy and Eco-Development in France, (for NTUA)*. Retrieved from www.brainet.gr-54 on 15/7/2013.

Lacroix, R., & Stamatiou, E. (2007) *Green Architecture and Sustainable Development: Applications & Perspectives, 3rd IASME / WSEAS Int. Conf. On Energy, Environment, Ecosystems and Sustainable Development (EEESD'07*), Agios Nikolaos, Crete Island, Greece.

Lai, K. H., Ngai, E. W. T., & Cheng, T. C. E. (2002). Measures for evaluating supply chain performance in transport logistics. Transportation Research Part E: *Logistics and Transportation Review*, 38(6), 439-456.

Lai, K.H., Cheng, T.C.E., & Tang, A.K.Y. (2010). Green retailing: Factors for success. *California Management Review, 52*(2*)*, 6-31.

Lambert D.M., & Burduroglu R. (2000). Measuring and selling the value of logistics. *The International Journal of Logistics Management*, 1-17.

Lambert, D. M., & M. C. Cooper. (2000). Issues in Supply Chain Management, *Industrial Marketing Management, 29* (1), 65-*83.*

Large, R.O., & Thomsen, C.G. (2011). Drivers of Green Supply Chain Management Performance: Evidence from Germany, *Journal of Purchasing and Supply Management, 17*, 176-184.

Last, J.M. (2001). *A Dictionary of Epidemiology.* Oxford University Press.

Lee, S. (2008). Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives, *Supply Chain Management: An International Journal*, 13(3), 185–198.

Lee, H. L. (2002), Aligning Supply Chain Strategies with Product Uncertainties, *California Management Review,* 44 (3), 105-119.

Levesque, R. (2007). *SPSS Programming and Data Management: A Guide for SPSS and SAS Users*, Fourth Edition. SPSS Inc., Chicago. USA.

Li, Y. (2011) Research on the Performance Measurement of Green Supply Chain Management in China. *Journal of Sustainable Development,* 4(3), 101-107.

Li, S., B. Ragu-Nathan, Ragu-Nathan T. & Rao S. S. (2006), The impact of Supply Chain Management Practices on Competitive Advantage and Organizational Performance, *Omega*, *34* (2), 107-124.

MacCallum, R.C. (1999). Sample size in factor analysis. *Psychological Methods*, 4, 84-99.

McGrath, J. E., & Brinberg D. (1983). External Validity and the Research Process: A

Comment on the Calder/Lynch Dialogue, *The Journal of Consumer Research, 10* (1), 115-124.

Maignan, I., & McAlister, D.T. (2003). Socially responsible organizational buying: How can stakeholders dictate purchasing policies? *Journal of Macro marketing, 23*(2), 78-89.

Malhotra, N. K. (2004). *Marketing research: An applied orientation* (4th ed.). Upper Saddle River, NJ: Prentice Hall

Matos, S., & Hall, J. (2007). Integrating sustainable development in the supply chain: The case of life cycle assessment in oil and gas and agricultural biotechnology. *Journal of Operations Management,* 25(6), 1083-1102.

Melnyk, S., Sroufe R., & Calantone, R. (2003). .Assessing the Impact of Environmental Management Systems on Corporate and Environmental Performance, *Journal of Operations Management, 21* (3), 329-351.

Mentzer, J. T., DeWitt W., Keebler J.S, Min S., N. W. Nix N., Smith C.D., & Zacharia G. (2001). Defining Supply Chain Management. *Journal of Business Logistics, 22* (2), 1- 26.

Min, S.,Mentzer, J. T., & Ladd, R. T. (2007). A Market Orientation in Supply Chain Management. *Journal of the Academy of Marketing Science*, 35 (4), 507-522.

Monette, D.R., Sullivan, T.J. & DeJong, C.R. (2002). *Applied Social Research*. Orlando, FLA: Harcourt Press.

Mukiri, (2012). Green supply chain management practices in the food manufacturing industry in Kenya, *Global journal of commerce and management perspective, 1* (4):6-17

Murphy, J., & Gouldson, A. (2000). Environmental policy and industrial innovation: integrating environment and economy through ecological modernisation. *Geoforum,* 31(1), 33-44.

Murphy, J. (2000). Editorial: Ecological modernisation. *Geoforum,* 31(1), 1-8.

Nawrocka, D., Brorson, T. & Lindhqvist, T. (2009). "ISO 14001 in environmental supply chain practices", *Journal of Cleaner Production, 17*, 1435–1443.

Newbold, J. (2006). Chile's environmental momentum: ISO 14001 and the large-scale mining industry E Case studies from the state and private sector, *Journal of Cleaner Production,* 14 , 248-261.

Ninlawan, C., Seksan, P., Tossapol, K. & Pilada, W. (2011). The Implementation of Green Supply Chain Management Practices in Electronics Industry, *Proceedings of the International Multiconference of Engineers and Computer Scientists, 3*.

Nokia Corporation (2004). *Environmental Report of Nokia Corporation* 2004. Retrieved from www.nokia.com/NOKIA.../Environment_/.../nokia_ymparistoraportti_2004.pdf on 15/7/2013.

Nunnaly, J. D. and Bernstein, I. H. (2004). *Psychometric Theory*. New York, NY: McGraw Hill.

Ondiso, E.A (2012). *Green supply chain management practices of the textile industry in Kenya.* Unpublished master's dissertation, University of Nairobi, Nairobi, Kenya.

Pagell, M., & Wu, Z. (2009). Building a More Complete Theory of Sustainable Supply Chain Management Using Case Studies of 10 Exemplars, *Journal of Supply Chain Management*, *45* (2), 37-56.

Pedace, R. (2013). "Multicollinearity". Econometrics for Dummies. Hoboken, NJ: Wiley. 175–190. ISBN 978-1-118-53384-0.

Phungrassami, H. (2008). "Eco-Efficiency as a Decision Tool for Cleaner Production: Application for SMEs in Thailand," *Environmental Research Journal*, 2(5), pp. 217- 221

Preston, L. E., & Post J. E. (1975). *Private Management and Public Policy: The Principle of Public Responsibility*. Englewood Cliffs: Prentice-Hall.

Preuss, L. (2005). *The green multiplier: A study of environmental protection and the supply chain.* Houndmills: Palgrave Macmillan.

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management*, 25(9).

Raymond, P. C., Lopez, J., Marche, S, Perron, G.M. & Wright, R. (2008). Influences, practices and opportunities for environmental supply chain management in Nova Scotia SMEs. *Journal of Cleaner Production, 16,* 1561–1570.

Razali, Nornadiah; Wah, Yap Bee (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics* 2 (1): 21–33.

Reinhardt, F. L. (2003). Environmental Product Differentiation: Implications for Corporate Strategy, *California Management Review*, 40 (4), 43-47

Revell, A. (2007). The ecological modernisation of SMEs in the UK's construction industry. *Geoforum,* 38(1), 114-126.

Rivera, J. (2004). Institutional pressures and voluntary environmental behavior in developing countries: Evidence from the Costa Rican hotel industry. *Society and Natural Resources,* 17, 779-797.

Ritter, N. (2010). Understanding a widely misunderstood statistic: Cronbach's alpha.

Paper presented at Southwestern Educational Research Association (SERA)

Conference 2010, New Orleans, LA (ED526237).

RoK. (2010).*Kenya constitution 2010.*Government of Kenya press, Nairobi, Kenya.

RoK. (2009). *Kenya National Environment Action Plan (2009-2013*). NEMA, Nairobi, Kenya.

RoK. (2007). *Kenya Vision 2030: A Globally Competitive and Prosperous Kenya*. Government of Kenya (GoK) press, Nairobi, Kenya.

RoK. (1999).*The Kenya Environment Management and Coordination Act (EMCA) (Act No. 8 of 1999.*Government press, Nairobi, Kenya

Rowley, T., (1997). Moving beyond dyadic ties: A network theory of stakeholder influences. *Academy of Management Review*, *22*(4), 887-910.

Rugman, T. & Verbeke, S. (1998), "Complementary theories to supply chain

management." Supply Chain Management: *An International Journal 12*(4): 284-296.

Shapiro, S. S. & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika* 52 (3–4): 591–611.

Sarkis, J. (2009). Convincing industry that there is value in environmentally supply chains. *Problems of Sustainable Development, 4*(1), 61-64.

Sarkis, J., Gonzalez-Torre, P., & Adenso-Diaz, B. (2010). Stakeholder Pressure and the Adoption of Environmental Practices: The Mediating Effect of Training *Journal of Operations Management,* 28(2), 163-176.

Sarkis, J., & Tamarkin, M. (2005). Real options analysis for "green trading": the case of greenhouse gases. *Eng. Econ., 50,* 273-294.

Sarkis, J., Zhu, Q., & Lai K. (2010) *An Organizational Theoretic Review of Green Supply Chain management Literature.* George Perkins Marsh Institute, Clark University, USA, University press.

Saunders, M., Lewis, P., & Thornhill, A. (2000). *Research Methods for Business Students*, Essex, Pearson Education Ltd.

Sekaran, U. (2003). *Research Methods for Business: A Skill Building Approach*. New York: John Willey and Sons.

Seman, N. S., Zakuan, N., Jusoh, A., Shoki, M., & Arif, M. (2012). Green supply chain management: A review and research direction. *International Journal of Managing Value and Supply Chains (IJMVSC)* 3 (1).

Seuring, S. (2004). Integrated chain management and supply chain management comparative analysis and illustrative cases. *J. Clean. Prod.,* 12, 1059-1071.

Shadish, W. R., Cook, T.D., & Campbell, D. T. (2001). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston: Houghton Mifflin

Shang, K.C., Lu, C.S., & Li, S. (2010). A taxonomy of green supply chain management capability among electronics-related manufacturing firms in Taiwan. *Journal of Environmental Management, 91*, 218–1226.

Shepherd, C., & Gunter H. (2006). Measuring supply chain performance: Current Research and Future Directions. *Int J Prod Perform Manage,* 55(3/4):242–258

Shiferaw, A. (2007). Firm Heterogeneity and Market Selection in Sub- Saharan Africa: Does it Spur Industrial Progress? *Economic Development and Cultural Change,* 52 (2), 393-423.

Simpson, D., Power, D. & Samson, D., (2007). Greening the automotive supply chain: a relationship perspective. *International Journal of Operations & Production Management,* 27 (1), 28-4.

Sirmon, D. G., Hitt, M. A. & Ireland, R. D. (2007). Managing Firm Resources in Dynamic Environments to Create value. Looking inside the Black Box, *Academy of Management Review, 32* (1), 273-292.

Smallbone, T. & Quinton, S. (2004). Increasing Business Students 'Confidence in Questioning the Validity and Reliability of their Research. *Electronic Journal of Business Research Methods, 2* (2):153-162.

Søndergård, B., Hansen, O.E., & Holm, J. (2004). Ecological modernisation and institutional transformations in the Danish textile industry. *Journal of Cleaner Production*, 12 (4), 337- 352.

Spaargaren, G., & Mol, A.P.J. (1992). Sociology, environment, and modernity: Ecological modernization as a theory of social change. Society & Natural Resources: *An International Journal*, 5(4), 323 - 344.

Srivastava, S. K. (2007). Green Supply-Chain Management: A State-of-the-Art Literature Review, *International Journal of Management Reviews, 9* (1), 53-80.

Srivastava, S.K. & R.K. Srivastava, (2006). Managing product returns for reverse logistics. *International Journal of Physical Distribution & Logistics Management. 36* (7), 524-546.

Steiner, G. A. (1975), *Business and Society*. New York: Random House

Stephens, S., (2000). The supply chain council and the supply chain operations reference (SCOR) model: integrating processes, performance measurements, technology and best practice. *Logistics Spectrum, July, 1* 2000, 16-18

Stock, J.R., Speh, T.W. & Shear, H.W. (2002). Many happy (product) returns. *Harvard Business Review, 80* (7), 16-17.

Taylor, David & Walley, (2003) *Effects of Green Purchasing Strategies on Supplier*

Behaviour. Greening the supply chain. J. Sarkis. Germany, Springer-Verlag London Limited**:** 25-39.

Tan, K. (2002). Supply Chain Management: Practices, Concerns, and Performance Issues, *Journal of Supply Chain Management, 38* (1), 42-53.

Tate, W. L., Dooley, K. J. & Ellram, L. M. (2011). Transaction Cost and Institutional Drivers of Supplier Adoption of Environmental Practice. *Journal of Business Logistics*, 32(1), 6-16.

Tate, W.L., Ellram, L.M., & Kirchoff, J.F. (2010). Corporate social responsibility reports: A thematic analysis related to supply chain management. *The Journal of Supply Chain Management, 46,* 19-44.

Teijlingen, E. R. & Hundley, V. (2001). *The importance of pilot studies*. Social research UPDATE, (35).

Toke L. K., Gupta R. C. & Dandekar, M. (2010). *Green supply chain management; critical research and practices*. *Proceedings of the International Conference on Industrial Engineering and Operations Management.* Dhaka, Bangladesh, January 9 – 10.

Truxillo, C. (2003). Multivariate Statistical Methods: *Practical Research Applications*

Course Notes. Cary, N.C.: SAS Institute

Umeda, Y., Tsukaguchi, H., & Li, Y. (2003). Reverse logistics system for recycling: Efficient collection of electrical appliances. *Proceedings of the Eastern Asia Society for Transportation Studies, 4*, 1319-1334.

UNEP, (1996). *"Sustainable Consumption and Production Policy Dialog*." Retrieved from http://www.unep.org on 15/7/2013.

Uniliver Kenya (2011). *Unilever Sustainable Living Plan Progress Report*. Retrieved from http://www.unilever-esa.com/Images/uslp on 15/7/2013.

Vachon, S., & Klassen, R. D. (2008). Environmental Management and Manufacturing Performance: The Role of Collaboration in the Supply Chain," *International Journal of Production Economics,* 111 (2), 299-315.

Vachon, S., & Klassen. R. D. (2006b). Green Project Partnership in the Supply Chain. The Case of the Package Printing Industry, *Journal of Cleaner Production*, 14 , 661-671.

Vachon, S., & Klassen, R.D., (2006). Extending green practices across the supply chain: The impact of upstream and downstream integration. *International Journal of Operations & Production Management,* 26(7), 795 - 821.

Vershuren, (2002), A comprehensive conceptual model for managing environmental

impacts, costs and risks in supply chains. Best Practice Procurement: Public and Private Sector Perspective. A. Erridge, R. Fee and McIlroy. Aldershot, Gower**:** 42-29.

Visseren-Hamakers, I. J., Arts, B., & Glasbergen, P. (2011). Interaction Management by Partnerships: The Case of Biodiversity and Climate Change. *Global Environmental Politics*, 11 (4), 89-107.

WBCSD, (1997b). '*Eco-Efficiency and Cleaner Production: Charting the Course to Sustainability, Sustainable Consumption and Production."* World Business Council for Sustainable Development and United Nations Development Programme.

WBCSD, (1997a). *Exploring Sustainable Development, Global Scenarios (2000-2050).* World Business Council for Sustainable Development, Geneva: Switzerland.

WBCSD, (2000a), *Measuring Eco-Efficiency, A Guide to Reporting Company Performance.* Verfaille, H.A., Bidwell.

William, S. C. (1994). *The Elements of Graphing Data*. Hobart Press.

William & Litabingwa J., (1996). Small – Scale Manufacturing in Kenya: Chareacteristics, Problems and Source of finance.Jacton:Jacton State University Press.

Williamson, K., D. Spitzer Jr & Bloomberg, D. (2000). Modern Logistics Systems: Theory and Practice, *Journal of Business Logistics*, 11 (2), 65-86.

World Health Organization, (2004). *Kenya Country Profile*.

Wu, H.J. & Dunn, S.C. (2008). Environmentally responsible logistics systems, *International Journal of Physical Distribution & Logistics Management,* 25(2),. 20-38.

Wuyts, S., Stremersch, S., Van Den Bulte, C., & Franses, P.H. (2004). Vertical marketing systems for complex products: A triadic perspective. *Journal of Marketing Research*, 41(4), 479-487.

Yamane, T., (1967). *Statistics*, *2nd Ed* .New York: Harper and Row.

Yamfwa, F., Szirmai, A. & Lwamba, C. (2002). 'Zambian Manufacturing Performance in Comparative Perspective' *Working Paper GD 53*. Groningen: Groningen Growth and Development Centre.

Zhu, Q., & Sarkis, J. (2004). Relationships between Operational Practices and Performance among Early Adopters of Green Supply Chain Management Practices in Chinese Manufacturing Enterprises. *Journal of Operations Management*, 22 (3), 265-289.

Zhu, Q. & Sarkis, J. (2006). An inter-sectoral comparison of green supply chain management in China: Drivers and practices, *J. Clean. Prod.*, 14, 472-486.

Zhu, Q., Sarkis, J., & Lai, K.H. (2008). Confirmation of a Measurement Model for Green Supply Chain Management Practices Implementation, *International Journal of Production Economics,* 111 (2), 261-273.

Zhu, Q., & Liu, Q. (2010). Eco-design planning in a Chinese telecommunication network company: Benchmarking its parent company. *Benchmarking. An International Journal,* 17(3), 363-377.

Zhu, Q., Geng, Y., Sarkis, J., & Lai, K.H. (2011). Evaluating Green Supply Chain Management among Chinese Manufacturers from the Ecological Modernization Perspective. *Ransportation Research Part E, 47*, 808-821.

Zhu, Q., Geng, Y., Fujita, T., & Hashimoto, S. (2010). Green Supply Chain Management in Leading Manufacturers: Case Studies in Japanese Large Companies, *Management Research Review*, 33 (4), 380-392.

Zhu, Q., Sarkis, J., & Lai, K.H. (2010c). Green supply chain management innovation diffusion and its relationship to organizational improvement: An ecological modernization perspective. *Journal of Engineering and Technology Management*, In Press.

Zisis, (2003), The Environmental as a Supply Chain Management Issue." *British Journal*

of Management **7**: 45-62.

Appendix 1: Study Questionnaire

This questionnaire has been designed to collect data and information from manufacturing firms in Kenya, to be used in examining the effect of **Green Supply Chain Management Practices** (GSCMP) on firm performance. To achieve the research objectives, your participation in this study is considered crucial. The information collected from you will be treated with strict confidence, and shall be used for only the intended purposes.

1.0 General information

a. Please provide the name of your firm (optional)

_____

b. What title/position do you hold in the firm? (Necessary)

_____

c. How many employees does the company have? Number:

_____

d. Which one of the following **sectors** best describes your firm? **(Necessary):**

Sectors	**Tick**
Building, Construction and Mining	
Chemical and Allied	
Energy, Electricals and Electronics	
Food and Beverages	
Leather and Footwear	
Metal and Allied	
Motor Vehicle and Accessories	
Paper and Board	
Pharmaceutical and Medical Equipment	
Plastic and Rubber	
Textile and Apparel	
Timber, Wood and Furniture	
Other (specify)	

2. 0 Green Supply Chain Management Practices (GSCMP) Indicators

Please indicate on a scale of 1 to 5 by ticking the appropriate box, the extent to which the following GSCMP indicators have been implemented in your firm? (Where not all, very small extent, small extent, average and a large extent are represented by scores of 1, 2, 3, 4 and 5 respectively).

Green procurement	**1**	**2**	**3**	**4**	**5**
Providing specification to suppliers that includes environmental requirements					
Environmental audits of supply base					
ISO14001 certification of supply base as a criteria for selecting vendor					
Prefer products that consumed fewer natural resources					
Working with suppliers to address environmental problems					

ISSN 2320-9186

Others (Please specify)_____					
Green Manufacturing	**1**	**2**	**3**	**4**	**5**
Using machines or tools which consume less energy, water and fuel					
Impact and life cycle assessment tools for manufacturing					
Risk assessment for energy and resource use					
Environmental friendly raw material					
Efficient processes to reduce solid waste , air emissions and conserve energy and water					
Environmental Management System (EMS)					
Others (Please specify)_____					
Green Distribution	**1**	**2**	**3**	**4**	**5**
Eco labeling of products					
Environment-friendly packaging and transportation					
Providing information to customers on environment friendly products					
Re-using and recycling of packages					
Collection of packages for proper disposal					
Others (Please specify)_____					
Environmentally Oriented Reverse Logistics	**1**	**2**	**3**	**4**	**5**
Waste collection for proper disposal					
Recycling, re-use and recovery of useful parts of the products					
Recovery of hazardous parts for proper disposal					
Arrangement with customers to return used packages					
Easy availability of information about returning of products					
Others (Please specify)_____					

2.1 Green Procurement and Firm Performance

Please indicate on a scale of 1 to 5 by ticking the appropriate box, the extent to which the following have been realized as a result of your firm embracing **green procurement**

practices (Where not all, very small extent, small extent, average and a large extent are represented by scores of 1, 2, 3, 4 and 5 respectively).

Cost efficiency		**1**	**2**	**3**	**4**	**5**
i.	Lowering waste management fee					
ii.	Lowering hazardous material management fee					
iii.	Savings from conserving water, fuel and energy					
iv.	Reduce product cycle time					
v.	Reduction of cost and time for reporting procurement issues					
vi.	Reduction of cost of transportation					

2.2 Green Manufacturing and Firm Performance

2.2.6 Please indicate on a scale of 1 to 5 by ticking the appropriate box, the extent to which the following have been realized as a result of your firm embracing **green manufacturing practices** (Where not all, very small extent, small extent, average and a large extent are represented by scores of 1, 2, 3, 4 and 5 respectively).

Measures		**1**	**2**	**3**	**4**	**5**
i.	Reduction of scrap and rework					
ii.	Reduction of hazardous waste					
iii.	Prevention of liability costs					
iv.	Reduction of quantity of raw material					
v.	Reduction of energy and water required					
vi.	environmental performance					
vii.	reduces environmental compliance costs					
viii.	general acceptability of your firm by the society					
ix.	improvement of your firm image					
x.	improvement of customer loyalty					

2.3 Green distribution and Firm Performance

2.3.5 Please indicate on a scale of 1 to 5 by ticking the appropriate box, the extent to which the following have been realized as a result of your firm embracing **green distribution practices** (Where not all, very small extent, small extent, average and a large extent are represented by scores of 1, 2, 3, 4 and 5 respectively).

Measures	**1**	**2**	**3**	**4**	**5**
i. Reduced storage costs					
ii. Reduced retrieval delay					
iii. Improved customer relationship					
iv. Minimized solid waste					
v. Reduced investment in packages					
vi. Improved customer service					
vii. Improved market share					
viii. Improved customer loyalty					

2.4 Environmentally – oriented reverse logistics (EORL) and Firm Performance

2.4.6 Please indicate on a scale of 1 to 5 by ticking the appropriate box, the extent to which the following have been realized as a result of your firm embracing **Environmentally-oriented reverse logistics practices** (Where not all, very small extent, small extent, average and a large extent are represented by scores of 1, 2, 3, 4 and 5 respectively).

Measures	**1**	**2**	**3**	**4**	**5**
i. Improved efficiency on waste management					
ii. Improved effectiveness in management of returned material					
iii. Source of new profits from wastes					
iv. Enhanced firm image to customers					
v. Reduced use of new material					
vi. Positive public opinion about the firm					
vii. Enhancement of environmental statutory compliance					

viii.	Compliance with environmental regulations					
ix.	Increased interaction with customers					
x.	Development of helpful customer policy					

3.0 Supply Chain Ecocentricity

3.1 Have the following **supply chain ecocentricity practices** been practiced by your firm? (Please tick).

Supply chain ecocentricity indicators	**Yes**	**No**
partner with external stakeholders for environmental research		
Sponsorship for implementation of environmental management practices by the external stakeholders		
Participation in external stakeholders eco-oriented workshops		
Environment fit through engagement with external stakeholders		
Environmental benchmarking with external stake holders		
Advance knowledge for environmental management practices		
Co-investment with external stakeholders on environmental management related issues		
Use environmental management experts from external stakeholders		
Allow environmental audit by external stakeholders		

3.2 From your **Yes** answers above, please list practices you think have influence on your firms' green supply chain management practices success

_____

_____

3.3 Please give reasons why you think they influence the success of your firms' green supply chain management practices

_____

_____

4.0 Firm Performance

In this study, firm performance is measured in terms of cost efficiency and environmental differentiation.

4.1 Cost Efficiency

From the following firm performance indicators, please choose the ones which best measure your firm performance after embracing Green Supply Chain Management Practices (Please tick).

Cost efficiency Performance indicators	Not at all	Between 1% & 4%	Between 5% & 12%	Between 13% & 20%	Above 20%
Waste management fee has been reduced by;					
Hazardous material management fees has been lowered by;					
Cost of energy and water has been lowered by;					
Statutory fines for non-environmental compliant is reduced by;					
Input costs have reduced due to recycle/re-use of material by;					

Environmental related liability costs have reduced by;					
Cost of storage has been reduced by;					
Cost of transport has been reduced by					
Speed and delivery time has improved by;					
Product cycle time has reduced by?					

4.2 Environmental Differentiation

From the following firm performance indicators, please choose the ones which best measure your firm performance after embracing Green Supply Chain Management Practices (Please tick).

Environmental Differentiation Performance Indicators	Not at all	Between 1% & 4%	Between 5% & 12%	Between 13% & 20%	Above 20%
Eco-friendly reputation has increased by;					
Charge higher price (premium) compared to competitors by;					
Eco-products sales has increased by;					
Eco-market share has expanded by ;					
Eco- brand loyalty has increased by;					
Echo-waste management has improved by;					
Echo-management of hazardous					

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material has improved by;					
Conservation of energy and water has improved by;					
Production of echo- unique products has increased by?					

5. Realization of the Green Supply Chain Management Benefits

5.1 Has the anticipated value of green supply management practices been realized in your firm? ☐ ☐

Yes No

Please justify your answer

_____

_____

_____

5.2 What do you think organizations should do to make green supply chain management practices a success?

_____

_____

_____

5.3 In your opinion, what do you perceive as benefits of embracing green supply chain management practices?

_____

_____

5.4 What drove your firm to implement green supply chain management practices?

_____

_____

6.0 How long has it taken since the establishment of GSCM by your firm? (Please tick).

Years	More than 4 years	3years	2yaes	1year	Not at all
Please tick the correct duration					