EFFECT OF REVERSE LOGISTICS ON OPERATIONAL PERFORMANCE OF LIQUEFIED PETROLEUM GAS COMPANIES IN KENYA

BY

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DECLARATION

This project is my original work and has not been submitted to any other university for examination.

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This research project has been submitted for examination with my approval as the University Supervisor.

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DEDICATIONS

To my parents (Samia and Gamal) for their unwavering support and unconditional love and to my brother (Salim) for all the laughter and cherished memories.

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ABSTRACT

One of the major concerns that companies have is the need to support sustainable environment. Customers' awareness on environmentally friendly initiatives have increased over the years, driving firms to become more responsible to the environment. Governments have put in place strict regulations that demand firms to monitor the impact of their activities on the environment or face heavy penalties due to non-compliance. Stiff competition and other economic factors have also pushed companies into adopting green strategies. Reverse logistics is one of the key green strategies that emphasizes on supporting sustainable environment in the field of logistics. There are many benefits associated with reverse logistics such as reduced costs, improved customer service, reduced waste, enhanced flexibility and improved quality. In this context, the objectives of this study were: to determine the reverse logistics practices among liquefied petroleum gas companies in Kenya and to establish the effect of adoption of reverse logistics practices on operational performance of liquefied petroleum gas companies in Kenya. The study used a descriptive cross-sectional survey. The population of the study comprised of 34 liquefied petroleum gas companies in Kenya listed under the Cylinder Exchange Pool list. A census was conducted since the population was small. The study used primary data that was collected through a self-administered questionnaire that was given to supply chain managers and operational managers in the absence of the supply chain managers. Out of 34 liquefied petroleum gas companies, 30 responded. A multiple regression analysis was used in establishing the effect of reverse logistics on operational performance of liquefied petroleum gas companies in Kenya. The findings revealed that liquefied petroleum gas companies in Kenya have adopted reverse logistics practices to appreciable levels with repackaging practices being the most adopted and recycling practices being the least adopted. Out of all the indicators, employees being trained on the adoption of reverse logistics practices ranked lowest. From the results, it was also noted that reverse logistics practices had a significant relationship with cost and quality and while the P values of the relationship between reverse logistics practices and flexibility as well as the relationship between reverse logistics practices and dependability were insignificant, a test of the correlation coefficient proved that a significant relationship exists. The relationship between reverse logistics practices and speed was found to be insignificant with remanufacturing practices being negatively related to speed. It is recommended that top management should train employees to increase awareness on reverse logistics practices and promote adoption. Similarly, the management should view reverse logistics as a way of not only improving operational performance but also social, environmental and economic performance. The study further recommends the use of joint reverse logistics to lessen the financial risks, promote information-sharing and capabilities and reduce uncertainty in the reverse supply chain.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Among several challenges that firms face globally such as high costs, stringent regulations, economic recessions and stiff competition, environmental degradation has also raised fears. Firms have become increasingly concerned over sustainability and environmental management. Reverse logistics has gained prominence due to its ability to provide solutions to this concern. The rise of reverse logistics is driven by several factors. Customers have put immense pressure on companies to become more environmentally responsible. In an online study conducted by the Nielsen Company (2015), 66% of worldwide respondents are willing to pay more for goods and services that come from companies that are committed to corporate social responsibility and environmental conservation, a rise from 55% in the year 2014, and 50% in 2013. Government and non-governmental bodies have acted as drivers to the adoption of reverse logistics through formulation and implementation of environmental acts, policies and agreements. Economic incentives have also contributed to the growth of reverse logistics. According to Ruiz-Benítez and Cambra-Fierro (2011), reverse logistics leads to reduced costs, improved customer service, increased productivity, increased facility output and improved service levels.

Theories that explain the relationship between reverse logistics and operational performance include the resource based view, natural resource based view, institutional theory and stakeholder theory. The resource based view argues that for a firm to gain competitive advantage, it must possess resources that are rare, difficult to imitate, non-substitutable and valuable (Wernefelt, 1984). Firms can adopt reverse logistics as a resource that possesses these qualities such that they are able to gain competitive advantage. The natural resource based view argues that a firm cannot simply rely on core competencies without taking the natural environment into account (Hart, 1995). Reverse logistics plays a key role in protecting the environment through reduction in waste associated with recycling as well as reduction in energy consumption through reusing. The institutional theory proposes that normative, mimetic and coercive forces influence how firms behave (Di Maggio & Powell, 1983). These three forces play an important role in encouraging the adoption of reverse logistics. The stakeholder theory argues that a firm is in a relationship with its stakeholders and this relationship may change from time to time depending on the firm's behaviour (Freeman, 1984). These stakeholders can influence the firm to adopt reverse logistics practices such as the case of customers putting pressure on firms to become more environmentally responsible.

In Kenya, reverse logistics has been incorporated into the automotive, manufacturing, service, ICT, medical and even the liquefied petroleum gas (LPG) firms though the level of adoption varies. For liquefied petroleum gas companies, reverse logistics plays a crucial role in ensuring profitability and survival. These companies practice reverse logistics through return of cylinders for refilling, reuse and proper disposal. The major challenges faced by LPG firms in Kenya are loss of cylinders, pirate filling, high cost of filling, illegal and legal competitors, inability to trace flow of cylinders, inadequately trained staff, safety concerns and heavy taxes (Chege, 2013). Around 5-7% of the population presently uses liquefied petroleum gas as a primary source of fuel whereas the rest use charcoal, firewood, dung or crop waste (Global LPG Partnership, 2013).

1.1.1 Reverse Logistics

Pohlen and Farris (1992) defined reverse logistics from a marketing perspective whereby they described it as the movement of goods from a consumer towards a producer through a distribution channel. This definition failed to mention the purpose of reverse logistics from the organization's perspective as well as the processes. Rogers and Tibben-Lembke (1999) described reverse logistics as the process of planning, implementing, and controlling the efficient, economical flow of raw materials, work-in-progress, finished goods, and information from the consumption point to the point of origin in order to recapture value or for proper disposal of products. This definition did not consider the point of origin may not necessarily be the point of recovery such as used toners do not go back to the original producers. However, this definition is still essential in the field of reverse logistics as it is highly used by other researchers. Hence the definition stated by Rogers and Tibben-Lembke (1999) is applicable but with the replacement of "point of origin" with "point of recovery".

There are several benefits companies can benefit from practising reverse logistics. One of the biggest benefits is reduced costs in terms of administration costs, transportation costs and after-sales costs. Other benefits include increased speed and flexibility, improved customer service and therefore greater customer loyalty and retention, improved quality, effective recovery of assets, improved transparency in the supply chain and greater market performance analysis. Reverse logistics would also improve the organizations' corporate image by showing they are environmentally friendly. It also helps ensure firms follow the legal regulations which would exempt them from incurring financial penalties if they do not comply (Laosirihongthong, Adebanjo & Tan, 2013).

Reverse logistics is not without its challenges. The recovery efforts involved in reverse logistics are capital-intensive (Tibben-Lembke, 2002). Necessary equipment such as reverse logistics software and recycling equipment would be required. Employees would also need to be trained. Other challenges include management inattention, lack of sufficient financial resources to invest in reverse logistics, lack of awareness, lack of appropriate performance management system, limited forecasting and planning and legal issues (Sharma, Panda, Mahapatra & Sahu, 2011).

1.1.2 Operational Performance

Voss, Ahlstrom and Blackmon (1997) defined operational performance as the measurable outcomes of a firm's processes such as productivity, reliability and production cycle turn which affect the overall business performance measures such as customer satisfaction and market share. This definition does not specify which among the firm's processes are taken into account. According to Richard, Devinney, Yip and Johnson (2009), operational performance is a construct in management research where all functions in the organization (procurement, human resources, marketing, operations, finance and strategy) are eventually judged based on their contribution to organizational performance. This definition gives a better understanding by stating that every process in the functions of an organization is judged to determine its value.

For service firms, operational performance involves activities undertaken by service providers. The indicators looked at are productivity, efficiency, responsiveness and reliability (Stank, Goldsby & Vickery, 1999). The performance indicators of manufacturing firms include reliability, responsiveness, agility, cost and asset management (Sillanpää & Kess, 2012). However, the most common performance indicators applicable to both manufacturing and service firms are cost, quality, speed, flexibility and dependability (Slack, Chambers & Johnston, 2010). These have both internal effects to the firm's processes and external effects on the customers. Cost is about doing things economically such that efficiency and productivity is improved (Batista, 2009). Quality is defined as conformity to customers' specifications on a consistent basis (Slack et al., 2010). Speed involves doing things at a fast pace such as the speed within which a firm takes to convert a customer's requirements all the way to delivery of the product. Flexibility means the ability to adapt to the changing environment or new requirements (Slack et al., 2010). Dependability involves being reliable by doing things as promised and on time (Batista, 2009).

Improved operational performance results in various benefits. They include improved customer service and customer retention, improved competitive position in the market, faster delivery of goods and services, greater productivity, effective risk management, increased visibility of related performance, reduced costs and improved capacity utilization. Other benefits include greater improved capacity utilization, reduced scrap, reduced inventory levels and improved quality (Ninlawan, Seksan, Tossapol & Pilada, 2010). However, operational performance is affected by many barriers. Some of these barriers include lack of a strong management commitment, resistance to change, use of obsolete technology, poor planning, insufficient information and lack of organizational-wide collaboration (Crabtree, 2014).

1.1.3 Reverse Logistics and Operational Performance

The impact of reverse logistics on operational performance can be felt from different angles. Reverse logistics has a positive effect on the operational performance through creation and sharing of knowledge. Ramirez and Morales (2011) found that reverse logistics promotes creation and spreading of knowledge across the supply chain thereby reducing uncertainty of reverse logistics processes. By reducing uncertainty, a firm would have a better understanding of customer demand and customer feedback or complaints regarding the quality of the product. This in turn would help the firm improve the quality of its products, the speed of delivery and the ability to supply products when needed (dependability).

Reverse logistics ensures cost savings. Through reuse and remanufacturing, a firm would spend less on raw materials (Daugherty, Autry & Ellinger, 2001). The reduction in waste caused by reusing and recycling would ensure a firm keeps its waste management costs low. Repackaging plays a key role in promoting the company's brand therefore reducing marketing costs. Information sharing across the reverse chain would reduce information costs and improve flexibility of information distribution (Koste and Malhotra, 1999). Aside from cost reductions, reverse logistics contributes to dependability. Through tracking of reverse flows, returned products will reach the firm faster and customer complaints will be resolved more quickly hence increasing customers' confidence in the firm.

The element of joint ventures and third-party reverse logistics partners create a positive impact on operational performance. In joint ventures and third-part reverse logistics providers, a partner's core competencies can be exploited through contractual arrangements as opposed to building such competencies internally. For instance, third-party reverse logistics providers have more advanced information systems, material handling equipment and sufficient warehouses (Kannan, Shaligram & Kumar, 2009). Hence, through third party reverse logistics providers, a firm would be able to improve the speed of delivery of products to customers and enhance its flexibility by focusing on its core competencies.

1.1.4 Liquefied Petroleum Gas Companies in Kenya

Liquefied petroleum gas (LPG) or propane or butane, are flammable mixtures of hydrocarbon gases used as fuel in lighting, refrigeration, cooking, heating and in vehicles. LPG is made from refining petroleum or "wet natural gas" and is usually derived from fossil fuel. It is one of the most widely used sources of fuel in the world because of its benefits such as it is greener, cheaper, easily accessible, affordable and safer.

An LPG company in Kenya is any company that belongs to the LPG Cylinder Exchange Pool (Energy Regulatory Commission, 2016). As at the year 2013, LPG penetration was greater in urban regions at 21% while only 1% of rural areas use LPG as a primary fuel. 60% of the market is estimated to be in Nairobi region while for Mombasa, it is estimated to be 15% and the rest are taken by other urban regions in Kenya (Global LPG Partnership, 2013). The government of Kenya has played a key role in supporting the LPG companies. Through the Legal Notice No. 121 of 2009, the cylinder exchange pool was created to monitor exchange of cylinders among LPG companies. The unified valves and regulators have improved accessibility of LPG for domestic use since customers can use the same valve and regulator for different LPG brands (Energy Regulatory Commission, 2006). The removal of tax on LPG gas has facilitated the reduction of price of LPG therefore boosting demand (Chege, 2013). Standardization of cylinder sizes (cylinders are available in 1kg, 3kg, 6kg and 13kg) have reduced unfair competition among different firms and have promoted accessibility.

While the LPG companies have a high market potential due to existence of large consumer segments, they face several challenges. These challenges include high cost of LPG equipment, insufficient storage space, high import and port costs, widespread illegal refilling due to limited regulations to protect investments, poor distribution networks, stiff competition and cylinder management issues such as cylinder unavailability (Global LPG Partnership, 2013). Among the challenges, cross-filling activities are rampant, causing no control over the cylinder condition and movement, no control over quality and quantity of the product, health and property damage risk to customers, unfair competition, delayed deliveries and poor reputation of the firm therefore reducing a customer's reliance and dependability on the product (Chege, 2013).

Reverse logistics can play a significant role in combating such challenges. For instance, the creation and spread of knowledge in reverse logistics would help LPG companies track cylinder movement. This would in turn not only reduce the need to invest in new cylinders due to cylinder unavailability and long turn-around time but also reduce illegal refilling and rebranding (Sriyogi, 2014). Reverse logistics can also help the firms gain competitive advantage through faster delivery of exchanged cylinders. Since cylinder tracking would be more effective, the cost investments in new cylinders can be reduced therefore resulting in cost savings. Poor distribution networks can be swapped with strong distribution networks provided by third-party reverse logistics service providers who have better information systems, material handling equipment and storage spaces (Kannan, Shaligram & Kumar, 2009).

1.2 Research Problem

While the relationship between reverse logistics and operational performance can be said to be negative, the contrary can be argued. One of the most important benefits of reverse logistics is its ability to reduce costs within the supply chain due to remanufacturing, reuse, repackaging and recycling. Costs such as information acquisition costs, transportation costs, procurement costs and lost sales can be reduced through efficiencies gained within their reverse logistics processes (Daughterty, Richey, Genchev & Chen 2005). According to Koste and Malhotra (1999), reverse logistics reduces uncertainty of information therefore improving flexibility of information distribution and dependability of processes. Reverse logistics also improves quality since the firm would be able to analyse the reasons why the products are returned and improve on the products' capabilities, design and features (Burnson, 2014).

LPG companies face several challenges such as insufficient storage space, inability to track movement of cylinders, threat of corporate image, safety threats, illegal cross-filling, high costs of transportation and refilling, poor regulations and stiff competition. In a study conducted by Global LPG Partnership (2013), there are only 3 filling plants namely: Mombasa, Nairobi and Eldoret. The lack of sufficient LPG filling points has forced firms to incur high transportation and storage costs. Illegal refilling does not only pose safety risks but also undermine the quality and quantity of the product. The inability to track movement of cylinders have made firms lose cylinders to illegal operators and forced them to purchase new cylinders, increasing costs as well as delaying delivery of the cylinders to customers. This study sees reverse logistics as a possible solution to these barriers.

Internationally, studies on reverse logistics are many. In a study conducted by Weeks, Gao, Alidaeec and Rana (2010), the researchers looked at only production mix and product route efficiencies as reverse logistics strategies on operations performance and profitability in the scrap steel industry. Agrawal and Chowdhary (2014) did a study on performance measures of reverse logistics and their effect in product lifecycle. However, these studies did not focus on the LPG companies. While Sriyogi (2014) focused on performance indicators affecting the reverse logistics activities in India with a case of LPG agencies, his study did not focus on operational performance of the firms but rather, the performance indicators that contributed to effective reverse logistics. Locally, Wainaina (2014) and Muttimos (2014) did a study on reverse logistics in the manufacturing firms. While the former looked at the reverse logistics practices and profitability, the latter looked at organizational performance. None discussed operational performance. Kiberenge (2014) did a study on the adoption of reverse logistics but the researcher's focus was on information and communications technology firms in Kenya. Kabergey and Richu (2015) focused on the link between reverse logistics and operational performance of sisal processing firms in Nakuru but only considered product recovery and reuse as the reverse logistics practices.

From the above background, there is no known study which has been done to establish the effect of reverse logistics on operational performance among LPG firms in Kenya. This study is done to fill in this gap. Therefore, this study seeks to answer the following questions: what are the reverse logistics practices among the liquefied petroleum gas companies in Kenya? Secondly, what is the effect of adoption of reverse logistics practices on operational performance of the liquefied petroleum companies in Kenya?

1.2 Research Objectives

The objectives of this study are to:

(i) Determine the reverse logistics practices among liquefied petroleum gas companies in Kenya.

(ii) Establish the effect of adoption of reverse logistics practices on operational performance of liquefied petroleum gas companies in Kenya.

1.4 Value of the Study

The findings of this study will act as a guide for the liquefied petroleum gas firms in Kenya in understanding the role that reverse logistics plays in operational performance. By understanding reverse logistics, they will be able to effectively implement it in solving the challenges they face through reducing costs, improving quality, enhancing delivery speed thereby improving customer retention and loyalty, improving dependability through ensuring effective management of cylinder movement and enhancing flexibility through promotion of knowledge-sharing.

In the academic world, this study will add to the body of knowledge for future generations and stimulate ideas for further research in different fields. Academicians and researchers can use the findings of this study for further research in the field of reverse logistics, especially in determining the effect of reverse logistics on operational performance among different sectors. The reverse logistics practices highlighted in the study can serve as an inspiration to scholars interested in finding out the reverse logistics practices adopted by firms in other industries.

The key policy makers within the government can also use the findings of this study to set policies that encourage adoption of reverse logistics not only among liquefied petroleum companies but also in other sectors. The concept and practices of reverse logistics can be implemented in governmental institutions to ensure effective utilization of resources including taxpayers' funds. In addition, reverse logistics can be fully implemented in military operations to effectively dispose battle-damaged equipment, provide a cleaner environment through recycling and seek possible financial recovery of government-owned assets. The study can also help the policy makers in coming up with policies and regulations that support the LPG sector.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter undertakes a review of the available literature on the field of reverse logistics starting with the theoretical review, the reverse logistics practices, empirical review, summary and knowledge gap and finally, the conceptual framework.

2.2 Theoretical Review

Reverse logistics can be explained by four theories. These theories are the resource based view, natural resource based view, institutional theory and stakeholders theory.

2.2.1 Resource Based View

Resource based view argues that a firm's competitive advantage can be achieved if it possesses resources that are valuable, uncommon, difficult to copy and non-substitutable (Wernefelt, 1984). These resources include assets, capabilities (individual skills, knowledge and experience), firm attributes, organizational processes, information, and knowledge under the control of a firm (Barney, 1991). A match between the internal organizational capabilities and the external environmental must exist to facilitate this competitive advantage. According to Porter (1985) cost leadership and differentiation are the two main sources of competitive advantage. Cost leadership is achieved through being a low-cost leader in the market and therefore generating high sales which results in higher profits. Differentiation focuses on brand loyalty by providing unique products distinct from a competitor's to cater for a certain market segment.

Aside from cost-leadership and differentiation, firms adopt other strategies in order to remain competitive in the market. One of these strategies involves "going green". A firm may adopt reverse logistics in order become more environmentally friendly. This in turn will improve the corporate image thus customers will be more interested in buying the firm's products. With a boost in sales, the firm will generate higher profits and gain a bigger market share compared to its competitors. It will also impact on operational performance through greater utilization of resources and waste minimization therefore reducing costs. What makes reverse logistics as a resource that is rare, valuable, difficult to imitate and non-substitutable is that many firms do not have adequate knowledge on reverse logistics. Hence a firm can see this as an opportunity to practice reverse logistics before a competitor and improve operational performance through cost-savings made due to recycling, remanufacturing of materials and reuse and improvement in quality through repair of returned products.

2.2.2 Natural Resource Based View

This theory was developed by Hart (1995) which highlights on the omission left by the resource based view, the natural environment. Currently, the world is facing massive environmental degradation which can be seen through global warming, overpopulation, fewer free lands, increased risk of extinction of some species, land overuse and depletion of natural resources. Firms cannot simply rely on core competencies and capabilities without being environmentally conscious. Therefore, this theory proposes three strategic capabilities: pollution prevention, product stewardship and sustainable development.

Pollution prevention involves reduction of wastes and emissions through lean management, housekeeping, resource utilization, process innovation, material substitution and reverse logistics. When products are returned back to a firm, they can be remanufactured, recycled or properly disposed. Remanufacturing and recycling of materials improve operational performance through creating huge cost savings and value recovery (Toffel, 2004). Proper disposal of non-biodegradable materials ensure harmful products are not leaked into the environment. Biodegradable waste materials can be converted to biogas which would help a firm earn additional profits that can offset the costs incurred during transportation of the waste materials from customers (Jensen &Webster, 2009).

Product stewardship involves incorporating the external stakeholder into the lifecycle of a product—from sourcing raw materials all the way to disposal after use—with a view of gaining competitive advantage through exclusive access to resources and establishment of rules, regulations and standards that are unique to the firm (Hart, 1995). Product designers need to minimize use of non-biodegradable materials, avoid toxic materials and use renewable resources in accordance with their replenishment rate (Robert, 1995). In order to achieve product stewardship, firms need to cooperate with suppliers in ensuring the purchased raw materials have less harmful impact on the environment (Smart, 1992). Firms would also need to liaise with customers so that used products are returned for remanufacturing, recycling, repackaging or even repair. This is where reverse logistics and operational performance come into play. According to Mao and Jin (2014), scrapped cars yield materials such as steel, rubber, plastic and non-ferrous metals that can be used to reproduce an almost new car. Remanufacturing using second-hand materials would improve efficiency since the time and cost taken to acquire materials from scratch is higher. With production speed improved, the products would reach the customers more quickly leading to customer satisfaction.

Sustainable development involves minimizing environmental burden of a firm as it grows and develops. This strategy proposes firms should build markets in the developing countries while reducing their environmental impact. According to Hart (1995), investing in developed countries might not provide a strong competitive edge because the markets in such countries are shrinking. There is untapped potential in the developing countries. As is the case with the other two strategies, reverse logistics can help firms improve operational performance through reducing costs, improving quality, enhancing flexibility and speed. For instance, the juakali sector provides an opportunity for investment whereby scrapped materials can be recycled to produce good quality products such as cooking utensils, toys, construction materials among others.

2.2.3 Institutional Theory

It is one of the most popular theories that have been used to understand how organizations develop and implement operational strategies (Adebanjo, Ojadi, Laosirihongthong & Tickle, 2013). This theory proposes that there are structures, rules, norms and routines that act as the framework for behaviour. According to Di Maggio and Powell (1983), managerial decisions to practice environmental management may be determined by three forces: normative, mimetic and coercive. Normative forces are associated with professionalism, coercive forces emerge from political influence and institutional legitimacy and mimetic forces involve mimicking behaviour in an attempt to survive in the uncertain environment.

Normative forces influence firms to adopt certain strategies such as environmental management so that they appear legitimate (Ball & Craig, 2010). Studies by other scholars have proven that customers in developing countries have intensified environmental awareness and are starting to prefer green products (Harris, 2006). Firms may practice reverse logistics due to pressures from the customers who value firms that are environmentally friendly as legitimate. They may also do so due to product returns. Nowadays, customers have low tolerance for products with poor quality thus product returns are more frequent. Reverse logistics can help speed up the returns management system so that product returns are dealt with quickly and in a simple manner without jeopardizing customer loyalty. Information collected from the reverse flow can be used to improve design, manufacturing, packaging and pricing of the product hence contributing to quality and flexibility.

Coercive pressures from the government and environmental bodies have driven firms to practice reverse logistics so that they avoid paying high fines and face threat of closure of business. For example, in the European Union, Restriction of Use of Certain Hazardous Substances Directive (RoHS), End-of-life Vehicles Directive (ELV) and Waste Electrical and Electronic Equipment Directive (WEEE) reduce waste and promote value recovery (Akdoğan & Coşkun, 2012). These directives have an impact on the operational performance of a firm. For instance, the Restriction of Use of Certain Hazardous Substances Directive (RoHS) would ensure firms do not supply toxic products to customers. This would drive firms to keep good quality standards in mind.

Mimetic forces motivate firms to adopt reverse logistics practices because of the success seen from their competitors. Joint ventures and franchising have encouraged firms to copy the operations of their parent companies, spreading the adoption of reverse logistics (Zhu & Liu, 2010). Globalization has inspired firms from all over the world to implement environmental management practices (Christmann & Taylor, 2001). In the presence of information technology, reverse logistics improves flexibility through product coding and tracking of product returns (Gunasekaran & Nagai, 2004). When firms see competitors have improved their flexibility through reverse logistics, they would be inspired to imitate the same.

2.2.4 Stakeholder Theory

A stakeholder is any person or a group with an interest in the organization and is affected by it (Freeman, 1984). The stakeholder theory proposes that a firm is in a relationship with its internal and external stakeholders and its activities may either influence the relationship positively or negatively. The importance of each stakeholder is relative, based on certain issues facing the firm and is capable of changing over time (Buysse & Verbeke, 2003). According to Berrone and Husillos (2004), the stakeholder's influence on the firm increases as the stakeholder acquires urgency, power and legitimacy. Examples of stakeholders include competitors, suppliers, customers, academicians, shareholders, the government, non-profit organizations and the general public.

Rogers and Tibben-Lembke (1999) argued that many firms have liberalized their return policies due to stiff competition. This shows that competitors as stakeholders do have an influence on the activities of a firm. Reverse logistics can help firm improve operational performance by simplifying processes to achieve greater efficiency and reduce time wastage. Companies may adopt reverse logistics due to fear of heavy fines as a result of noncompliance with environmental regulations. With shareholders demanding higher profits, they may also practice reverse logistics with the intention of gaining economic benefits such as in the second-hand markets (De Brito and Dekker 2004). As customers demand better quality and faster delivery, firms may use the information gathered from reverse logistics to improve the quality of their products and speed of delivery.

2.3 Reverse Logistics Practices

Several scholars have tried to categorize reverse logistics practices. Rogers and Tibben-Lembke (2001) categorized reverse logistics practices into remanufacturing, refurbishing, landfill, recycling, repackaging, returns processing and salvage based on a study conducted on the reverse logistics practices of service firms, manufacturers, wholesalers and retailers in the U.S. In a study conducted by Muttimos (2014) on the relationship between reverse logistics practices and organizational performance of manufacturing firms in Kenya, the practices were reusing, remanufacturing and recycling. For purposes of this study, the following practices were looked at bearing the context in mind.

2.3.1 Remanufacturing Practices

Remanufacturing is the process of restoring a product taken back from the market in order to return it to a new-like state or improve its performance through refurbishing, repair or replacement of defective parts (Eltayeb, Zailani & Ramayah, 2010). Remanufacturing is applied to a variety of products such as tyres, furniture, motor vehicles, cameras, mobile phones, automatic teller machines, vending machines, automobile parts and electronic devices. The main steps of remanufacturing typically include dismantling, cleaning of parts, inspection and sorting, repair, refurbishment or replacement of faulty parts and lastly, assembly and testing (Steinhilper, 2001).

Remanufacturing is beneficial in improving operational performance. For one, it can help firms recapture the value that would have been lost if the product is not returned. It is estimated that 85% or more of the original energy and materials are preserved in remanufacturing (Statham, 2006). This saves the cost of acquiring materials as well as other costs associated with energy such as electricity costs. Secondly, remanufacturing allows firm to do an analysis on the product to improve design and functionality therefore improving the product quality as a whole. Thirdly, it’s easier for a firm to remanufacture compared to producing from scratch so the time taken for the product to reach the customer will be shorter.

2.3.2 Reusing Practices

Reusing should not be mistaken with remanufacturing. Reusing is the process by which unused or slightly used products are distributed back to the market without any processing being involved. This means that reusing saves the energy that would be required from recycling or remanufacturing. However, the value of the product is reduced since no manufacturing is done to improve performance or restore it to a new-like state (Eltayeb et al., 2011). The process of reusing generally involves inspection and sorting of the products, conducting repairs without the need for processing, cleaning of the products in preparation for reuse and finally distributing the products to the customers.

Reusing contributes to operational performance in many ways. Firstly, reusing saves energy because there's no processing involved. This promotes cost savings. Secondly, reusing means that products can swiftly be taken back to the market so dependability and speed of delivery is improved.

2.3.3 Recycling Practices

Recycling is the breaking down of a used product into its component parts and reprocessing it into new or original forms. Examples of recyclable materials are plastic items, paper, glass, batteries, bulbs and metal materials (Wong, 2010). The process of recycling begins from bin collection where bins containing recyclable materials are taken. The bins are then transported to the firm. The materials are sorted, cleaned and then processed. The sorting process depends on the materials to be recycled. For example, steel cans are sorted using a magnet separation process.

There is a link between recycling and operational performance. Recycling saves a firm the cost of transportation of materials to be disposed and the cost of land acquisition for a landfill. For instance, in New Zealand, the setup costs for a landfill vary between $2m to $30m with annual capacities between 10,000 tonnes to 500,000 tonnes (Denne, Irvine, Atreya & Robinson, 2007). Secondly, recycling saves the firm energy consumption and promotes material recovery. The material usage per unit of output is reduced and therefore yield improved eco-efficiency (World Business Council for Sustainable Development, 2000). Thirdly, recycling promotes environmental conservation. According to NEMA (2007), over 2,000,000 plastic bags are generated in Nairobi. This shows a growing concern for the need to recycle. When a firm recycles for the sake of being more environmentally responsible, consumers would find it more legitimate therefore they would be more willing to buy the firm's products.

2.3.4 Repackaging Practices

Repackaging is the process of providing physical protection, containment, handling, transportation and marketing of goods again from raw materials to finished products (European Federation of Corrugated Board Manufacturers, 2000). Repackaging involves three levels: primary, secondary and tertiary repackaging. Primary repackaging is the type of packaging in direct contact with the product such as the tube storing a toothpaste. Secondary repackaging is the type of repackaging intended to advertise and market the product in the market such as the box of toothpaste showing the brand, features and functionality while tertiary repackaging is meant for distribution and warehousing such as the use of a pallet or a container (Long, 1982).

Repackaging has an impact on operational performance of a firm. For one, repackaging is more economically feasible compared to recycling and remanufacturing (Hazen, Hall & Hanna, 2012). Secondly, repackaging improves flexibility of operations through packaging of materials in different sizes so customers have an option of choosing what package size they require. Thirdly, repackaged materials take up less storage space than unpackaged materials. When there is more free space in a warehouse, movement of people and materials is made easier thus improving productivity.

2.4 Empirical Review

A number of studies have been carried out internationally in an attempt to establish the relationship between reverse logistics and operational performance. Weeks et al., (2010) conducted a study on the impacts of two reverse logistics strategies (production mix and product route efficiencies) on operations performance and profitability in the scrap steel industry in the United States. The results of the study were that there is no direct positive relationship between operations management and profitability hence the two strategies must be implemented to achieve profitability. However, this study only focused on two reverse logistics studies which may not be applicable to all firms such as is with the case of production mix being inapplicable to firms that offer only one type of a product.

A study conducted by Sriyogi (2014) focused on performance indicators affecting the reverse logistics activities as well as developing framework for implementing effective reverse logistics network among liquefied petroleum gas agencies in India. He found that order fulfilment, lead time, inventory carrying cost, acceptable stock turnover ratio, volume flexibility, cylinder utilization ratio, CCT of working stock cylinders at distributors and working stock ratio are the key performance indicators of successful implementation to reverse logistics. This study did not discuss the relationship between reverse logistics and operational performance but rather, it focused on the key performance indicators affecting reverse logistics.

Agrawal and Chowdhary (2014) conducted a study on the performance measures of reverse logistics and their effect in product lifecycle. They attempted to explain the reverse logistics practices that affect each stage of a product's lifecycle. They found that the main enabling strategies of reverse logistics were new technology implementation and support, customer satisfaction, strategic alliance, eco-compatibility and environmental performance, value recovery and knowledge management. They also suggested the use of a balance scorecard in determining the performance of reverse logistics.

Several local studies have focused on reverse logistics. Ongombe (2012) conducted a study on reverse logistics and competitive advantage with a focus on water bottling companies in Nairobi. She found that a strong relationship exists between reverse logistics and competitive advantage with the main reverse logistics practices done by water bottling companies being return of defective products, screening, refurbishing, reuse and recycling and remanufacture. The study also revealed maintaining good relationships with stakeholders was important in ensuring a smooth flow or reverse logistics activities. The study however, focused on competitive advantage and did not deal with operational performance.

Wainaina (2014) conducted a study on reverse logistics practices and profitability among large scale manufacturing firms in Nairobi. He concluded that the level of adoption of reverse logistics among large scale firms in Nairobi was low due to the lack of awareness or knowledge on the reverse logistics. He also found that most manufacturing firms use landfills to dispose materials though they did not tap into the large amounts of energy released from landfill gases. The study mainly focused on the adoption of reverse logistics practices and their relationship with profitability and not their effect on operational performance.

Kiberenge (2014) did a study on the adoption of reverse logistics in information and communications technology firms in Kenya. He found that many of the operators in the ICT sector have adopted reverse logistics to appreciable levels due to its significance for their operations. He discovered the main barriers to effective adoption of reverse logistics practices were inadequate financial resources, inadequate human capital, poor collaboration between supply chain partners, poor IT infrastructure and company size. He also mentioned the main drivers of reverse logistics as government support, resource allocation, quality of returned products and performance measurement of reverse logistics. Kiberenge's study did not touch on aspects of operational performance.

Kabergey and Richu (2015) investigated the effect of reverse logistics on operational performance of sisal processing firms in Nakuru County. They found that product reuse has statistically significant positive effect on operational performance of sisal processing firms, due to reused products being more affordable than newly produced materials thereby creating cost-advantage to the organization. Secondly, product reuse minimizes time it takes to acquire materials thereby enhancing efficiency in the processing operations. However, their study only focused on two reverse logistics practices which were reuse and product recovery.

Muttimos (2014) conducted a similar study to Wainaina (2014) though his study did not only focus on profitability but the link between reverse logistics and organizational performance as a whole. In his study, he actually found that the level of adoption of reverse logistics in manufacturing firms in Kenya was of more appreciable levels. His findings also revealed that recycling and reuse has a negative effect on organizational performance while remanufacturing improved the quality of the organizational performance. Like the others, his study did not address operational performance.

2.5 Summary and Knowledge Gap

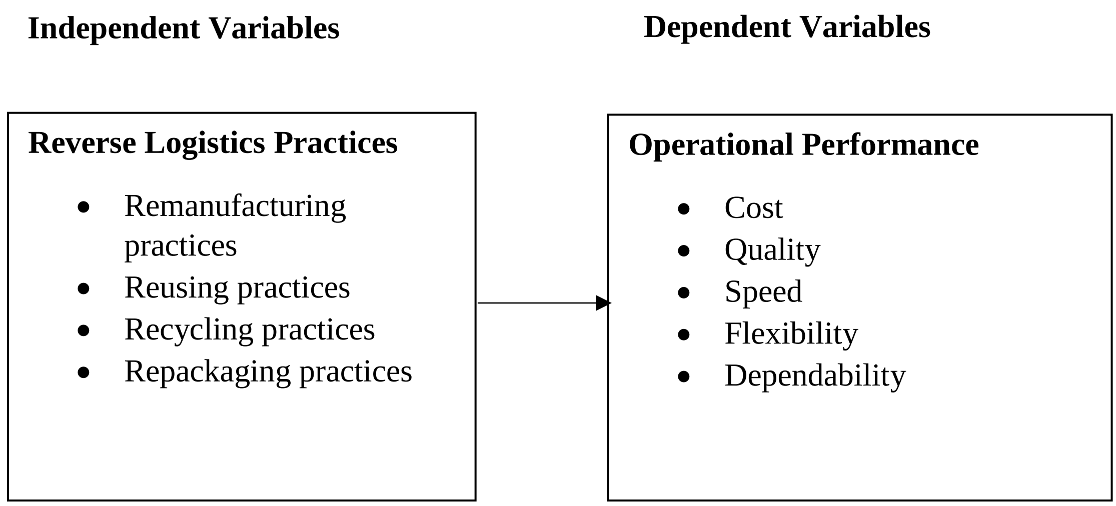
Most studies have been carried out abroad such as the study conducted by Weeks et al., (2010) which was done in the U.S. and Sriyogi (2014) and Agrawal and Chowdhary (2014) which were done in India. Little research has been done in developing countries. The closest research to this study was conducted by Sriyogi (2014) who looked at the performance indicators affecting reverse logistics among liquefied gas petroleum agencies in India.

Locally, studies by Ongombe (2012), Wainaina (2014), Kiberenge (2014) and Muttimos (2014) focused on profitability or aspects of organizational performance and not operational performance. While Kabergey and Richu (2015) brought out the link between reverse logistics and operational performance, they only studied product reuse and recovery among the reverse logistics practices. None of the local studies have focused on the liquefied petroleum gas companies in Kenya. Majority studied manufacturing firms. From the empirical review, it can be noted that most studies on reverse logistics in Kenya occurred between the years 2012 to current showing that the level of interest in reverse logistics has only increased recently.

2.6 Conceptual Framework

The study intended to find out the effect of reverse logistics on operational performance of liquefied petroleum gas companies in Kenya. It was hypothesized that improvement in operational performance of liquid petroleum gas companies in Kenya is influenced by how effective reverse logistics practices are. The conceptual model is summarized in figure 2.1.

Figure 2.1: Conceptual Framework



Source: Author (2016)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research design. This is followed by the population of the study, operationalization of study variables, data collection procedures and data analysis methods.

3.2 Research Design

A descriptive cross-sectional survey was used for this study. A descriptive design answers the question "what is". It describes events under the study and the characteristics of the variables so that a researcher has a picture of the situation. According to Roberts and Burke (1989), a descriptive research is useful in observing a variable when little conceptual background has been developed on various facets of the variables. A cross-sectional study is one where the variables or events are studied at one point in time. It is suitable for describing variables and their distribution patterns at on a single occasion (Hulley, Cummings, Browner, Grady & Newman, 2007). A survey means collecting data about the characteristics, opinions or actions from large samples of the population (Pinsonneault & Kraemer, 1993).

A descriptive cross-sectional design is relatively easy to conduct and is inexpensive. Since it captures data at one specific point in time, there is no waiting for the outcome to occur. Furthermore, this research design has been found useful by other researchers who have studied reverse logistics such as Muttimos (2014) and Odhiambo (2014).

3.3 Population of the Study

The population of the study comprises of all liquefied petroleum gas companies in Kenya. As per the list circulated by Energy Regulatory Commission (2016), there are

34 licensed brand owners. A census of all the 34 LPG companies was done because this population is small.

3.4 Operationalization of Study Variables

This study sought to find out the effect of reverse logistics on operational performance therefore, the dependent variable was operational performance while the independent variables were the reverse logistics practices. Table 3.1 shows the operationalization of the reverse logistics practices and table 3.2 shows the operationalization of operational performance.

Table 3.1: Independent Variables

Variable	**Sub-constructs**	**Indicators**
Reverse Logistics Practices	Remanufacturing	• Employees are trained on the importance of remanufacturing. • Existence of a documented and communicated remanufacturing policy. • Firm remanufactures returned cylinders through repairs, refurbishing or replacement of parts. • Existence of a warehouse for storage of cylinders that can be remanufactured.
	Reusing	• Cylinders are reused and sent back to the market. • Employees are trained on reuse as an environmental management strategy. • Firm encourages customers and distributors to reuse cylinders.
	Recycling	• Firm returns used cylinders to supplier for recycling. • Existence of a documented and communicated recycling policy.

		• Employees are trained on recycling as a waste management strategy.
	Repackaging	• Firm receives returned cylinders for repackaging. • Returned cylinders are repackaged and distributed back to the customers. • Existence of a documented and communicated repackaging policy.

Source: Author (2016)

Table 3.2: Dependent Variables

Variable	**Sub-constructs**	**Indicators**
Operational Performance	Cost	• Reduced costs in purchasing. • Reduced cost in manufacturing. • Reduced costs of inventory. • Reduced transportation costs. • Reduced costs in waste management. • Improved productivity.
	Quality	• Quality of cylinders and services offered to customers. • Quality of processes. • Number of returned cylinders. • Number of customer complaints. • Record accuracy. • Scrap rate.
	Speed	• Delivery speed of cylinders. • Customer issues resolved in time. • Process completed in time.
	Flexibility	• Ability to change cylinders depending on the customer's needs.

		• Ability of the firm to vary delivery time to demand. • Ability to increase production should there be an increase in demand. • Ability to offer different cylinder sizes.
	Dependability	• Dependability of equipment and machines. • Product reliability. • Dependability of information gathered from reverse logistics flow.

Source: Author (2016)

3.5 Data Collection

Data was obtained from primary sources. A self-administered questionnaire was used to obtain primary data and provide clarifications where necessary. The questionnaire was administered through a drop-and-pick-later method as well as through emails.

The questionnaire was divided into three sections. The first section sought the general information. The second section sought to establish the reverse logistics practices adopted by the firms. The third section contained questions aimed at finding out the effect of reverse logistics on operational performance of the liquefied petroleum gas companies. The target respondents were the supply chain managers. In the event that the supply chain managers were absent, operations managers were given the questionnaires.

3.6 Data Analysis

The data collected from respondents was checked for accuracy, completeness and consistency before being edited, tabulated, coded, and processed for easy understanding and interpretation. With the help of Statistical Package for Social Sciences (SPSS), data to achieve the first objective was analysed using descriptive statistics. The frequency, percentage, mean and standard deviation were obtained. Frequency and percentage were used to analyse the background information of the firms while mean and standard deviations were used to analyse the reverse logistics practices adopted. To achieve the second objective which was to establish the effect of adoption of reverse logistics practices on operational performance among liquefied petroleum gas companies in Kenya, a multiple regression model was used in analysing the data. The regression model used follows:

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$

Where:

Y = operational performance

β_0 = the intercept of the model

X_1 = extent to which remanufacturing practices are adopted by the firm

X_2 = extent to which reusing practices are adopted by the firm

X_3 = extent to which recycling practices are adopted by the firm

X_4 = extent to which repackaging practices are adopted by the firm

ε = Error term

β_1, β_2, β_3 = coefficients of the model

Before the regression model was generated, two tests were carried out to find out its applicability. The first test was to determine multicollinearity through the variation inflation factors (VIFs). The second test looked at autocorrelation which was determined using the Durbin-Watson test. Afterwards, a number of tests were carried out during the analysis. A test of the significance of the correlation coefficient was done to analyse the relationship between reverse logistics and operational performance. The R-squared was used as a measure of fitness and the f-test was used as a measure of the overall equation.

CHAPTER FOUR: DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents an analysis of data collected and discusses the study findings obtained from the primary data that was collected from respondents. All the filled questionnaires were cross-checked to ensure accuracy, consistency and completeness.

4.2 Demographic Information of the Respondents

The study targeted 34 LPG companies out of which 30 responded. This represented 88.24% response which was considered a satisfactory representation of the whole population. A summary of the findings on the demographic information of the respondents are presented and interpreted in Table 4.1.

Table 4.1: Demographic Information of the Respondents

Demographic Information	Frequency	Percentage
Number of years the firm has been in operation		
1-4 years	6	20.0
4-8 years	7	23.3
8-12 years	4	13.3
12-16 years	3	10.0
16 years and above	10	33.3
Total	**30**	**100.0**
Size of the staff in the company (full-time employees)		
0-49 employees	3	10.0
50-99 employees	9	30.0
100-149 employees	5	16.7
150-199 employees	6	20.0
200 employees and above	7	23.3
Total	**30**	**100.0**
Length of time the respondent worked for the company		
1-4 years	15	50.0
4-8 years	8	26.7
8-12 years	5	16.7
12-16 years	2	6.7
16 years and above	0	0
Total	**30**	**100.0**
Respondents' highest academic level		

Secondary school	1	3.3
Certificate	0	0
Diploma	9	30.0
Bachelors degree	16	53.3
Masters degree	4	13.3
Ph.D. degree	0	0
Total	**30**	**100.0**
Existence of the respondents' professional qualifications		
Yes	6	20.0
No	24	80.0
Total	**30**	**100.0**
Type of respondents' professional qualifications		
CIPS	3	10.0
CPA	3	10.0
None	24	80.0
Total	**30**	**100.0**

Source: Research Data (2016)

From the findings in Table 4.1, it can be observed that LPG companies had been in operation for 16 years and above (33.3%). 23.3% of the respondents stated their company had been in existence between 4 to 8 years, followed by 20% who stated their company had been in operation between 1 to 4 years then 13.3% who stated their company had been operating for a period of 8 to 12 years and lastly, 10% of the companies had been in business for a period of 12 to 16 years. This means that majority of the firms had been operating for periods long enough to have made an attempt at the adoption of reverse logistics practices.

The findings it Table 4.1 also show that 30% of the LPG firms had 50 to 99 full-time employees, 23.3% had 200 full-time employees and above, 20% had 150 to 199 full-time employees followed by 16.7% who had 100 to 149 full-time employees and lastly, 10% of the LPG firms had 0 to 49 full-time employees. This shows that almost all the firms have a sufficient number of employees to facilitate the adoption of reverse logistics.

From Table 4.1, 50% of the respondents had worked for the LPG company for a period of 1 to 4 years, 26.7% had worked for 4 to 8 years, 16.7% had worked for 8 to 12 years and 6.7% had worked for 12 to 16 years. None of the respondents had worked for the company for a period of 16 years and above. Based on the findings, majority of the respondents had worked for a period of time long enough to have knowledge and experience on reverse logistics.

53.3% of the respondents had a bachelors degree as their highest academic level, 30% had a diploma, 13.3% had a masters degree and 3.3% had only completed high school education as shown on Table 4.1. None of the respondents had a Ph.D. degree or a certificate as their highest academic level. This means that most of the respondents had knowledge on reverse logistics.

20% of the respondents had a professional qualifications while 80% did not have professional qualifications. This shows that most of the respondents don’t have professional qualifications that would have further contributed to their knowledge and skills in reverse logistics.

Out of the 20% of the respondents who had professional qualifications, 10% had CIPS (Chartered Institute of Purchasing and Supply) qualifications and 10% had CPA (Certified Public Accountant) qualifications. The remaining 80% did not have any professional qualifications. This could be attributed to majority of the respondents being in the field of engineering whereby engineering professional qualifications are not quite common in the Kenyan context.

4.3 Extent of Adoption of Reverse Logistics Practices

The study sought to determine the extent of adoption of reverse logistics practices by the LPG companies in Kenya using a 5-point Likert scale. Respondents were asked to rate the extent of adoption of reverse logistics practices on a scale of 1 to 5 where 1 meant ‘no extent at all’, 2 meant ‘small extent’, 3 meant ‘moderate extent’, 4 meant ‘great extent’ and 5 meant ‘very great extent’. The following subsections discuss the results.

4.3.1 Remanufacturing Practices

The study assessed the extent of adoption of remanufacturing practices by LPG companies in Kenya. The findings are indicated in Table 4.2.

Table 4.2: Extent of Adoption of Remanufacturing Practices

Indicator	Mean	Std. Deviation	Rank
Employees are trained on the importance of remanufacturing	3.8333	0.74664	4
Existence of a documented and communicated remanufacturing policy	4.1667	0.74664	3
Firm remanufactures returned cylinders through repairs, refurbishing or replacement of parts	4.4000	0.72397	2
Existence of a warehouse for storage of cylinders that can be remanufactured	4.6333	0.49013	1
Grand Mean	**4.2583**	**0.67685**	

Source: Research Data (2016)

From Table 4.2, the results reveal that remanufacturing is a prominent reverse logistics practice as shown by its grand mean of 4.2583. The indicator “existence of a warehouse for storage of cylinders that can be remanufactured” was rated highest with a mean of 4.6333. This was followed by the indicator “firm remanufactures returned cylinders through repairs, refurbishing or replacement of parts” with a mean of 4.4000 then “existence of a documented and communicated remanufacturing policy” with a mean score of 4.1667. Lastly, employees being trained on the importance of remanufacturing ranked lowest (3.8333).

4.3.2 Reusing Practices

The study further determined the adoption of reusing practices among LPG companies in Kenya. The respondents were asked to rank the reusing practices they have adopted. The results of the findings are provided in Table 4.3.

Table 4.3: Extent of Adoption of Reusing Practices

Indicator	Mean	Std. Deviation	Rank
Cylinders are reused and sent back to the market	4.6333	0.55605	2
Employees are trained on reuse as an environmental management strategy	4.4333	0.62606	3
Firm encourages customers and distributors to reuse cylinders	4.7333	0.44978	1
Grand Mean	**4.5999**	**0.54396**	

Source: Research Data (2016)

Table 4.3 shows that the extent of adoption of reusing practices is to appreciable levels as indicated by its grand mean of 4.5999. The indicator "firm encourages customers and distributors to reuse cylinders" ranked highest with a mean score of 4.7333. This was followed by cylinders being reused and sent back to the market as represented by a mean score of 4.6333 and lastly, employees being trained on reuse as an environmental management strategy (4.4333).

4.3.3 Recycling Practices

The study determined the extent of adoption of recycling practices by LPG companies in Kenya. Table 4.4 shows a ranking of the extent of adoption of recycling practices as provided by the respondents.

Table 4.4 Extent of Adoption of Recycling Practices

Indicator	Mean	Std. Deviation	Rank
Firm returns used cylinders to supplier for recycling	4.5667	0.67891	1
Existence of a documented and communicated recycling policy	4.1000	0.80301	2
Employees are trained on recycling as a waste management strategy	3.8000	0.92476	3
Grand Mean	**4.1556**	**0.80223**	

Source: Research Data (2016)

From the findings in Table 4.4, recycling is a prominent reverse logistics practices as indicated by its grand mean of 4.1556. Respondents indicated that the LPG firms return used cylinders to supplier for recycling as shown by the mean score of 4.5667. This ranked as the highest indicator. This was followed by firms documenting and communicated recycling policy as shown by its mean score of 4.1000. Indicator "employees are also trained on recycling as a waste management strategy" ranked last as shown by a mean of 3.8000.

4.3.4 Repackaging Practices

The study also reviewed the extent of adoption of repackaging practices by the LPG firms in Kenya. Table 4.5 shows the findings based on the responses provided by the respondents.

Table 4.5 Extent of Adoption of Repackaging Practices

Indicator	Mean	Std. Deviation	Rank
Firm receives returned cylinders for repackaging	4.8667	0.34575	1
Returned cylinders are repackaged and distributed back to the customers	4.8333	0.37905	2
Existence of a documented and communicated repackaging policy	4.3000	0.74971	3
Grand Mean	**4.6667**	**0.49150**	

Source: Research Data (2016)

According to the findings in Table 4.5, the extent of adoption of repackaging practices is to appreciable levels as indicated by its weighted mean of 4.6667. The respondents ranked indicator "firms receive returned cylinders for repackaging" highest as shown by its mean score of 4.8667. This was followed by returned cylinders being repackaged and distributed back to the customers as shown by a mean score of 4.8333. The indicator "existence of a documented and communicated repackaging policy" ranked lowest with a mean of 4.3000.

4.3.5 Extent of Adoption of Reverse Logistics Practices

The study also assessed the extent of adoption of each of the reverse logistics practices. Table 4.6 shows a ranking of remanufacturing, reusing, recycling and repackaging practices based on the findings.

Table 4.6 Extent of Adoption of Reverse Logistics Practices

Reverse Logistics Practices	Mean	Std. Deviation	Rank
Remanufacturing	4.2583	0.67685	3
Reusing	4.5999	0.54396	2
Recycling	4.1556	0.80223	4
Repackaging	4.6667	0.49150	1
Grand Mean	**4.4201**	**0.62863**	

Source: Research Data (2016)

From Table 4.6, it can be observed that reverse logistics practices have been adopted to appreciable levels as shown by its mean of 4.4201. Repackaging ranked as the most adopted reverse logistics practice by LPG firms in Kenya (4.6667). The second most adopted reverse logistics practice is reusing with a mean score of 4.5999, followed by remanufacturing (4.2583) and lastly, recycling (4.1556) in descending order. Given that cylinders can last for a long period of time (between 5 to 8 years), repackaging and reusing reverse logistics practices ranked first and second respectively. Recycling ranked last because for a cylinder to be scrapped off and sent to a recycling company, it must have a damage rate of 50% or above.

4.4 Reverse Logistics Practices and Operational Performance

The relationship between the adoption of reverse logistics practices by LPG companies in Kenya and operational performance was analyzed using a multiple regression model. Given that operational performance was measured in terms of cost, quality, speed, flexibility and dependability, each of these components were labelled as Y_1, Y_2, Y_3, Y_4 and Y_5 respectively. They were then regressed against the independent variables which were labelled as X_1, X_2, X_3 and X_4 where X_1 meant remanufacturing practices, X_2 meant reusing practices, X_3 meant recycling practices and X_4 meant repackaging practices. Table 4.7 shows the data collected from the respondents.

Table 4.7: Average Responses for the Relationship between Reverse Logistics and Operational Performance

Respondents	Y_1	Y_2	Y_3	Y_4	Y_5	X_1	X_2	X_3	X_4
1	4	3.67	4.67	4	3.33	4.75	5	4	5
2	4	3.5	4	3.75	4	5	4.33	4	5
3	5	4.67	4	4	4	4.75	4	5	5
4	4.5	4.5	3.67	3.75	3.67	4.5	5	4.67	5
5	4.33	4.67	4.67	4	4	5	4.67	4.33	4.67
6	4.17	4	4.33	3.5	4	4.5	5	4.33	4.33
7	4.83	3.83	4.33	3.25	3.33	4.25	5	1.67	5
8	3.17	3.83	4	4	4	3.25	4	3.33	4
9	4	3.67	4.67	3.5	4	4.25	5	4.33	4.67
10	4.5	4.33	4	3	3.67	3.5	4.33	5	4.67
11	5	4.83	5	3.75	5	4	4.67	5	5
12	4.33	4	4.33	4	4	4.25	4.33	4	4.67
13	4.17	4	4.33	4	4	4.25	4.33	4	5
14	3.67	3.67	4	4.25	4	3.5	4.67	4.33	4.33

15	4	4	4.33	4	4.33	4.25	4.33	4	5
16	4.33	4.17	3.67	2.75	3.33	4.25	5	4.33	5
17	4.33	4.33	4.33	4.25	4	3.5	5	5	4.33
18	3.83	3.67	3	3.75	3.67	4.75	5	3.67	5
19	3.5	4	4.67	4.5	3.67	4	4.33	4.33	4.67
20	4.33	4	4.67	4.25	4	4.25	4.67	4.33	4.67
21	3.5	4.17	3.33	3.75	3.33	4.5	4.33	4	4.33
22	4.17	4.33	4	3.75	3.67	4.25	4.33	4	4.67
23	3.5	3.83	3.67	3.75	3.33	4	5	3.33	4.33
24	3.83	3.67	3.67	4	3.33	4.25	4.33	4	4.67
25	4.17	3.5	3.33	5	3	4.25	4.67	4	4
26	4	4	4	4.25	4.33	4.5	4	4	4.67
27	4.17	4.33	4	4	4	4.25	4	5	4.67
28	3.33	3.67	3	4	3.33	4	4.67	4	4.67
29	3.33	3.5	4	4	3.33	4.25	5	4.33	4.33
30	4.5	3.67	4.33	4.75	5	4.75	5	4.33	4.67

Source: Research Data (2016)

4.4.1 Relationship between Reverse Logistics Practices and Cost

The multicollinearity test between revere logistics practices and cost are presented and interpreted in Table 4.8. The findings of the relationship between remanufacturing, reusing, recycling and repackaging practices with cost are revealed in Table 4.9.

Table 4.8: Multicollinearity Test between Reverse Logistics Practices and Cost

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Remanufacturing practices	.752	1.329
	Reusing practices	.966	1.036
	Recycling practices	.976	1.025
	Repackaging practices	.761	1.314

Source: Research Data (2016)

From Table 4.8, remanufacturing practices, reusing practices, recycling practices and repackaging practices have a VIF of 1.329, 1.036, 1.025 and 1.314 respectively. Since the VIFs are all less than 5 and the maximum acceptable value is 10, multicollinearity is not a problem in the regression model.

Table 4.9: Relationship between Reverse Logistics Practices and Cost

		Unstandard. Coeff.		Standard Coeff.							
	Model	B	Std. Error	Beta	t	Sig.	F	R	R^2	P (sig. from ANOVA	Durbin-Watson
Y_1	β_0	-.921	1.638		-.562	.579	3.070	.574	.329	.035	1.743
	X_1	.020	.208	.018	.097	.924					
	X_2	.120	.215	.093	.557	.583					
	X_3	.168	.121	.231	1.392	.176					
	X_4	.787	.292	.507	2.698	.012					

Source: Research Data (2016)

The model yielded the following equation:

$$Y_1 = -.921 + 0.020X_1 + 0.120X_2 + 0.168X_3 + 0.787X_4 \qquad P=0.035$$

The Durbin-Watson test in Table 4.9 shows a statistical value of 1.743. Since it is a two-tailed test at 5% level of significance with the number of independent variables (k) being 4 and the number of observations (n) being 30, the lower bound value (dL) obtained from the Durbin-Watson significance table is 1.143 and the upper bound value (dU) is 1.739. Since d (1.743) is greater than the dU (1.739), there is no autocorrelation in the relationship between reverse logistics practices and cost.

From Table 4.9, R = 0.574. In order to test the significance of the correlation coefficient, the t-test was used where:

H_0: r = 0 (the correlation coefficient is not significant)

H_1: r ≠ 0 (the correlation coefficient is significant)

This is a two-tailed test at 0.05 level of significance. The degree of freedom = n – 2= 30 – 2 = 28. From the t-distribution table, critical t = 2.048. The decision rule would therefore be to reject H_0 if computed t is either less than -2.048 or greater than +2.048.

Computed t = $r\sqrt{\frac{n-2}{1-r^2}} = 0.574\sqrt{\frac{30-2}{1-0.574^2}}$ = 3.709

Since computed t (3.709) is greater than critical t (2.048) the null hypothesis is rejected and it can be concluded that the relationship between reverse logistics practices and cost is significant.

The model was found to be generally significant given P=.035 which is less than 0.05. R^2 = 0.329 signifies that 32.9% of the variation in cost is accounted for by variation in reverse logistics practices. The model also shows that remanufacturing practices (X_1), reusing practices (X_2), recycling practices (X_3) and repackaging practices (X_4) are positively related to cost as shown by their coefficient values. Only repackaging practices are significantly related to cost with a p-value of 0.012 while the others are not since their P values are above 0.05. This implies that the model is not appropriate to predict cost because all the other parameters are not significant in explaining cost.

4.4.2 Relationship between Reverse Logistics Practices and Quality

The multicollinearity test between revere logistics practices and quality are presented and interpreted in Table 4.10. The findings of the relationship between remanufacturing, reusing, recycling and repackaging practices with quality are shown in Table 4.11.

Table 4.10: Multicollinearity Test between Reverse Logistics Practices and Quality

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Remanufacturing practices	.752	1.329
	Reusing practices	.966	1.036
	Recycling practices	.976	1.025
	Repackaging practices	.761	1.314

Source: Research Data (2016)

From Table 4.10, remanufacturing practices, reusing practices, recycling practices and repackaging practices have a VIF of 1.329, 1.036, 1.025 and 1.314 respectively. Similarly, the VIFs have a value of less than 5 hence there is no multicollinearity between reverse logistics practices and quality.

Table 4.11: Relationship between Reverse Logistics Practices and Quality

		Unstandard. Coeff.		Standard Coeff.							
	Model	B	Std. Error	Beta	T	Sig.	F	R	R^2	P (sig. from ANOVA	Durbin-Watson
Y_2	β_0	2.332	1.263		1.845	.077	3.356	.591	.349	.025	1.174
	X_1	-.120	.160	-.139	-.746	.463					
	X_2	-.173	.166	-.172	-1.045	.306					
	X_3	.253	.093	.444	2.719	.012					
	X_4	.412	.225	.339	1.833	.079					

Source: Research Data (2016)

The model yielded the following equation:

$Y_2 = 2.332 - 0.120X_1 - 0.173X_2 + 0.253X_3 + 0.412X_4$ P=0.025

Table 4.11 shows a Durbin-Watson statistical value of 1.174. It is a two-tailed test at 5% level of significance with the number of independent variables (k) being 4 and the number of observations (n) being 30. Given the lower bound value (dL) obtained from the Durbin-Watson significance table is 1.143 and the upper bound value (dU) is 1.739, d (1.174) lies between the two bounds. Therefore, the test is inconclusive.

From Table 4.11, R = 0.591. The significance of R was tested where:

H_0: r = 0 (the correlation coefficient is not significant)

H_1: r ≠ 0 (the correlation coefficient is significant)

This is a two-tailed test at 0.05 level of significance and the degree of freedom = n – 2= 30 – 2 = 28. From the t-distribution table, critical t = 2.048. The decision rule would therefore be to reject H_0 if computed t is either less than -2.048 or greater than +2.048.

Computed t = $r\sqrt{\frac{n-2}{1-r^2}} = 0.591\sqrt{\frac{30-2}{1-0.591^2}}$ = 3.877

Since computed t (3.877) is greater than critical t (2.048) the null hypothesis is rejected and it can be concluded that the relationship between reverse logistics practices and quality is significant.

The model was generally found to be significant since P=0.025 is less than 0.05 and R^2=0.349 indicated that 34.9% of the variation in quality can be explained by variation in reverse logistics practices. Recycling practices (X_3) and repackaging practices (X_4) are positively related to quality as shown by their coefficient values under column B while remanufacturing practices (X_1) and reusing practices (X_2) are negatively related to quality. The reasons could be that remanufacturing practices incite customers' perception of lower quality and reusing practices may lower the value of a product therefore, affecting quality. From the four reverse logistics practices, only recycling practices are significantly related to quality with a p-value of 0.012, the others being not significant since their p-values are above 0.05. It would thus not be appropriate to predict quality using this model because all the other parameters are not significant in explaining quality.

4.4.3 Relationship between Reverse Logistics Practices and Speed

The multicollinearity test between reverse logistics practices and speed is shown in Table 4.12. Regression model was used to analyze the relationship between reverse logistics practices and speed. The findings are revealed in Table 4.13.

Table 4.12: Multicollinearity Test between Reverse Logistics Practices and Speed

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Remanufacturing practices	.752	1.329
	Reusing practices	.966	1.036
	Recycling practices	.976	1.025
	Repackaging practices	.761	1.314

Source: Research Data (2016)

From Table 4.12, the reverse logistics practices have a VIF of 1.329 for remanufacturing practices, 1.036 for reusing practices, 1.025 for recycling practices and 1.314 for repackaging practices. All the VIF values are less than 5 and have not gone beyond the limit of 10 hence there is no multicollinearity.

Table 4.13: Relationship between Reverse Logistics Practices and Speed

	Model	Unstandard. Coeff.		Standard Coeff.	t	Sig.	F	R	R^2	P (sig. from ANOVA	Durbin-Watson
		B	Std. Error	Beta							
Y_3	β_0	1.824	2.027		.900	.377	0.565	.288	.083	.690	2.055
	X_1	-.152	.257	-.130	-.590	.560					
	X_2	.076	.266	.056	.287	.776					
	X_3	.129	.149	.167	.862	.397					
	X_4	.429	.361	.261	1.189	.245					

Source: Research Data (2016)

The model yielded the following equation:

$$Y_3=1.824 - 0.152X_1 + 0.076X_2 + 0.129X_3 + 0.429X_4 \qquad P=0.690$$

Table 4.13 indicates a Durbin-Watson statistical value of 2.055. It is a two-tailed test at 5% level of significance with the number of independent variables (k) being 4 and the number of observations (n) being 30. Since the lower bound value (dL) obtained from the Durbin-Watson significance table is 1.143 and the upper bound value (dU) is 1.739, d (2.055) is greater than dU (1.739). Therefore, there is not autocorrelation between reverse logistics practices and speed.

Table 4.13 also shows R = 0.288. The significance of R was tested where:

H_0: r = 0 (the correlation coefficient is not significant)

H_1: r ≠ 0 (the correlation coefficient is significant)

This is a two-tailed test at 0.05 level of significance and the degree of freedom = n – 2= 30 – 2 = 28. From the t-distribution table, critical t = 2.048. The decision rule would thus be to reject H_0 if computed t is either less than -2.048 or greater than +2.048.

Computed t = $r\sqrt{\frac{n-2}{1-r^2}} = 0.288\sqrt{\frac{30-2}{1-0.288^2}} = 1.591$

Since computed t (1.591) is greater than -2.048 but less than +2.048, the null hypothesis is accepted. Therefore, it can be concluded that the correlation coefficient in the relationship between reverse logistics practices and speed is insignificant.

With P being 0.690 which is greater than 0.05, the model was found to be generally insignificant. R^2=0.083 indicated that only 8.3% of the variation in speed can be explained by variation in reverse logistics practices. The model also shows that reusing practices (X_2), recycling practices (X_3) and repackaging practices (X_4) are positively related to speed. Remanufacturing practices (X_1) are negatively related to speed as indicated by their coefficient values under column B. The reason could be because remanufacturing of cylinders does not contribute much in speeding up processes. None of the reverse logistics practices are significantly related to speed given their p-values are all above 0.05. It would therefore, not be appropriate to predict speed using this model because all the parameters are not significant in explaining speed.

4.4.4 Relationship between Reverse Logistics Practices and Flexibility

The multicollinearity test between reverse logistics practices and flexibility is revealed in Table 4.14. The findings from the relationship between reverse logistics practices and flexibility are shown in Table 4.15.

Table 4.14: Multicollinearity Test between Reverse Logistics Practices and Flexibility

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Remanufacturing practices	.752	1.329
	Reusing practices	.966	1.036

Recycling practices	.976	1.025
Repackaging practices	.761	1.314

Source: Research Data (2016)

Table 4.14 shows the VIFs for remanufacturing practices, reusing practices, recycling practices and repackaging practices are 1.329, 1.036, 1.025 and 1.314 respectively. The VIFs have a value of less than 5 therefore no multicollinearity exists in the relationship between reverse logistics practices and flexibility.

Table 4.15: Relationship between Reverse Logistics Practices and Flexibility

	Model	Unstandard. Coeff.		Standard Coeff.			F	R	R^2	P (sig. from ANOVA	Durbin-Watson
		B	Std. Error	Beta	t	Sig.					
Y_4	β_0	6.796	1.645		4.131	.000	2.247	.514	.264	.093	1.760
	X_1	.253	.209	.334	1.690	.104					
	X_2	-.217	.216	-.176	-1.007	.324					
	X_3	.084	.121	.121	.695	.493					
	X_4	-.799	.293	-.537	-2.730	.011					

Source: Research Data (2016)

The model yielded the following equation:

$$Y_4=6.796 + 0.253X_1 - 0.217X_2 + 0.084X_3 - 0.799X_4 \qquad P=0.093$$

Table 4.15 shows a Durbin-Watson statistical value of 1.760. It is a two-tailed test at 5% level of significance with the number of independent variables (k) being 4 and the number of observations (n) being 30. The lower bound value (dL) obtained from the Durbin-Watson significance table is 1.143 and the upper bound value (dU) is 1.739. Since d (1.760) is greater than dU (1.739), there is not autocorrelation between reverse logistics practices and flexibility.

R from Table 4.15 is 0.514. The correlation coefficient was tested where:

H_0: r = 0 (the correlation coefficient is not significant)

H_1: r ≠ 0 (the correlation coefficient is significant)

This is a two-tailed test at 0.05 level of significance and the degree of freedom = n – 2= 30 – 2 = 28. From the t-distribution table, critical t = 2.048. The decision rule would thus be to reject H_0 if computed t is either less than -2.048 or greater than +2.048.

Computed t = $r\sqrt{\frac{n-2}{1-r^2}} = 0.514\sqrt{\frac{30-2}{1-0.514^2}} = 3.171$

Since computed t (3.171) is greater than +2.048, the null hypothesis is rejected. Therefore, it can be concluded that the relationship between reverse logistics practices and flexibility is actually significant even though P from Table 4.15 is 0.093 which is greater than 0.05.

R^2=0.264 shows that 26.4% of the variation in flexibility is accounted for by variation in reverse logistics practices. The model further shows that remanufacturing practices (X_1) and recycling practices (X_3) are positively related to flexibility as shown by their coefficient values. Reusing practices (X_2) and repackaging practices (X_4) are however, negatively related to flexibility. The reason could be that both reusing and repackaging practices do not allow flexibility of changing cylinder sizes to customized needs. All the cylinder sizes are dictated by the government in order to promote fair competition. From the results, only repackaging practices are significantly related to flexibility given a significance value of 0.011 which is less than 0.05. It would therefore, not be appropriate to predict overall flexibility using this model because all the other parameters are not significantly related to flexibility.

4.4.5 Relationship between Reverse Logistics Practices and Dependability

The multicollinearity test between revere logistics practices and dependability are presented in Table 4.16. The findings of the relationship between remanufacturing, reusing, recycling and repackaging practices with dependability are revealed in Table 4.17.

Table 4.16: Multicollinearity Test between Reverse Logistics Practices and Dependability

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Remanufacturing practices	.752	1.329
	Reusing practices	.966	1.036
	Recycling practices	.976	1.025
	Repackaging practices	.761	1.314

Source: Research Data (2016)

From Table 4.16, remanufacturing practices, reusing practices, recycling practices and repackaging practices have VIFs of 1.329, 1.036, 1.025 and 1.314. Since the VIF values are all less than 5, no multicollinearity exists in the relationship between reverse logistics practices and dependability.

Table 4.17: Relationship between Reverse Logistics Practices and Dependability

	Model	Unstandard. Coeff.		Standard Coeff.							
		B	Std. Error	Beta	t	Sig.	F	R	R^2	P (sig. from ANOVA	Durbin-Watson
Y_5	β_0	2.132	1.791		1.190	.245	1.490	.439	.193	.235	1.869
	X_1	-.037	.227	-.034	-.164	.871					
	X_2	-.177	.235	-.138	-.754	.458					
	X_3	.241	.132	.333	1.829	.079					
	X_4	.356	.319	.230	1.118	.274					

Source: Research Data (2016)

The model yielded the following equation:

Y_5=2.132 - 0.037X_1 - 0.177X_2 + 0.241X_3 + 0.356X_4 P=0.235

The Durbin-Watson test from Table 4.17 shows a statistical value of 1.869. Since it is a two-tailed test at 5% level of significance with the number of independent variables (k) being 4 and the number of observations (n) being 30, the lower bound value (dL) obtained from the Durbin-Watson significance table is 1.143 and the upper bound value (dU) is 1.739. From the results, d (1.869) is greater than dU (1.739) therefore, there is not autocorrelation between reverse logistics practices and dependability.

From Table 4.17, R = 0.439. The significance of correlation coefficient was tested where:

H_0: r = 0 (the correlation coefficient is not significant)

H_1: r $\neq$ 0 (the correlation coefficient is significant)

This is a two-tailed test at 0.05 level of significance and the degree of freedom = n – 2= 30 – 2 = 28. From the t-distribution table, critical t = 2.048 hence the decision rule would be to reject H_0 if computed t is either less than -2.048 or greater than +2.048.

Computed t = $r\sqrt{\frac{n-2}{1-r^2}}$ = $0.439\sqrt{\frac{30-2}{1-0.439^2}}$ = 2.585

Since computed t (2.585) is greater than +2.048, the null hypothesis is rejected. Therefore, it can be concluded that the relationship between reverse logistics practices and dependability is actually significant even though P from Table 4.17 is 0.235 which is greater than 0.05.

R^2=0.193 shows that 19.3% of the variation in dependability can be explained by variation in reverse logistics practices. Recycling practices (X_3) and repackaging practices (X_4) are positively related to dependability shown by their coefficient values while remanufacturing practices (X_1) and reusing practices (X_2) are negatively related to dependability. Remanufacturing practices (p=0.871), reusing practices (p=0.458), recycling practices (p=0.079) and repackaging practices (p=0.274) are not significantly related to dependability given their p-values have exceeded the significance level of 0.05. It would therefore, not be appropriate to use this model to predict dependability.

4.4.6 Relationship between Reverse Logistics Practices and Operational Performance

The multicollinearity test between revere logistics practices and operational performance as a whole are presented in Table 4.18. The findings of the relationship between reverse logistics practices and operational performance are revealed in Table 4.19.

Table 4.18: Multicollinearity Test between Reverse Logistics Practices and Operational Performance

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Remanufacturing practices	.752	1.329
	Reusing practices	.966	1.036
	Recycling practices	.976	1.025
	Repackaging practices	.761	1.314

Source: Research Data (2016)

Table 4.18 shows the VIF values of remanufacturing practices, reusing practices, recycling practices and repackaging practices as 1.329, 1.036, 1.025 and 1.314 respectively. Since the VIF values are all less than 5, no multicollinearity exists in the relationship between reverse logistics practices and operational performance

Table 4.19: Relationship between Reverse Logistics Practices and Operational Performance

	Model	Unstandard. Coeff.		Standard Coeff.							
		B	Std. Error	Beta	t	Sig.	F	R	R^2	P (sig. from ANOVA	Durbin-Watson
Y	β_0	2.432	1.049		2.319	.029	2.067	.498	.248	.115	2.127
	X_1	.013	.133	.019	.097	.924					
	X_2	-.074	.138	-.095	-.540	.594					
	X_3	.175	.077	.398	2.265	.032					
	X_4	.237	.187	.252	1.269	.216					

Source: Research Data (2016)

The model yielded the following equation:

$Y=2.432 - 0.013X_1 - 0.074X_2 + 0.175X_3 + 0.237X_4$ P=0.115

The Durbin-Watson test from Table 4.19 shows a statistical value of 2.127. It is a two-tailed test at 5% level of significance with the number of independent variables (k) being 4 and the number of observations (n) being 30. The lower bound value (dL) obtained from the Durbin-Watson significance table is 1.143 and the upper bound value (dU) is 1.739. Given d (2.127) is greater than dU (1.739), there is not autocorrelation between reverse logistics practices and operational performance.

From Table 4.19, R = 0.498. The significance of the overall correlation coefficient was tested where:

H_0: r = 0 (the correlation coefficient is not significant)

H_1: r ≠ 0 (the correlation coefficient is significant)

This is a two-tailed test at 0.05 level of significance and the degree of freedom = n – 2= 30 – 2 = 28. From the t-distribution table, critical t = 2.048 hence the decision rule would be to reject H_0 if computed t is either less than -2.048 or greater than +2.048.

Computed t = $r\sqrt{\frac{n-2}{1-r^2}} = 0.498\sqrt{\frac{30-2}{1-0.498^2}}$ = 3.039

Since computed t (3.039) is greater than +2.048, the null hypothesis is rejected. Therefore, it can be concluded that the relationship between reverse logistics practices and operational performance is significant even though P from Table 4.19 is 0.115 which is greater than 0.05.

R^2=0.248 shows that 24.8% of the variation in operational performance can be explained by variation in reverse logistics practices. Remanufacturing practices (X_1), recycling practices (X_3) and repackaging practices (X_4) are positively related to operational performance while reusing practices (X_2) are negatively related to operational performance as shown by their coefficient values. Reusing practices are negatively related to operational performance considering they were negatively related to quality, flexibility and dependability. Recycling practices (p=0.032) are significantly related to operational performance given the p-value is less than 0.05. However, remanufacturing practices (p=0.924), reusing practices (p=0.594) and repackaging practices (p=0.216) are not significantly related to operational performance since their p-values have exceeded the significance level of 0.05. It would therefore, not be appropriate to use this model to predict operational performance.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The purpose of the study was to determine the reverse logistics practices among liquefied petroleum gas companies in Kenya and to establish the effect of reverse logistics on operational performance of these companies. This chapter therefore, covers the summary of the findings, conclusion, recommendation and suggestions for further research.

5.2 Summary of the Findings

The topic of the study was divided into three sections on the questionnaire, the first being demographic information on respondents, the second being the reverse logistics practices adopted by the LPG companies in Kenya and lastly, the effect of reverse logistics on operational performance. A summary of the analysis conducted in chapter four is as follows:

5.2.1 Demographic Information

According to the findings, the questionnaire that were completed and delivered by respondents were 30 out of 34, representing a response rate of 88.24%. The respondents were supply chain managers in their respective LPG companies and in the event that the supply chain managers were absent, the operational managers dealing with LPG were given the questionnaire. It was observed that most LPG companies in Kenya have been in operation for periods long enough to adopt reverse logistics. Most respondents said their companies had been in operation for a period of 16 years and above (33.3%), followed by a period of 4 to 8 years (23.3%), then 1 to 4 years (20%) then 8 to 12 years (13.3%) and lastly, 12 to 16 years (10%). The findings also revealed that most LPG companies have 50 to 99 full-time employees (30%). 23.3% of the LPG firms have 200 full-time employees and above, followed by 150 to 199 full-time employees (20%), followed by 100 to 149 full-time employees (16.7%). Lastly, 10% of the LPG firms have 0 to 49 full-time employees.

While none of the respondents have worked for their LPG companies for a period of 16 years and above, all of them have worked for a period of 1 year and above, with 50% of the respondents having worked between 1 to 4 years. It is evident that majority of the respondents have worked for their companies long enough to have experience and knowledge on reverse logistics practices. In terms of the respondents' educational levels, 53.3% of the respondents have a bachelors degree as their highest academic level, indicating that majority of the respondents had sufficient knowledge on reverse logistics. 30% of the respondents have a diploma while 13.3% have a masters degree. Only 3.3% have their highest academic level as high school education. None of the respondents have a Ph.D. degree or a certificate as their highest academic level. 20% of the respondents have a professional qualifications out of which 10% had CIPS and 10% had CPA. 80% of the respondents did not have any professional qualifications.

5.2.2 Extent of Adoption of Reverse Logistics Practices

The results of the analysis revealed that there is a significant level of adoption of each of the reverse logistics practices considering the grand mean was 4.4201. Repackaging was the most adopted reverse logistics practices by LPG companies in Kenya, having a mean score of 4.6667. The second most adopted reverse logistics practice was found to be reusing (4.5999) followed by remanufacturing (4.2583) and then recycling (4.1556). For remanufacturing practices, it was discovered that existence of a warehouse for storage of cylinders to be remanufactured ranked as the highest indicator with a mean score of 4.6333. The lowest ranked indictor of remanufacturing practices was employees being trained on the importance of remanufacturing (3.8333).

The analysis further revealed that for reusing practices, the highest ranked indicator was firms encouraging customers and distributors to reuse gas cylinders (4.7333). Similarly, the lowest ranked indicator was employees being trained on reuse as an environmental management strategy (4.4333). For recycling practices, firm returning used cylinders to supplier for recycling was ranked as the highest indicator with a mean score of 4.5667 while employees being trained on recycling as a waste management strategy ranked as the lowest indicator (3.8000). The highest ranked indicator of repackaging practices was found to be firm receiving returned cylinders for repackaging with a mean score of 4.8667. Existence of a documented and communicated repackaging policy was ranked as the lowest indicator of repackaging practices (4.3000). The findings show that there is a need for top management to train employees on the importance of reverse logistics.

5.2.3 Relationship between Reverse Logistics Practices and Operational Performance of LPG companies in Kenya

Using a multiple regression model, the data obtained from the respondents was used to regress reverse logistics practices against each component of operational performance. The analysis on the relationship between reverse logistics and cost showed that the reverse logistics practices have an overall significant relationship with cost as an operational performance component (P=0.035). 32.9% of the variation in cost was explained by reverse logistics practices, the rest being explained by other factors. Out of all the four reverse logistics practices, remanufacturing was negatively related to cost. Reusing, recycling and repackaging were positively related to cost. While the model was generally found to be significant, only repackaging practices were significantly related to cost given a p-value of 0.012 while the others were not.

Further, the analysis revealed that there was a generally significant relationship between reverse logistics practices and quality (P=0.025). R^2 indicated that 34.9% of the variation in quality can be explained by variation in reverse logistics practices. Recycling practices and repackaging practices were found to be positively related to quality while remanufacturing and reusing were negatively related to quality. Out of all the four reverse logistics practices, only recycling practices were significantly related to quality with a p-value of 0.012. In establishing the relationship between reverse logistics practices and speed, the model used was generally found to be insignificant given P=0.690 which was greater than 0.05. R^2 revealed that only 8.3% of the variation in speed can be explained by variation in reverse logistics practices. Reusing practices, recycling practices and repackaging practices were found to be positively related to speed while remanufacturing practices were negatively related. All the reverse logistics practices had p-values greater than 0.05 therefore, none were significantly related to speed.

The study also showed that the overall relationship between reverse logistics practices and flexibility and dependability was statistically insignificant given P=0.093 for flexibility and P=0.235 for dependability. R^2=.264 revealed that 26.4% of the variation in flexibility can be explained by variation in reverse logistics practices. Remanufacturing practices and recycling practices were positively related to flexibility while reusing and repackaging were negatively related. Only repackaging practices were significantly related to flexibility given a p-value of 0.011. For dependability, R^2=0.193 showed that 19.3% of the variation in dependability can be explained by variation in reverse logistics practices, the rest resulting from other factors. Recycling practices and repackaging practices were found to be positively related to dependability. On the other hand, remanufacturing and reusing were negatively related to dependability. All the four reverse logistics practices had significance values of above 0.05 therefore they were not significantly related to dependability.

From the analysis, reverse logistics practices were also regressed against operational performance as a whole. R^2=0.248 indicated that 24.8% of the variation in operational performance can be explained by variation in reverse logistics practices. Remanufacturing practices (X_1), recycling practices (X_3) and repackaging practices (X_4) were found to be positively related to operational performance while reusing practices (X_2) were negatively related to operational performance. Recycling practices (p=0.032) were found to be significantly related to operational performance given the p-value is less than 0.05. However, remanufacturing practices, reusing practices and repackaging practices had p-values greater than 0.05 therefore, the model would not be appropriate to predict operational performance.

5.3 Conclusion

Out of all the four reverse logistics practices under the study, repackaging practices were the most adopted by LPG firms in Kenya, followed by reusing practices. This is because gas cylinders can last for a long period of time without suffering any damage thus promoting repackaging and reusing. Another possible reason for the prominent adoption was because repackaging and reusing results in cost savings far greater than from remanufacturing and recycling. The findings conform to that of Kabergey and Richu (2015) who found that product reuse results in reduced costs since reused products are cheaper to acquire than new materials. The researchers also found that product reuse minimized waste and the time it takes to acquire the materials.

Recycling ranked as the least adopted reverse logistics practices. This is because LPG companies do not actually conduct recycling directly but rather, they deliver scrapped cylinders to recycling companies. In addition, gas cylinders are only scrapped if they have a damage rate of 50% or above. Considering the durability of the gas cylinders, LPG companies are less likely to scrap them off hence resulting in low adoption of recycling practices. The findings are contrary to that of Muttimos (2014) who found that recycling was the most adopted reverse logistics practice among manufacturing firms in Kenya. It is likely that the types of reverse logistics adopted by a company depend on the industry in which the company exists.

Findings further revealed that there is an overall significant relationship between reverse logistics and operational performance of LPG companies in Kenya. While the P value (0.115) was found to be insignificant, an indication that the model would not be appropriate in predicting operational performance, a test of the significance of the correlation coefficient confirmed that there is actually a significant relationship between reverse logistics and operational performance. The test of the significance of the correlation coefficient further concluded that reverse logistics practices are significantly related to cost, quality, flexibility and dependability even though the P values of flexibility and dependability were found to be insignificant. This study is consistent with a study conducted by Kabergey and Richu (2015) who found that reverse logistics positively affects the operational performance of sisal processing firms in Nakuru County. The findings are also in agreement with a study conducted by Daugherty, Autry & Ellinger (2001) who found that reverse logistics ensures cost savings. Similarly, the findings conform to a study conducted by Koste and Malhotra (1999) who found that reverse logistics reduces uncertainty within the reverse flows therefore, improving flexibility of information distribution.

The results also revealed that reverse logistics practices were not significantly related to speed as shown by the P value and the test of the significance of the correlation coefficient. The reason could be because remanufacturing of cylinders does not contribute much in speeding up processes.

5.4 Recommendation

The study recommends that the top management should train employees on the importance of remanufacturing, reusing, recycling and repackaging practices. This would help increase awareness on reverse logistics practices and promote adoption. Similarly, the top management should formalize the adoption of reverse logistics through setting up policies and regulations and ensure they are well communicated to the employees. The management should also look at reverse logistics as a way of not only improving operational performance but also social, economic and environmental performance.

The study further recommends that LPG firms should consider joint reverse logistics. Through exploiting a partner's competencies and sharing capabilities, speed, dependability and quality would be improved. Information-sharing among the reverse supply chain partners would enhance flexibility and reduce uncertainty within the reverse flows. The strategic arrangement between the reverse logistics partners would also help lessen the burden of financial risk through risk sharing as well as boost competitive advantage.

5.5 Limitations of the Study

Two limitations were noted during the study. Firstly, the study looked at four reverse logistics practices. Further research on the other reverse logistics practices such as landfill, product returns and salvage would have been useful in examining the relationship between reverse logistics and operational performance. Secondly, the researcher faced time constraints. It would have been convenient if sufficient time had been allocated to the study.

5.6 Suggestions for Further Research

Future studies may consider investigating the drivers and challenges of reverse logistics in liquefied petroleum gas companies in Kenya. The results may be useful in understanding the drivers that influence the adoption of reverse logistics and highlighting the challenges that the liquefied petroleum gas companies face from the adoption.

In addition, a comparative study on the effect of reverse logistics on operational performance of companies in other sectors or countries is suggested as this study focused on liquefied petroleum gas companies in Kenya. The types of reverse logistics practices adopted by companies may depend on the sector and country.

Lastly, a study on the effect of culture on the adoption of reverse logistics may be undertaken. This would be useful in understanding the role of organizational culture in supporting the adoption of reverse logistics practices as well as the impact of culture on third-party reverse logistics as well as international reverse logistics.

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APPENDICES

Appendix I: List of LPG Companies in Kenya

	COMPANY NAME	CYLINDER BRAND
1	ALFA GAS LIMITED	ALFA GAS LIMITED
2	ASPAM ENERGY LIMITED	ASPAM ENERGY LIMITED
3	BOC KENYA LIMITED	HANDIGAS
4	CITY GAS LIMITED	CITY GAS
5	DEPAR LIMITED	GASKY
6	FOSSIL FUELS LIMITED	PETGAS
7	GALANA OIL KENYA LTD	DELGAS
8	GREEN ENERGY LIMITED	G-GAS
9	GREEN GAS CO. LIMITED	AMAAN GAS
10	HASHI ENERGY LIMITED	HASHI GAS
11	HASS PETROLEUM K. LIMITED	HASS GAS
12	HUNKAR TRADING CO. LIMITED	HUNKAR GAS
13	JAMII GAS LIMITED	JAMII GAS
14	KENOLKOBIL LIMITED	K-GAS
15	LAKE GAS LIMITED	LAKE GAS
16	LIBYA OIL KENYA LIMITED	MPISHIGAS
17	MEGTRACO LIMITED	KAPRI GAS
18	MIDLAND ENERGY LIMITED	MIDGAS
19	MOTO GAS COMPANY LIMITED	MOTOGAS
20	MULTI ENERGY LIMITED	MENGAS
21	NATIONAL OIL CORPORATION OF KENYA	SUPAGAS
22	OILCOM LIMITED	OILCOM
23	ORANGE ENERGY LIMITED	ORANGE GAS
24	ORYX ENERGY KENYA LIMITED	TRIGAS
25	SAFARI PETROLEUM LIMITED	SAFARI GAS
26	SAFE ENERGY LIMITED	COMPOSITE CYLINDER
27	SALAMA GAS LIMITED	SALAMA GAS

28	SOLUTION EAST AFRICA LIMITED	SEAGAS
29	SPAREMAN TRADING LIMITED	HOME GAS
30	TEX TRADING LIMITED	TEXGAS
31	TOSHA PETROLUEM K LTD	TOSHA GAS
32	TOTAL KENYA LIMITED	TOTAL GAS
33	TUANGAZE LIMITED	T-ENERGY
34	VIVO ENERGY K LIMITED	AFRIGAS

Source: Energy Regulatory Commission (2016).

Appendix II: Questionnaire

Declaration

This research intends to study the effect of reverse logistics on operational performance of liquefied petroleum gas companies in Kenya. The information obtained from this survey shall be treated as confidential used for academic purposes only.

SECTION A: GENERAL INFORMATION

1. What is the number of years your company has been in business?
   [1] 1-4 years [2] 4-8 years [3] 8-12 years [4] 12-16 years [5] 16 years and above
2. What is the size of the staff in your company (full-time employees)?
   [1] 0-49 employees [2] 50-99 employees [3] 100-149 employees [4] 150-199 [5] 200 employees and above
3. What is the length of time you have worked in your company?
   [1] 1-4 years [2] 4-8 years [3] 8-12 years [4] 12-16 years [5] 16 years and above
4. What is your highest academic level?
   [1] Secondary school [2] Certificate [3] Diploma [4] Bachelors degree
   [5] Masters degree [6] Ph.D. degree
5. Do you have any professional qualifications?
   [1] Yes [2] No
6. If "yes" to question 5. what is your professional qualification?...

SECTION B: REVERSE LOGISTICS PRACTICES

7. Indicate the extent to which your firm has implemented the following reverse logistics practices by ticking where appropriate. The scale stands for the following:
   [1] Not at all [2] Small extent [3] Moderate extent [4] Great extent [5] Very great extent

Reverse Logistics Practices	**1**	**2**	**3**	**4**	**5**
Remanufacturing					
Employees are trained on the importance of remanufacturing					
Existence of a documented and communicated remanufacturing policy					
Firm remanufactures returned cylinders through repairs, refurbishing or replacement of parts					

Existence of a warehouse for storage of cylinders that can be remanufactured					
Reusing					
Cylinders are reused and sent back to the market					
Employees are trained on reuse as an environmental management strategy					
Firm encourages customers and distributors to reuse cylinders					
Recycling					
Firm returns used cylinders to supplier for recycling					
Existence of a documented and communicated recycling policy					
Employees are trained on recycling as a waste management strategy					
Repackaging					
Firm receives returned cylinders for repackaging					
Returned cylinders are repackaged and distributed back to the customers					
Existence of a documented and communicated repackaging policy					

SECTION C: OPERATIONAL PERFORMANCE

8. Indicate to what extent your firm has experienced an improvement in the following operational performance measures as a result of adopting reverse logistics practices by ticking where appropriate.

[1] Not at all [2] Small extent [3] Moderate extent [4] Great extent [5] Very great extent

Operational Performance Measures	**1**	**2**	**3**	**4**	**5**
Cost					
Reduced costs in purchasing					
Reduced cost in manufacturing					
Reduced costs of inventory					
Reduced transportation costs					
Reduced costs in waste management					
Improved productivity					
Quality					
Quality of cylinders and services offered to customers					
Quality of processes					
Number of returned cylinders					
Number of customer complaints					
Record accuracy					
Reduced scrap rate					

Speed					
Delivery speed of cylinders					
Customer issues resolved in time					
Processes completed in time					
Flexibility					
Ability to change cylinders depending on the customer's needs					
Ability of the firm to vary delivery time to demand					
Ability to increase production should there be an increase in demand					
Ability to offer different cylinder sizes					
Dependability					
Dependability of equipment and machines					
Product reliability					
Dependability of information gathered from reverse logistics flow					

THANK YOU VERY MUCH FOR YOUR TIME