REVERSE LOGISTICS PRACTICES AND THE PERFORMANCE OF LARGE MANUFACTURING FIRMS IN KENYA

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Reverse Logistics Practices and the Performance of Large Manufacturing Firms in Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

This thesis is dedicated to my wife Catherine Waithera, my children Joan Wambui and Grace Njeri for giving me unconditional love and inspiration to accomplish my studies.

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ACRONYMS AND ABBREVIATIONS

B2B	Business to Business
BSC	Balanced Score Card
CEO	Chief Executive Officer
CSCM	Council of Supply Chain Management
CSCMP	Council of Supply Chain Management Professionals
EDI	Electronic Data Interchange
EMCA	Environmental Management Coordination Act
EOL	End of Life
EPR	Extended Producer Responsibility
ERL	Enterprise Resource Logistics
EU	European Union
GDP	Gross Domestic Product
GM	General Motors
HRM	Human Resource Management
ICT	Information Communication Technology
IOT	Internet of Things
IT	Information Technology
KAM	Kenya Association of Manufacturers

KIPPRA	Kenya Institute for Public Policy Research and Analysis
NEMA	National Environmental Management Agency
OEM	Original Equipment Manufacturers
PLC	Product Life Cycle
PPAD	Public Procurement and Assets Disposal Act,
PRM	Product Recovery Management
RBV	Resource Based View
RFID	Radio Frequency Identification
RL	Reverse Logistics
RoK	Republic of Kenya
RSCM	Reverse Supply Chain Management
RV	Relational View
SA	Strongly Agree
SCM	Supply Chain Management
SCOR	Supply Chain Operation Reference
SCP	Supply Chain Performance
SD	Strongly Disagree
SPSS	Statistical Package for Social Sciences
TCE	Transaction Cost Economics

USA United State of America

UVM Use Visibility Measures

VIF Variance Inflation Factor

DEFINITION OF OPERATIONAL TERMS

Disposition These are the activities that place product back into inventory or temporary storage through the process of: repackaging, repair, refurbishing or remanufacturing (Kariuki, Ngugi & Mburu, 2022)

End-of-Life Returns These are all items of no longer use to anyone, which need to be processed due to contractual or legislative take back obligations. These returns are often worn out and compulsory processed according to legislative prescriptions (Wang, Zhu, Krikke, & Hazen, 2020).

Firm Performance This is the financial or non-financial Indications that a firm is able to meet at least some interests of most or all its stakeholders (Rehman, Mohamed & Ayoup, 2019).

Information Technology Information technology (IT) is defined as a wide range of increasingly convergent and linked technologies that process the information as well as the information that business generates and use (Wirtz, 2021).

Inventory Management It is the process of consistently having the optimal number of raw materials for transformation and finished products available in order to deliver them rapidly to meet a customer's inventory requirement in a competitive manner (Ross, 2017).

Large Manufacturing Firms These are value-adding industries in Kenya that are registered members of Kenya Manufactures' Association (KAM) and are large in size compared to others in their specific sector (KAM, 2018).

Firm Resources These entails all the assets, capabilities, organizational processes, firm attributes, information, knowledge, personnel etc. that influence a firm's efficiency and effectiveness (Barney, Ketchen Jr, & Wright, 2021)

Logistics Grant, Lambert, Stock and Ellram (2019) define logistics as the management of the flow of goods, information or materials from one point of origin to point of consumption, and in some cases even to the point of disposal.

Manufacturing This is the production of merchandise for use or sale using labor and machines, tools, chemical and biological processing, or formulation. The term is most commonly applied to industrial production, in which raw materials are transformed into finished goods on a large scale (Wang, 2019).

Manufacturing Firms These are organizations which produce physical tangible components through processing raw materials, assembling products parts and repairing of manufactured products (KAM 2018).

Performance Refers to the extended supply chain activities in meeting end-customer requirements, including product availability, on-time delivery, and all the necessary inventory and capacity in the supply chain to deliver that performance in a responsive manner (Fernando, Chidambaram & Wahyuni-TD, 2018).

Performance Measurements These are Indicators employed to imply that a firm is achieving its objectives (Kaydos, 2020)

Product Return Product returns refer to all those returns that are initiated by a supply chain actor at any stage, after the product has been manufactured (Christopher, 2018).

Recycling Recycling refers to the process through which waste products and materials are converted into new products and resold to the consumer (Giri & Masanta, 2020).

Resource A resource is a specific asset under the custodian of a firm, which can be used to create a cost or differentiation advantage (Milimo, Sagwa & Sakwa, 2018).

Reverse Logistics This is the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal (Giri, Molla & Biswas, 2022).

Reverse Logistics Practice Reverse Logistics practice is a way/process/method which adds value to products produced by firms in a manufacturing process through managing product EOL (Jabbour & de Sousa, 2016).

Stakeholders These are parties whose interests are linked with the firms such as shareholders, employees, investors, suppliers, customers, government, communities and natural environment (Tsuma, 2021).

Supply Chain A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request (Nagurney, 2021).

Supply Chain Management This is the task of integrating organizational units along a Supply Chain (SC) and coordinating materials, information and financial flows in order to fulfil ultimate customer demands with the aim of improving competitiveness of the SC as a whole (Albrecht, 2021)

Supply Chain Performance This is the process of qualifying the efficiency and effectiveness of the supply chain in performing supply chain activities and adding value customer receives from the activities (Albrecht, 2021).

Sustainability A concept on use of natural resources to meet today's needs without compromising the ability of future generations to utilize the same (Hua *et al*., 2015).

Third Party Logistics A firm that provides multiple logistics services for use by customers. These services are integrated, or bundled together, by the provider. These are Freight forwarders, Courier companies and other companies integrating and offering subcontracted logistics and transportation services (Evangelista, Santoro & Thomas, 2018).

Waste Disposal Waste disposal methods, refers to all activities and actions required to manage waste from its inception to its final disposal point (Osmani & Villoria-Sáez, 2019).

ABSTRACT

In a world of scarce resources and disposal capacities, recovery of used products and materials is key to supporting a growing population at an increasing level of consumption. There are pressures on organizations to act responsibly in terms of the protection of the environment and create value for all stakeholders. There is a rising global interest in reverse logistics. It is therefore prudent to consider reverse logistics practices as a key competence in large manufacturing firms as has been realized by some developed economies. Kenya Vision 2030 identifies the manufacturing sector as one of the key drivers for realizing a sustained annual GDP. However, growth in manufacturing firms has created an emergence of problems such as; scarcity of resources, pollution, waste accumulation and environmental damage in recent years. Manufacturing waste is a resource that can be harnessed to create wealth, employment and reduce pollution of the environment. Manufacturing firms have the opportunity to increase their profit margins and minimize loss through efficiently handling returns via reverse logistics. In this connection, the study aims at examining reverse logistics practices and the performance of large manufacturing firms in Kenya. This research was anchored on theories relevant to specific objectives of the study which include: product disposition practice, recycling practice; reverse product flow practice, end-of-life management practice and the moderating effect of firm resources on the relationship between reverse logistics and large manufacturing firm's performance in Kenya. The study adopted the descriptive research design and used purposive sampling method to pick the sample. The target population was 240 firms, whereby 129 firms responded representing response rate of 89 percent. Primary data was collected using questionnaires which were dropped and picked later. Multiple linear regression model was used to show the hypothesized relationships between variables while content analysis was used to analyze qualitative data. Purposive sampling was used as it allowed the choice of subjects who are most advantageously placed to provide required information in relation to the study objectives. The data was quantitatively analyzed based on research objectives. The quantitative data was analyzed through descriptive statistics and inferential analysis by use of statistical package for social sciences (SPSS) software. Both correlation and regression analysis were done. The results for the effect of Reverse Logistics Practices and firm performance were assessed using Pearson correlation coefficient. The output indicated that Reverse Logistics practices had a strong positive relationship with firm performance ($r = .837$, $p < 0.05$). Upon introduction of the interaction term the regression model was significant for all the variables (F value=53.071, $p<0.05$) inferring that Firm Resources, significantly moderates the relationship between Reverse logistics Practices and the performance of large manufacturing firms in Kenya. On the basis of these statistics, the study concluded that there is significant positive relationship between all the specific Reverse Logistics Practices and firm performance. The study therefore recommended that manufacturing firms should introduce these practices in their operations and make use of them because of the benefits associated with them.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The study looked at the general background information of reverse logistics in supply chain management, Reverse logistics practices globally, regionally and locally. It also looked into the general concept of manufacturing firm performance and manufacturing firms in Kenya. This was followed with the problem statement, the general and specific objectives of the study, research hypotheses, justification, scope and limitations of the study. The study focused on examining the reverse logistics practices and the performance of large manufacturing firms in Kenya.

In the mid-1980s, an awareness of Supply Chain Management (SCM) began to develop as businesses recognized the important role of logistics as well as other activities and processes in serving customers. Supply Chain Management can be defined as the process of integrating organizational activities along a Supply Chain (SC) and coordinating materials, information and financial flows in order to fulfill the required customer demands with the aim of improving competitiveness of the supply chain as a whole (Albrecht, 2021). A forward supply chain can be viewed as the flow of product and materials from producers to end consumers via intermediaries like wholesalers and retailers. The reverse supply chain refers to the backward flow of products recovered from users. There are different definitions of reverse logistics with some researchers emphasizing the economic aspect of reverse logistics (Agrawal & Singh, 2020). Mutha and Pokharel (2019) argued that reverse logistics can be seen as a forward chain re-designed to manage the flow of products backwards from customers to manufacturing for refurbishment and reproduction. Morgan, Tokman Richey and Defee (2018) pointed out the environmental impact of returned products.

Reverse logistics is a notion that has been used to promote customer service and resource re cycling. Recycling and protecting the earth's resources are becoming more and more important due to the growing human population and diminishing resources. Reverse Logistics (RL) was not given much consideration in organizations until recently (Abdissa, Ayalew, Dunay & Illés, 2022). Reverse logistics is the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal (Sabioni, Daaboul & Duigou, 2020).

From a narrower view, RL refers to the movement of products or services back from their final destination to the point of origin aiming at recapturing value from them. Products may not necessarily be returned to the point of origin. From a broader view, RL extends to the handling of returned products due to, for example, production defectives (production related), product recalls, commercial returns, wrong deliveries (distribution related), etc. In recent years, reverse logistics has become a field of importance for all organizations due to growing environmental concerns, legislation, corporate social responsibility and sustainable competitiveness. Increasingly, customers expect companies to minimize the environmental impact of their products and processes. Moreover, legislation extending producers' responsibility has become an important element of public environmental policy.

1.1.1 Reverse Logistics Practices

Reverse logistics is becoming more and more popular worldwide. Through effective return management, manufacturing businesses can boost their profit margins and reduce losses. Many businesses are learning how to take advantage of secondary market opportunities to increase their returns while recovering some of their losses (Corvellec, Böhm, Stowell & Valenzuela, 2020). Organizations are under pressure to operate responsibly in terms of environmental preservation and provide value for all stakeholders (Epstein, & Buhovac, 2018). Global economy is another factor that makes reverse logistics a key improvement area for manufacturing firms that are expanding. The Ongoing global economic "volatility" as well as the growing global focus on sustainability are placing more pressure on logistics managers to establish a strategic alternative distribution network such as reverse logistics.

Reverse Logistics has been stretching out worldwide, involving all the layers of supply chains in various industry sectors. A study by Dias, Braga, Silva and Satolo (2019) found that overall customer returns are approximately 15 percent of sales for mass merchandisers and up to 35 percent for catalog and e-commerce retailers in the USA and other nations. The collection and reprocessing of returns require some investment of preparing RL systems infrastructure. Since the impact of RL is mostly not properly understood in many firms Bouzon (2019), most firms regard RL as a "necessary evil" rather than an opportunity for better supply chain performance.

Reverse logistics is fast becoming a strong focal point in the supply chain business within manufacturing firms in Africa. However African countries are a number of years behind their international counterparts with regard to the reverse logistics functions. This is because the international environmental laws have not been as strictly implemented in Africa as they have been internationally. The return as a process was recently added to the Supply Chain Operations Reference (SCOR) model, stressing its importance for supply chain management in the future (Roscoe, Eckstein, Blome & Goellner, 2020). As a result of the growth in manufacturing industries, environmental laws and the consumer awareness in their product rights African countries have no choice other than adopting reverse logistics as part of manufacturing process.

Kenya Vision 2030 identified the manufacturing sector as one of the key drivers for realizing a sustained annual GDP growth of 10 per cent (KAM 2015). The manufacturing sector has high, yet untapped potential to contribute to employment and GDP growth. In their study on evaluation of the use of RL on organizational profitability, Kazemi, Modak and Govindan (2019), found that there is a significant relationship between RL practices and profitability in Kenya manufacturing firms. One of the current Kenya government's Big Four Agenda is manufacturing because of it s potential on job creation. In Kenya, National Environmental Management Agency (NEMA) was established under the Environmental Management and Coordination Act (EMCA) No. 8 of 1999, as the principal instrument of government in the implementation of all policies relating to the environment. Legal disposal issues are a major concern for many organizations. The Kenyan government has a

Public Procurement and Assets Disposal (PPAD) Act, (2015) which aims at establishing procedures for procurement and the disposal of unserviceable, obsolete or surplus stores and equipment by public entities.

There are many reverse logistics practices which are likely to influence the manufacturing firm performance. Key among them include: disposition, recycling, reverse product flow, end-of-life management and green procurement. The study adopted the first four because of their direct attachment on manufacturing firms. However, proper implementation of these RL practices may be influenced by the level of firm resources. Different manufacturers adopt industry best practices in order to stay competitive. A company's capacity to appear successful depends partly on its ability to capture and put in use best practices from within and outside the company (Teece, 2018). Reverse logistics practices reduce the customer's risk when buying products, as well as increasing customer value (Adebayo, 2022).

Disposition options are often industry or product-specific and depend upon characteristics of the product such as price/value, cost to transport, shelf life of the product, and market demand patterns. A recycled product is wholly or partially constructed from materials that were initially something different. Recycling is a viable process in the reverse logistics and the most common. Effective reverse product flow management can provide additional means of positively impacting the firm's financial performance as well as building stronger relationships with key customers (Christopher, 2018). It's important to understand the total impact of return products. In Kenya, the government's current disposal mechanisms through procurement pose a challenge. Not all government institutions follow the required disposal procedures during procurement (Osmani & Villoria-Sáez, 2019). By adopting reverse logistics, proper waste management offers reduction of materials in the forward system in such a way that fewer materials flow back, reuse of materials is possible, and recycling is facilitated.

Reverse logistics presents economic and competitive opportunities for companies because it creates additional sales by offering refurbished products on the secondary market and reduce expenses by reusing some parts and components in the remanufacturing process. Reverse logistics activities such as remanufacturing represent a cost-effective strategy. In general, 70% of the cost to build something new is in the materials and 30% of it is in the labor; when remanufacturing, the material cost is only 40% (Saruchera & Asante-Darko, 2021). It is estimated that reverse logistics costs account for almost one percent of the total United States GDP. In addition, a recent survey of 125 product manufacturing firms estimated that 50-70 percent of companies' total potential revenue from the average product lifecycle is unserved. Therefore, reverse logistics should become an integral component of retailers' a nd manufacturers' profitability and competitive position.

Despite its strategic importance, research on RL practices and development remains limited (Christ & Burritt, 2019). Moreover, even though previous research has provided a strong foundation for developing RL and subsequent practices, examination of the contributions of RL practices on firm performance is scarce. Adebayo (2022) noted that there was lack of reverse logistics information and management systems in their empirical survey conducted to over 150 managers with reverse logistics responsibilities. Similarly, as reported in the study of Tripathi and Gupta (2019), most organizations recognize the importance of the product returns process, but only in a few cases do firms actually adopt specific practices to manage them in a better way. According to Christopher (2018), the best managerial resources should be focused on developing innovative ways to handle returns. In their study Ochieng (2019) found weakness along the supply chain managers, whereby a significant margin did not fully understand that logistics does not stop with the delivery of goods to customers, but also requires stocks to be returned to suppliers via a feedback loop.

1.1.2 Manufacturing Firm Performance

Manufacturing firm managers are not aware of opportunities which can arise from improving and measuring performance of reverse logistics. They start to recognise and understand the value of product returns only after implementing it. Ahi and Searcy (2017) stated that performance measurement is rated important by many companies, but had limited academic attention. It is therefore important to explore the relationships between reverse logistics as a competitive strategy and the overall firm performance. Companies can recover value from end-of-life products by reusing components, recycling materials or recovering energy through incineration (Jiang, Yi, Zhou & Zhu, 2019).

The perceived contribution of a supply chain member to firm Performance was measured using four constructs of efficiency, responsiveness, quality and supply chain cost. Efficiency is a measure of how well resources are utilized, and include logistic costs and profits (Rushton, Croucher & Baker, 2022). Logistic cost refers to the operating and opportunity cost items that can be influenced by logistic decisions and integration of management practices and activities throughout the supply chain. Profits refer to the net positive gains from investments or business undertaking. Responsiveness is a measure of speed/rate of providing the requested products. Responsiveness is measured in terms of lead time and customer complaints (Dora, 2016). Lead time is the total amount of time which elapses between sending/getting request and delivery/receiving of goods or services (Odongo, & Dora, 2016). Customer complaints are registered complaints from customers about products or services. Quality consists of product and process quality. Product quality consists of safety and attractiveness while process quality is measured by environmental friendliness.

1.1.3 Manufacturing Firms in Kenya

The manufacturing sector’s share of Gross Domestic Product (GDP) has remained stagnant with only limited increases in the last three decades, contributing an average of 10% from 1964-73 and rising marginally to 13.6% from 1990-2007 and averaging below 10% in recent years. Production in the manufacturing sector is predominantly geared towards consumer goods. Despite the static nature of the manufacturing sector with regards to its overall role in the economy, there have been significant shifts in the production levels of various manufacturing sub-sectors over the last ten years alone. Any analysis of the manufacturing sector's economic situation must take this into account. The sector is frequently homogenized as a single unit of examination, but to build a comprehensive understanding of its performance and function in the economy, the undercurrents of several sub-sectors must be explored (KAM, 2020). The manufacturing sector's share of GDP remained stagnant at less than 10%, and its contribution to wage employment was on the decline (RoK, 2016). According to Kenya Institute for Public Policy Research and Analysis (KIPPRA, 2016), the manufacturing sub-sector in Kenya constitutes 70% of the industrial sector’s contribution to GDP.

The manufacturing sector has high, yet untapped potential to contribute to employment and GDP growth compared to Agriculture. Manufacturing sector in Kenya is important and it makes a substantial contribution to the country’s economic development. It has the potential to generate foreign exchange earnings through exports and diversify the country’s economy. The competitive manufacturing environment is one that is rapidly changing as globalization and technology force organization’s to constantly seek ongoing improvement in all areas in terms of their knowledge, flexibility and performance (Muha, 2019). Kenya Vision 2030 identifies the manufacturing sector as one of the key drivers for realizing a sustained annual GDP growth (RoK, 2016). Manufacturing industries have the opportunity to increase their profit margins and minimize losses through efficiently handling returns via reverse logistics. Many companies are discovering that they can maximize secondary market opportunities to recoup some losses in their returns (Corvellec, Böhm, Stowell & Valenzuela, 2020).

1.2 Statement of the Problem

Historically, manufacturing sector's contribution to the economy and job creation in Kenya has stagnated at around 10% of the gross domestic product for the last five years. This problem has continued for the fifth year in a row dealing a blow to the government Big 4 Agenda whose aim was to increase the GDP contribution of the sector to 15% by 2022. Data published by the Kenya National Bureau of Statistics (KNBS) in 2021 shows the sector’s contribution to gross domestic product (GDP) stood at 7.6% in 2020 down from 7.9% in 2019. It stood at 8.4% 2018, 8.7% in 2017, and 9.3% in 2016. The drop in year 2020 coincided with a plunge in local factory activity as the coronavirus pandemic disrupted local and global supply chains.

Currently, Kenya is a lower-middle income economy. Figures from the World Bank (WB) show that the value added per worker in manufacturing firms has declined steadily since the 1970s, which points to challenges in manufacturing sector (WB, 2019).

The weak performance has been attributed by high production costs, scarce material resources and lack of sustainability (Barnett & Morse, 2017). Asset recovery through reverse logistics utilises disposition of returned goods, surplus, obsolete, scrap, waste and excess material products, and other assets, in a way that maximizes returns to the firm, while minimizing costs and liabilities associated with the dispositions. Reverse Logistics Practice is one way of bringing back resources to the firm but despite its relevance in manufacturing industries, research on this area is very limited (Ergüzel, Tunahan & Sinan, 2019). Reverse logistics has been considered as a major approach in promoting sustainability of the supply chain management through which manufacturing firm performance is enhanced as well as meeting the environment conditions of the modern-day World (UNEP, 2018).

There is therefore a great opportunity for researchers to advance the study of reverse logistics in order to fill this gap as was confirmed in the study by Gikonyo and Ngugi (2022). Most available research on reverse logistics implementation has focused on developed countries, with relatively little attention being paid to developing countries. Based on the current reverse logistics scenario and backed by lack of qualitative studies that focus on Kenya, this study is geared toward contributing to the reverse logistics literature by carrying out a research study whose aim is to examine reverse logistics practices and the performance of large manufacturing firms in Kenya.

1.3 Objectives of the Study

The study had both the general and specific objectives.

1.3.1 General Objective

The general objective for this research was to establish the relationship between reverse logistics practices and the performance of large manufacturing firms in Kenya.

1.3.2 Specific Objectives

The following were the specific objectives:

1. To establish how product disposition practice relates to the performance of large manufacturing firms in Kenya.
2. To determine the relationship between recycling practice and the performance of large manufacturing firms in Kenya.
3. To evaluate how reverse product flow practice influences the performance of large manufacturing firms in Kenya.
4. To examine the influence of End-of-Life management practice and the performance of large manufacturing firms in Kenya.
5. To find out the moderating effect of firm resources on the relationship between reverse logistics practice and the performance of large manufacturing firms in Kenya.

1.4 Study Hypotheses

The following hypotheses were tested:

1. **Ho:** There is no significant relationship between product disposition practice in reverse logistics and the performance of large manufacturing firms in Kenya.
2. **Ho:** There is no significant relationship between recycling practice in reverse logistics and the performance of large manufacturing firms in Kenya.
3. **Ho:** There is no significant influence between reverse product flow practice in reverse logistics and the performance of large manufacturing firms in Kenya.

4. Ho: There is no significant influence between End-of-Life management practice in reverse logistics and the performance of large manufacturing firms in Kenya.

5. Ho: There is no moderating effect of firm resources on the relationship between reverse logistics and the performance of large manufacturing firms in Kenya.

1.5. Significance of the Study

This section explains the significance of carrying out a study on reverse logistics practices and the performance of large manufacturing firms in Kenya. The study of reverse logistics in manufacturing firms and how it influences large manufacturing firm performance was considered relevant as it provides insights of significant importance to a myriad of stakeholders seeking understanding on ways of boosting profit, waste management and value addition.

1.5.1 Governments

To the government, the study will provide greater insight into the relationship between reverse logistics management and manufacturing firm performance in Kenya manufacturing industry. This may aid in formulation of policies and regulations that can help improve efficiency and effectiveness in the sector such as waste disposal. Improved manufacturing sector performance could increase national GDP and by extension increase job creation. In line with vision 2030 the study will help manufacturers in implementation of reverse logistics in order to boost their performance hence improve the economy and drive industrial growth and realization of 15% contribution of manufacturing sector to GDP by 2030.

1.5.2 Manufacturing Industry

Manufacturers need appropriate information on the best supply chain mix to respond to the ever-changing business and natural environment. According to KAM, various manufacturers face environmental related challenges, which constitute one of the areas this study aims to support. Manufacturing firms will gain from the study as they could better understand the underlying reverse logistics practices that can influence performance of their manufacturing firms. Hence, they may be better placed to deal with challenges that impede successful reverse logistics implementation. By so doing they will have a competitive edge and become compliant with environmental and legislative requirements.

1.5.3 Academicians

The study will benefit the academic fraternity as it will contribute to the existing body of literature on reverse logistics. It will provide a framework of Reverse logistics management dimensions which will be used as a test base for further research. The review may be useful for academicians, researchers and practitioners for better understanding of reverse logistics and guidance for future research. Findings of this study may also be useful to researchers and scholars in providing more insights on how effective reverse logistics practices can be implemented in Kenya manufacturing industries. This study may lay a theoretical framework for future empirical study on the contribution of reverse logistics on manufacturing firm performance. Other than being useful in terms of availing literature review, findings of this study may be of great importance to supply chain professionals in both the private and public sector as it adds to the body of knowledge on theory and practice of effective reverse logistics practices.

1.6 Scope of the Study

Large manufacturing companies registered with the Kenya Association of Manufacturers (KAM) served as the study's primary data source. However, the study concentrated on Nairobi and its surrounding areas, where the majority of large manufacturing is headquartered. Nairobi generates 60% of Kenya's GDP (KNBS, 2017). Therefore, a sample taken from this County is suitable for generalization. Moreover, Nairobi County in Kenya has the highest number of manufacturing businesses (KAM, 2017). This high concentration of firms, whether in direct or indirect competition, in a given locality makes them to be good research model. The information gathered can easily be adapted to other manufacturing firms. According to Kenya Association of Manufacturers Directory, (2016), there are 240 large manufacturing firms based within Nairobi County. The study embarked on manufacturers that have large business size because large organizations are more likely to have well-structured reverse logistics management than small ones. The respondents of the study will be procurement managers in the department of supply chain management in the selected manufacturing firms or production managers as they have the relevant knowledge related to supply chain processes.

1.7 Limitation of the study

The research had a number of limitations. Since the research used purposive sampling procedure where members of a sample are chosen with a purpose to represent a location or type in relation to the criterion, there was likelihood of bias in selecting the sample.

Secondly, the response of the respondents limited the study results particularly the freedom which respondents had in disclosing their opinions about reverse logistics practices in their firms thinking that they may be reprimanded by management of their firms. This made it hard to get information from some firms that were reluctant to participate in the research for fear that the information will be shared by government agencies despite being assured of the confidentiality.

The willingness to give information for secondary data from private owned manufacturing firms was a key challenge in primary data collection. However, the study was able to get the information from other sources for example industry magazine and government reports.

Thirdly, there was also lack of adequate current studies on reverse logistics practices in the manufacturing sector, especially in the developing countries and specifically in Kenya. The study mitigated this challenge by comparing similar research globally to try and infer the research findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Literature review is a critical look at the existing research that is related to the study (Creswell & Creswell, 2017). The review of literature sharpens and deepens the theoretical foundation of the research. Literature review provides a framework for relating new study to previous studies. The same author further argues that it is a means of demonstrating a researcher's knowledge about a particular field of study. Similarly, Bryman and Bell (2015) argued that literature review informs the influence the research study in the field. This chapter will review literature related to the area of study on reverse logistics practices and the performance of large manufacturing firms in Kenya. The areas covered include: theoretical review, conceptual framework, empirical review, critique of existing literature, research gaps and summary.

2.2 Theoretical Framework

Bryman and Bell (2015) looked at a theory as a set of systematic interrelated concepts, definitions and propositions that are advanced to explain and predict phenomena. Creswell and Creswell (2017), defines a theoretical framework as a collection of interrelated ideas based on theories. This section reviewed the theoretical framework on which the concept of reverse logistics practices and manufacturing firm performance are anchored on. Reverse logistics is based on many theories of which this study is supported by the following theories: Transaction Cost Economics, Network-level approach theory, The relational view theory, Institutional theory, and Resource Based View.

2.2.1 Transaction Cost Economics Theory

Transaction Cost Economics (TCE) was developed by Willamson (1975). It focuses on the role and effects of transaction costs on the economic behavior of individuals and organizations. The basic unit of analysis is the economic transaction: a transfer of a good or service from one party to another rather than the unit of analysis used in neoclassical theory of a price and output of a good, service or resource. According to Suematsu (2014), transaction costs are those related to acquiring and handling information about the quality of inputs, the relevant prices and the supplier's reputation.

Transaction cost economics determines the conditions under which a firm should manage an economic exchange internally within its boundary or externally through inter-organizational arrangements (Vanhaverbeke & Cloodt, 2014). It focuses on reducing the total transaction costs of producing and distributing a particular good or service. These costs consist of the costs for initiation, negotiation, execution, monitoring, and adjustment, which are determined by frequency, uncertainty, and asset specificity involved in the transactions. Lytvinenko, (2015) identified three types of asset specificity which include: site specificity (location), physical asset specificity (machines, equipment, and tools), human asset specificity (know-how, management skills).

This study used the TCE as a theoretical base for explaining the formation of inter-organizational collaboration in reverse logistics operations. The TCE can explain the strategic disposition decisions that a firm can adopt such as refurbishing, remanufacturing, reconditioning or repackaging for product take-back and recovery based on its assumptions and its key concepts of asset specificity, uncertainty, and transaction frequency (Abdulrahman *et al.*, 2019). The specificity of recovered components (recovered value used for new products) and the asset specificity of human resources and physical assets in reverse logistics process (investments in skilled labor, specialized equipment, and technology) are some of important criteria in selecting inter-organizational collaboration in reverse logistics operations. Due to the complexity of reverse logistics and high uncertainty environments, Afum *et al*. (2022) indicate that product recovery transactions such as refurbishing and remanufacturing are more efficient by having OEMs vertically integrate, or develop hybrids like consortia, alliances, or joint ventures to gain better access to information and mitigate hold-up risks.

2.2.2 Network-level Approach Theory

The rational self-interest school within network research can be traced back to the work of sociologist James Coleman (1988). Coleman showed how, from two-actor interactions, with each actor operating out of self-interest, emerges the basis for a social system (such as a small group). While each actor is trying to maximize his or her individual interests, each is at the same time constrained because he or she is embedded in an interdependent relationship with the other. Networks of enterprises allow relations to be established in all possible directions including horizontal, vertical, lateral and diagonal relations.

Sydow, Schüßler and Müller-Seitz (2015) postulate that an inter-organizational network at network level consists of multiple organizations linked through multilateral ties, which refer to a group of three or more organizations connecting in ways that facilitate achievement of a common goal. Firms are connected indirectly across their partners through multiple chains of alliances that together form the network as a whole. The analysis of network as a whole is more complex than blocks of network. Through indirect ties of inter-firm network, each additional node that a firm has access to can serve as an information-gathering device, information processing, or screening device for ensuring the quality of products and services, developing of new technologies, processes, and know-how (Parameswar & Dhir, 2018). The strength of ties can be measured by the frequency of interaction between partners and their level of resource commitments to the relationships (Redd & Wu, 2020).

This study used network-level approach to support the arguments of the adaptability to reverse logistics at network level because a reverse logistics system encompasses networks of providing logistics and processing services for collection, transport, sorting, and recovering products returned and discarded. Inter-organizational cooperation for the development of intra and inter-organizational product recovery and recycling has gained increased theoretical and practical importance over the last decade (Perna, & Baraldi, 2018). Therefore, the network-level approach may gain significant importance as a newly comprehensive approach to reverse supply chain management because the implementation of take-back and product recovery involves numerous multilateral ties operating in the system. The integration with suppliers for eco-design development, and the collaboration with service providers for dismantling, repair, remanufacturing and recycling are typical network relationships in an inter-organizational reverse logistics system (Pande & Adil, 2019). These network relationships are basically established to share information and knowledge to obtain a set of closely connected resources from their members for cost-effective reverse logistics operations.

2.2.3 The Relational View Theory

Dyer and Singh (1998) opined that the (dis)advantages of an individual firm are often linked to the (dis)advantage of the network of relationships in which the firm is embedded. The relational view postulates four potential sources of inter-organizational competitive advantages: relation-specific assets, knowledge sharing routines, complementary resources/capabilities, and effective governance. The relational view theory emphasizes the adaptability of firms in strategic alliances to get the competitive advantages. It postulates that alliances generate the benefits only if they move the relationships away from the attributes of market relationships such as, nonspecific asset investment, minimal information exchange, low level of interdependence of resources, and minimal investment in governance mechanism (Arora & Sivakumar, 2016).

Relation View Theory according to Ujwary-Gil (2017) focuses on the generation and development of inter-organizational resources and capabilities through alliance, which are particularly difficult to be replicated by rivals due to their uniqueness. Firms in inter-organizational collaboration may adapt and gain the competitive advantages quickly when potential alliance partners have necessary complementary resources and available relational capabilities (Bittencourt, Zen & Prévot, 2020). Firms therefore try to seek advantages by creating assets that are specialized in conjunction with the assets of an alliance partner.

This study used Relational View Theory as a theoretical base for explaining the formation of inter-organizational relationship and collaboration in reverse logistics reverse product flow process. Due to the complexity and uncertainty of Reverse Logistics, strategic alliance and cooperative agreements between companies taking part in the reverse logistics initiatives are required. This involves specific investments of assets and commitments of a business, organizational and relational nature (Ujwary-Gil, 2017). In reverse logistics management for customer returns (warranty returns, defect returns & recalls) and business to business (B2B) returns, many firms are able to utilize their existing resources and capabilities to develop new capabilities with their partners by combining the complementary resources (Arrieta, 2015).

Combining resources and developing capabilities for reverse logistics operations, are specific to members in RL networks and have the potential at least to provide competitive benefits such as lower costs for recovery and higher revenues from parts and material sales. Moreover, by collaborating and sharing information with retailers, OEMs in manufacturing industry can have better forecasting of returned products, especially for sales information, returns rates, and inventory level of slow-moving products (Hugos, 2018).

2.2.4 Institutional Theory

In their study Scott and Meyer (1994) mentioned how institutional environment influences firm outcomes by imposing constrains on firms' operations and demanding adaptation of firms' processes in order to survive. The institutional environment was defined by Burke, (2017), as an entity that lies outside the boundaries of the organization. Institutional theory is recognized through the pressures of social, cultural, political, and legal sector as main factors influencing the operation of organizations. Institutional theory is concerned with the influence of external forces on organizational decision-making and it emphasizes the role of social and cultural pressures imposed on organizations that influence practices and structures (Delmas & Toffel, 2003). Institutional theory implies that a strong motivating force behind firm behavior is socially based and proposes that an organization is bound to satisfy its social stakeholders (Vlachos, 2014). In particular, Kauppi, (2018) asserted that institutional theory emphasizes homogeneity and it argues that forces exist in the environment that would encourage convergent business practices. The term that best describes the homogeneity is called isomorphism, which is a constraining process forcing one unit in a population to resemble other units that face the same set of environmental conditions.

This study used institutional theory as a theoretical background of management insights to explain how external pressures on End-of-Life (waste) management promote reverse logistics management practices of firms in the manufacturing industry. The study used institutional theory to explain issues related to waste management. Institutional Theory may be regarded as the traditional approach used to examine elements of public procurement (Kauppi, 2018). Hall and Scott (2019) noted three pillars of institution as: regulatory, normative and cultural cognitive. The regulatory pillar puts more emphasis on the use of rules, laws and sanctions as enforcement mechanisms which must be complied with. Institutions are composed of cultural-cognitive and regulative elements that together with associated activities and resources end up giving life some meaning. The normative pillar refers to the norms (how things should be done) and values (the preferred and desirable) social obligation being the basis of compliance. Finally, cultural-cognitive pillar is based on shared understanding such as common belief, symbols and shared habits.

The Kenya Government has put in place a variety of policies, institutional and legislative frameworks to address the major causes of environmental degradation and negative impacts on ecosystems brought by industrial wastes and other economic development programs. Hence this theory can be used to link the legal and regulatory framework and its influence on reverse logistics practices. Researchers have increasingly used institutional theory to study how a company addresses green and environmental issues due to external pressures and it has become a major theoretical direction to explain the response of firms to environmental related practices, such as green logistics and reverse logistics (Zhu, Sarkis, & Lai, 2013). For example, government agencies with laws enforcement are an example of powerful institutions that may coercively affect the environmental awareness and the actions of organizations toward environmentally oriented reverse logistics management. Berrone et al., (2013) state that institutional environments affect a firm's adaptability behavior through its adjustments of company strategies, policies, and processes. Zhu, Sarkis and Lai (2013) also indicate institutional pressures factor into companies' decisions.

2.2.5 Resource Based Theory

The resource-based view describes how business owners build their businesses from the resources and capabilities that they currently possess or can acquire (Dollinger, 1999). It investigates the importance of internal resources in determining firm actions to create and maintain a competitive advantage and improve performance. However, only possessing such resources does not guarantee the development of competitive advantage or the creation of value (Albrecht, 2021). To obtain superior performance, firms must effectively manage, allocate, and exploit resources. Barney et al., (2014), reviewed the Resource-based View (RBV) as one of the most influential theories in strategic management. Firms that are able to correctly match resources to specific programs, events and to environmental opportunities are more likely to develop capabilities that result in better performance.

Firms compete based on their resources and capabilities, Cricelli, Greco and Grimaldi (2021). Distinctive capabilities of firms are critical resources of sustained competitive advantage and superior performance. The internal resources and capabilities provide the basic direction of a firm's strategy and are the primary sources for the improved profitability (Teece, 2018). Grant, (2016) argues that resources are only useful to a firm to increase value if the resources are used in a way that takes into account the dynamic external business environment. Many researchers also explore the relationship between resource and strategy, and their influence on business performance. They highlight the key role of strategic management in appropriately adapting, integrating, and reconfiguring company resources and strengths towards changing environments. Czinkota, Kaufmann and Basile (2018) argue that resource commitment covers the allocation of tangible and intangible entities that a firm has which enable it to produce efficiently and/or effectively. Resources may be inputs or factors available to a firm which assist to perform operations. Even though reverse logistics may be the most neglected activity in a firm, a well-designed RL program can unbundle these resources.

This study used the RBV and its extended approaches to explain how firms in the Kenya manufacturing industry can adapt reverse logistics practices by using their resources to improve their performance. Managing resources for Reverse logistics operations is nowadays critical for most firms, Zhu, Sarkis and Lai (2013) especially for RL because its complexity and uncertainty requires more concerns and resource investments. The RBV has significant potentials for evaluating the influence of investments on reverse logistics capabilities and firm performance (Subburaj, Sriram & Mehrolia, 2020). Resources to RL may be given more priority because resource allocations may influence firms' strategy formulation and internal capabilities for reverse logistics operations, which results in the differences of adaptability, innovations, effectiveness and efficiency in reverse logistics implementation (Nakiboglu, 2019). Depending on resource allocations, firms may have strategies to improve capabilities, or develop relationships such as outsourcing, strategic alliance, or joint venture to implement reverse logistics efficiently (Govindan, Khodaverdi & Vafadarnikjoo 2015).

2.3 Conceptual Framework

According to Kamal (2019), a conceptual framework can be defined as a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation. Its aim is to assist a researcher to develop awareness and understanding of the situation under scrutiny and communicate the same in a broad perspective. It highlights the study variables and illustrates the underlying relationships. This displays the inputs as independent variables and the output as dependent variables. Any changes in the input brought about by the way reverse logistic process is carried out will have an effect on the outputs.

The conceptual framework for this research brings into view the independent and dependent variables of the study. A moderating variable is a third variable that affects the strength of the relationship between a dependent and independent variable (Hayes, 2013). The independent variables are the variables that will influence in order to decide on their effect on the dependent variable. They helped the study foresee the amount of discrepancy that occurs in the dependent variable. The value of the dependent variable depends on the independent variables. The independent variables included: disposition, recycling, reverse product flow, and End-of-Live management. While the dependent variable was the performance of large manufacturing firms, the moderating variable was firm resources. The relationship between independent variables and the dependent variable was of insightful significance as it clearly laid down the contribution of reverse logistics practices on the performance of large manufacturing firms in Kenya. In correlation, a moderator is a third variable that affects the correlation of two variables.

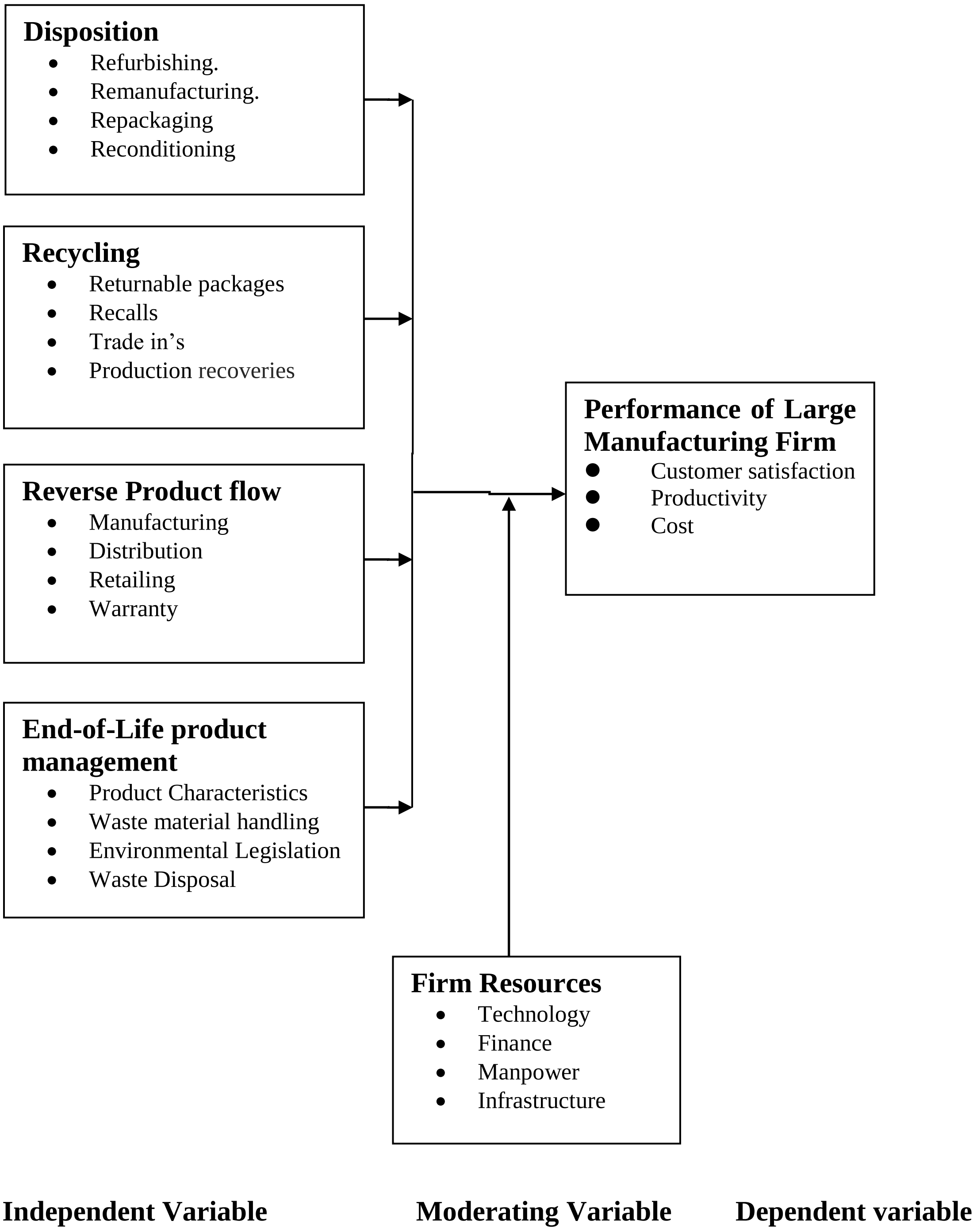

Figure 2.1: Conceptual Framework

2.3.1 Disposition Practice

Disposition refers to the activities that place products back into inventory or temporary storage through refurbishing, remanufacturing, reconditioning or repackaging (Krykawskyy & Fihun, 2015). The company resorts to the refurbishment process when the simple repair of defective parts is not efficient enough. The successful refurbishing aims at improving the product’s performance, extending their service life and bringing them up to an acceptable quality level. Very often, it is cheaper for expensive products to be refurbished instead of replacing the whole product by a new one. Moreover, the returns are disassembled to separate items and modules which are subject to an accurate screening, inspection and testing process to replace or fix the outdated or damaged parts (Abdelshafie, 2018). The average of the remaining service life of a refurbished part is shorter than the service life of new ones (Royo, Mulet, Chulvi & Galán, 2020).

Remanufacturing processes aim at making the product’s quality standard, life expectancy and performance like that of new products (Royo *et al*., 2020). In order to do that, the company has to take deeper interventions. All components of returned products are fully disassembled and inspected. The outdated, worn-out or damaged materials are changed with new parts, and the exchanged parts are fixed and evaluated. The company should identify which remanufactured items meet the quality standard. Further, the customer can purchase high quality product with low price and full warranty (Abdelshafie, 2018).

Reconditioning is a repair process in which products are fixed and returned to working order (Christopher, 2018). A product is restored to good condition by replacing parts. According to Ngu, Lee and Osman (2020), repair is simply the correction of specified faults in a product. Reconditioning relates to a moderate magnitude of repairs which allows the product to be reused (Kariuki *et al*., 2022). In the reconditioning process, a product is cleaned and repaired in such way that it is returned to almost new state. Reconditioning components for reuse will allow organizations to capture value from the returned products. Reconditioning is the process of returning a used product to a satisfactory working condition that may be inferior to the original specification.

An organization may result to repackaging a product as a result of damages on the outlook of the product. Repackaging involves complete or partial change of the entire look of the products before being presented to the consumer. Repackaging can occur as a result of complaints from consumers as a result of inability to use the products due to the way it has been packed or difficulty in using the products (Williams, 2016). Organizations may find it necessary to repackage their products to make them more suitable and appealing to their customers. It also consists of offloading products initially packed in large volumes to smaller easy to handle and distributable packaging. Repackaging is a necessary step in reverse logistics as it helps organizations assess their consumer needs and repackage their products into more convenient and effective packages (Gencer & Akkucuk, 2015). Organizations are able to address the specific needs of their customers in terms of sizes, shapes and materials used in the repackaging process.

2.3.2 Recycling Practice

Recycling refers to the process through which waste products and materials are converted into new products and resold to the consumer (Giri & Masanta, 2020). Organizations have come up with returnable packages that facilitate the process of recycling to avoid wastage of useful products. The organizations have devised a method that allows packages to be returned to the manufacturers for recycling instead of becoming waste. This can be well illustrated by the beverage companies that have taken it upon themselves to collect bottles for recycling after the consumption of the packed beverages. The preparation of returnable packages has allowed companies to save on the cost of production by the use of the already available packaging devices. The reverse logistics through the use of returnable packages is also available in other manufacturing companies such as the motor vehicle industry, pharmaceuticals and the medical industry (Agrawal, Singh, & Murtaza, 2019).

Reusable items or functional returns are related to consumption, use or distribution of the main product where products go backwards and forwards in the supply chain owing to their inherent function. An example would be reusable containers, bottles and pallets which can be used in the distribution process because their function is to carry other products and they can serve this purpose several times. The common characteristic is that they are not part of the product itself, but contain and/or carry the actual product (Walia, 2020).

Product recalls include complicated products that are recollected because of safety or health issues where the manufacturer or a supplier is the initiator and not the customer (Kariuki et al., 2022). Product recalls fall under "distribution returns" since they are usually initiated in this phase and are specifically demanding with respect to distribution (Roni, Moein, & Effendi, 2018). Well-known examples of product recalls are in the automotive industry. Commercial returns take place when a buyer has a contractual option to return products to the seller (Roni et al., 2018). These are products returns that occur during or shortly after the sales process. These may be the results of wrong/damaged deliveries to products with a too short remaining shelf life or unsold products that retailers or distributors return and overstock at retailers and promotional actions.

Under the reverse logistics, product recalls are also included in this process. This is the process through which an organization takes back products dispatched to customers due to faults or risks posed to consumers if they use them. The discovery of safety issues on a product puts a company's reputation at risk. The process puts organization on the risk of legal action if the customers are harmed by the products. For competitiveness some companies have created revenue for voluntary recalls making them appear more reliable to customers (Elsbach, 2017). Products recall can be costly to companies as they call for full refund of the purchase money to the customers.

Trade-in is a sales promotion strategy where the consumers are offered a fixed discount which is also called trade-in allowance on prices of new model or item in exchange for older model or item (Raz, & Souza, 2018). In reverse logistics, organizations are encouraged to accept trade-ins in lieu of discounts on the initial sale. In some stores discounting and negotiating are a part of daily life, although there are ways of eliminating negotiations. Trade-ins can work to actually increase overall margins and average sale size, and help recycle used merchandise (Qin, 2018). For operations with designated clearance areas, the organization should set a dollar rate for various trade-in commodities.

When negotiating with the customers, one need to inform them that the organization can only discount a small percentage for cash payment, but there is a trade-in program where they can receive price discount depending on the item being traded in (Deresky, 2017). When customer agrees to trade in, the organizations representative should inquire from them if there is anything else they may wish to replace in their homes. It is often not important to inspect the item being traded in; the business should be prepared to lose some and win others. The traded in items can be sold in the clearance area.

Introduction of product recovery is an environmentally conscious approach where products are returned from users or production lines to be reused. Product recovery aims at recovering the residual value of used products. Recovery options include the extension of the life span of a product or some of its parts through repair and remanufacturing or of materials through recycling (Govindan, Soleimani, & Kannan, 2015). Recovery prevents waste by diverting materials from landfills and conserves natural resources (energy and materials). Firms are often encouraged to offer product recovery activities as a demonstration of corporate citizenship.

The fact that landfilling is prevented and that the environmental processing cost for the transfer is lower than the environmental cost to produce from virgin materials, hence it is not enough to have it implemented in the real world. The question is whether Reviews in Environmental Science is worthwhile for a firm to engage in product recovery activities (Shaharudin, Zailani, & Tan, 2015).

2.3.3 Reverse Product flow Practice

Effective Reverse product flow can provide additional means of positively impacting the firm's financial performance as well as building stronger relationships with key customers. Product returns refer to all those returns that are initiated by a supply chain actor at any stage, after the product has been manufactured (Christopher, 2018). Perhaps even more important, however, is the impact of returns on customer relationships. Every return represents a failed service encounter. For some reason the customer was not happy with the sale, and this can result in dissatisfaction with the company itself. If returns become a hassle for the customer, the longevity or quality of the customer relationship may be impacted. Companies that handle returns effectively by working with customers to resolve service issues can actually improve a customer's loyalty to their firm (Christopher, 2018).

Original Equipment Manufacturers (OEMs) refer to the organizations that manufacture the products as the "original" manufacturer. However, with the growth of outsourcing, the term "OEMs" can also refer to organizations that buy, assemble and resell the products (Sayed, Hendry & Zorzini Bell, 2021). Normally, products or materials that require remanufacturing will be sent to the OEM. From there the products will move back through the supply chain to the distributors or wholesalers.

Manufacturer returns in the reverse supply chain take place between the manufacturer and its supplier. Manufacturing returns include all those cases where components or products have to be recovered in the production phase. This occurs for a variety of reasons. Raw materials may be left over, intermediate or final products may fail quality checks and have to be reworked and products may be left over during production (Stefanova & Zlateva, 2018). Hence the reasons for manufacturing returns can include raw material surplus, quality control returns, and production leftovers or by-products and scraps. These include materials or products resulting from the production process or ones that do not fulfill the quality requirements. Some products can be reworked to meet the quality requirements, while the excess products need to be disposed of or recycled to reduce costs and the environmental impact (Afum *et al*., 2022).

Distributors or wholesalers are organizations that typically receive the goods in quantity from the manufacturer and ship them to the customers in smaller quantities (Sayed *et al*., 2021). In the reverse logistics process, distributors or wholesalers may receive goods for refurbishment or repair which can then be resold to the retailer or customer. Distribution returns in the reverse supply chain take place between the distributor and the manufacturer. Distribution returns refer to all those returns that are initiated by a supply chain actor during distribution, after the product has been made (Christopher, 2018). There are various types of distribution returns such as product recalls, commercial returns, stock adjustments and functional returns (Roni, Moein, & Effendi, 2018).

Retailers are organizations that purchase products from a manufacturer or distributor and resell them to the ultimate consumer (Sayed *et al*., 2021). In reverse logistics, retailers may play a two-way role. Retailers are usually the initial link in the reverse flows of products (Cardoso, Barbosa-Póvoa & Relvas, 2019). They accept product returns from the end customers and distribute them back into the reverse supply chain, to the distributors or OEMs for remanufacture, refurbishment or repair. The retailers also participate in reselling the repaired, refurbished or remanufactured products to the ultimate customers. Customer returns in the reverse supply chain take place between the customer and distributor or customer and manufacturer. Customer or user returns as argued by, Kariuki *et al*. (2022) are those that are initiated by the customer or user of the product as a result of consumption and can include reimbursement guarantees, warranty and service returns, end-of-use returns.

Reimbursement guarantees involve customers being given opportunities to change their mind about the purchase; Warranty and service returns involve the incorrect functioning of products during use, or a service relating to the product; End-of-use returns include situations where the user has the chance to return the product at a certain stage of its life. In other words, these products are returned after some period of use owing to end of lease, trade-in or replacement. It is clear that there are many different reasons for product returns, which increase the need for effective reverse logistics. The reason for returns not only stems from damaged products or quality issues but also from issues within the organization and supply chain (Moro, Cauchick-Miguel & Campos, 2021).

2.3.4 End-of-Life product management

End-of-Life (EoL) products are all items of no longer use to anyone, which need to be processed due to contractual or legislative take back obligations. When a product is EoL, it is no longer useful or does not work. The product may no longer meet a customer's needs or be replaced by a newer, better version. Manufacturers often recycle or dispose of products that are end-of-life. These products form part of waste and can create environmental challenges for manufacturers and countries hence require proper management.

These returns are often worn out and compulsory processed according to legislative prescriptions (Kariuki *et al*., 2022). End-of-life returns include returns that are at the end of their physical life and are either returned to the OEM because of legal product take-back requirements or for value-added recovery (Kariuki *et al*., 2022). This means that when products have reached the end of their physical or economical life, they are treated as waste hence end-of-life returns occur. Business Dictionary states that waste management is the collection, transportation and disposal of different kinds of waste, which implies management of all processes and materials for proper handling of waste materials, taking into consideration human health codes and environmental regulations Business Dictionary, (2016). Glossary of Statistical Terms details the processes which are included in the concept of waste management and states that it covers such important processes as appropriate treatment of waste, control, monitoring and regulation, prevention of waste production, reuse and recycling (Mitra, 2016). Waste from manufacturing industries includes different waste streams arising from a wide spectrum of industrial processes.

Three characteristics seem to be relevant when considering product disposal and return: Product composition, product use pattern and product deterioration since they affect recovery (Satyanarayana & Venugopal, 2019). The product composition entails ease of disassembly, homogeneity of constituting elements, presence of hazardous materials and ease of transportation. The product use pattern affects the collection of the items and is related to the amount of deterioration that the product has experienced. It covers location of use. Similarly, the intensity and duration of use makes a difference if the use is constant for a long time as occurs with distribution items, like containers, bottles, pallets and crates which are used by their receivers only for a short time during which they do not really deteriorate. Finally, there are the deterioration characteristics, which determine whether there is enough functionality left to make a further use of the product, either as a whole or as parts.

This strongly affects the recovery option. These may include; intrinsic deterioration or how fast does the product age during use, repairability which consider whether the product can be easily repaired or upgraded to a better condition, homogeneity of deterioration which check whether all parts age equally or not, and finally economic deterioration due to new products arriving on the market making the old ones obsolete.

Solid waste handling means the management, storage, collection, transportation, treatment, utilization, processing, and final disposal of solid wastes. This includes the recovery and recycling of materials from solid wastes, the recovery of energy resources from solid wastes or the conversion of the energy in solid wastes. Manufacturers must pay for the waste handling costs and collection and reuse the unused products if possible. Recycling and reusing useful materials from end-of-life products can reduce the size and volume of waste generated.

Waste reductions, followed by product reuse, recovery and recycling have been popular practices for EoL products in almost all developed countries. In Kenya, there was a ban on use of plastic bags in reference to Gazette Notice No. 2356 of 2017. This was a directive from National Environmental Management Authority (NEMA). Legislation can also encourage the implementation of RL. Today, many countries have enforced legislation for recovering end-of-life products. Legislation here refers to any jurisdiction indicating that a company should recover its products or take them back. Reverse logistics will be efficient only if waste management is highly developed. At the same time, it is worth noting that actual reverse processes are various and the level of their complexity is increasing. Consequently, there is a need to address issues of sustainability and integration within the whole supply chain, not only to the post-consumption stage (Jabbour & de Sousa 2016). In this way, if each stage of supply chain minimizes waste production and reduces materials and energy consumption in order to create an environmentally friendly and qualitative product, sustainability of supply chain will be achieved, which is considered to be one of the main objectives of reverse logistics (Sassanelli, Rosa & Terzi, 2020).

End-of-Life (EoL), in the context of manufacturing and product lifecycles (PLC), is the final stage of a product's existence. The particular concerns of end-of-life depend on the product in question and whether the perspective is that of the manufacturer or the user. For the manufacturer, EoL concerns involve not only discontinuing production but also continuing to address the market needs that the product addresses which might lead to the development of a new product. For the business using the product, EoL concerns include disposing of the existing product responsibly, transiting to a different product and ensuring that disruption will be minimal. Waste disposal methods refer to the different treatments which are given to the waste or avoiding environmental and health hazards. There has been a change in perception towards viewing waste as a resource, especially for product at the end of its useful life. Waste streams that businesses would have had to pay to be taken away a decade ago, are now being collected, recycled, and resold for big amounts of money (Lacy & Rutqvist, 2016).

Generally, several methods have been identified in literature as being in use in the disposal of waste. The first and generally the most preferred method is prevention or reducing the waste generated from different manufacturing processes. The rapid population growth makes it imperative to use secondhand products or judiciously use the existing ones because if not, there is a potential risk of people succumbing to the ill effects of toxic wastes (Blacker & McConnell, 2015). A conscious decision should be made at the personal and professional level to judiciously curb the menacing growth of wastes. Another method commonly used is the Incineration. The method features combustion of wastes to transform them into base components, with the generated heat being trapped for deriving energy. Assorted gases are common by-products. Other methods used in waste disposal encompass Sanitary landfill and disposal in oceans and/or seas. Sanitary Landfill involves the dumping of wastes into a landfill (Blacker & McConnell, 2015).

2.3.5 Firm Resources

The firm resources may influence the extent to which successful implementation of RL is achieved since it determines the level of resources needed. A very serious problem faced by firms in the implementation of reverse logistics practices is the lack of good information systems. Due to the technology gaps for reverse logistics as cited by Jayasinghe, Chileshe and Rameezdeen (2019), there are a number of critical challenges for reverse logistics management such as lack of visibility from initiation of return to ultimate disposition, lack of monitoring and control of service providers, and highly labor-intensive requirement of returns processes. Information Technology makes transaction of returns flows easier and more transparent than paper-based methods for both firms and customers involved in RL operations. This is made possible with the application of Internet and techniques of barcode scanning, Electronic Data Interchange (EDI) and Radio Frequency Identification (RFID). For example, companies proceeding automatic electronic return authorization and following up with electronic credit refund to their customers often offer better customer services and obtain higher competitive advantages than others do (Agrawal & Singh, 2020).

For management of physical flows of returns processes, the application of real time information system with the support of barcode scanning, serial number identification, electronic data interchange, and RFID are used in developed economies. It is the key to the success of reverse logistics operations in many companies dealing with electrical and electronic equipment's (Rushton, Croucher & Baker, 2022). Technologies like two-dimensional barcodes and RFID allow sellers to embed much information in the product. RFID tagging improves the accuracy and timeliness of information about the movement of goods in supply chains. Consumers could return items without receipts because RFID tags would act as indices into database payment records, and help retailers track the pedigrees of defective or contaminated items.

Having adequate financial funds are essential to carry out reverse logistics activities as the necessary technology and programs are significant in reverse logistics. However, setting up an advanced technological and information system is an expensive initiative for the businesses (Ross, 2017). It has been shown that firms have limited financial resources. Because of that, they are not able to develop necessary technologies and programs. Besides, companies often consider the rate of return when they make investment and the slow rate of return on the investments as well as the cost of investments hinder implementation of reverse logistics activities (Abdulrahman *et al*., 2019). Many firms therefore are not willing to implement a product recovery system because of the costs involved in the returns process. These costs include: collection/storage costs at retailer, transportation from retailer to manufacturer, transformation of products from unsalable to saleable (this involves refurbishing, repairing, or recycling), and redistribution of saleable products. Firms must weigh the upfront costs of implementing a product recovery program against potential revenue generated via sales on the secondary market (Saruchera & Asante-Darko, 2021).

Implementation of reverse logistics is also dependent on the level and quality of manpower or human resource possessed by the implementing firm. Effective Human Resources Management (HRM) is a critical element for the success of organizational goals. At an international level it has been emphasized the key role of the effective human resources management as a key element of competitive advantage (Armstrong & Taylor, 2020). Relevant studies internationally, have pointed out the positive relationship between HRM practices and implementation of reverse logistics in the organization. Thriving companies exhibit innovation, efficiency, flexible structure and require new skills in their organizations and their human resources. Human Resources Management recognizes the vital role of the human factor at work and its importance for the success of an organization (Paillé, Chen, Boiral & Jin, 2019).

Infrastructure plays a vital role in RL implementation. Researchers and practitioners found that affordable recycling technologies with the support and coordination of all the members would enhance the success of RL implementation (Armstrong & Taylor, 2020). The existence of good RL infrastructure provides a company with the capability and ability to quickly and efficiently handle returns and/or recalls (Abdulrahman *et al*., 2019). The presence of good returns-handling system can be a source of significant cost savings and even function as a profit center (Kaur, Kakade & Bhagat, 2016). Conversely, a lack of Reverse Logistics infrastructure will impede a company’s ability to quickly and efficiently deal with returns and/or recalls and any effort at handling returns will be a financial burden with the costs exceeding the benefits (Prokop, Gerstlberger, Zapletal & Striteska, 2022).

2.3.6 Performance of Large Manufacturing Firms

A performance measurement system can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions (Ahi & Searcy, 2017). Jamwal, Agrawal, Sharma and Kumar (2021) introduced the concept of the balanced scorecard (BSC), which integrates the strategic objectives of manufacturing firm with the financial and nonfinancial measures. The BSC has four perspectives, namely financial perspective, customer perspective, internal business processes perspective and learning and growth perspective. These perspectives help in achieving the vision and mission of the organization by translating a business unit's mission and strategy into tangible objectives and measures. Awino (2012) noted that large manufacturing companies have not been able to formulate the right strategies required to achieve their objectives in firm Performance. The financial perspective analyses profit left after removing operational costs.

To measure manufacturing firm performance in the logistics industry, firms need to incorporate parameters on operations, efficiency and service effectiveness to ensure that they have a balanced framework (Tripathi & Gupta, 2019). Their Supply Chain Operations Reference (SCOR) model not only considers both the effectiveness and efficiency aspects of performance measurement, but also recognizes the internal as well as customer-related reasons for measuring performance. Many studies can be found in the literature that deals with manufacturing firm performance measurements. Various researchers have attempted to measure firm performance in unique ways and developed a wide variety of performance measures. The SCOR model, developed by the Supply Chain Council is the most commonly used tool among all the exact conceptualizations and frameworks developed for measuring firm performance. It provides a practical framework that takes into account the performance requirements of member organizations in a supply chain.

In this model, fir m activities are considered as a series of inter-organizational processes that are inter-linked, as well as possess a common process-oriented language for communication among firm members in the following decisions areas: plan, source, make, deliver and return. One of the views of the SCOR model is that performance must be measured in multiple dimensions. Hence, each of the above decision areas is considered as an important intra-organizational process in the firm having five dimensions of measurement: firm reliability; responsiveness; flexibility; cost; and efficiency in asset utilization. The SCOR model describes firm performance as being efficient in terms of resource utilization and effective in terms of accomplishment of the supply chain objectives. According to Muthoni and Mose (2020), the greatest challenge related to firm performance measurement has to do with having the people administering the measurement to focus, not on their individual link in the chain, but on the real performance of the entire supply chain. Furthermore, Masadeh, Maqableh, and Karajeh (2017) argue that performance measurement should take a holistic system perspective beyond the organizational boundaries.

The perceived contribution of a supply chain member to firm Performance was measured using four constructs of efficiency, responsiveness, quality and supply chain cost. Efficiency is a measure of how well resources are utilized, and include logistic costs and profits (Rushton, Croucher & Baker, 2022). Logistic cost refers to the operating and opportunity cost items that can be influenced by logistic decisions and integration of management practices and activities throughout the supply chain. Profits refer to the net positive gains from investments or business undertaking. Responsiveness is a measure of speed/rate of providing the requested products. Responsiveness is measured in terms of lead time and customer complaints (Dora, 2016). Lead time is the total amount of time which elapses between sending/getting request and delivery/receiving of goods or services (Odongo, & Dora, 2016). Customer complaints are registered complaints from customers about products or services. Product quality consists of safety and attractiveness while process quality is measured by environmental friendliness.

2.4 Empirical Literature Review

An empirical literature review process involves the evaluation of previous empirical studies to bring to rest a specific research issue. An empirical literature review is more commonly called a systematic literature review and it examines past empirical studies to answer a particular research question.

2.4.1 Disposition Practice

A study done by Mbovu and Kiarie (2018) established that remanufacturing practice has a strong positive influence on competitiveness of the manufacturing firms in Kenya. Disposition decisions depend upon proposition of the product sold to the customer such as quality, selling price and logistics cost, as well as demand of the product in the market. If the product has sufficiently high value and the quality of returned product is good enough for recapturing value, then product can be remanufactured because of higher re-sale value (Arrieta, 2016). Vlachos (2014) examined the reverse logistics using the resource-based view and argued that companies should allocate their resources to developing reverse logistics programs in order to avoid the potential negative impact on the bottom line. Conversely, if adequate resources (tangible/intangible or property-based/ knowledge-based) are targeted to reverse logistics programs, companies may gain a tremendous positive financial impact as well as important relational implications.

In their study, Kwak and Kim (2019) found that part replacements from suppliers must be preferred over refurbishment of equipment's being more profitable. So, the firm may adopt the disposition strategy of parts replacement rather than refurbishment. The choice to destroy the product must be preferred in case of resource scarcity because other disposition alternatives like recycling or remanufacturing may need higher investment for recapturing value. Although there may be legal restrictions on destroying some products in many countries Agrawal, Singh and Murtaza (2019) reported that if time is not relevant, then recycling is preferred, and reprocessing is preferred if time is primarily relevant. The findings of the study by Kazemi, Modak and Govindan (2019) led to the conclusion that disposition has many other benefits such as saving storage space besides freeing capital. It enables efficient use of materials and reduced overall costs.

In their study (Mbuvi & Kiarie, 2018) found that increasing levels of repackaging practice increases the levels of competitiveness of the manufacturing firms in Kenya. This shows that repackaging has a strong positive influence on competitiveness of the manufacturing firms in Kenya. Different firms in different industries have been using potential disposition alternatives such as: reuse, recycle, remanufacture and repair or disposal in practice. However, no model, methodology or approach was found for selecting the best disposition alternative in reverse logistics system. There is more value in products that have been repaired or refurbished as compared to those that are sold as scrap or salvage. There is also a market for harvesting product components and selling them as spares (Kotler, 2015).

Jindal and Sangwan (2016) developed a model for the returned products considering the time of the return, the quality of the product and the clogging effect at the remanufacturing facility. Agrawal, Singh and Murtaza (2019) developed a flexible decision model for the selection of best alternative of disposition strategy. Christopher (2018) analyzed the strategic factors to provide a summary of these factors for the betterment of a firm's reverse logistics functions.

The study done by Panya & Marendi, (2021) found that reverse logistics practices such as repackaging and remanufacturing have a direct and significant effect on organizational performance of fast-moving consumer goods Companies. The study recommended that management of such Companies need to adopt reverse logistics practices related to repairing, remanufacturing and repackaging strategies. Moreover, the study highlighted the need for these industries to embrace disposition as an investment for improved performance, thereby moving towards sustainable growth which is one of the foundations of Kenyan Vision 2030.

2.4.2 Recycling Practice

A study conducted by Mwirigi, (2017) established that in order to realize the potential benefits of waste recycling, and organizing and managing recycling programs, firms need to consider appropriate options for recycling programs with regard to financial-economic constraints, the existing situation, regulation, institutional, environment, socio-cultural, and technical issues. Manufacturing firms as they practice green logistics through recycling increase their level of performance. Literature has found numerous benefits associated with recycling concept within the reverse logistics management. A study carried by Guerrero, Maas and Hogland (2017) outlined the importance of recycling as a waste management strategy due to its ability to reduce disposal costs and waste transport costs, and to prolong the life span of sanitary landfill sites.

Agrawal, Singh and Murtaza (2019) conducted a study whose objective was to analyze post-consumer plastic recycling technological and market aspects and to identify difficulties and benefits involved with these activities. These goals were being reached through case studies in Rio Grande do Sul, Brazil. The cases being studied were post-consumer plastic recycling companies and companies that manufacture end-use products from recycled plastics. The article describes their recycling technology and some market aspects. They suggested on their study that post- consumer plastic recycling can be a sustainable development tool which helps to solve the problems of solid waste. Postconsumer recycling was a technological trend that recovers the economic value from objects discarded by consumers (bottles and packaging).

A study done at the University of Exeter (2016-2021) found that waste management strategy emphasizes the role of recycling in waste handling. The University generates 1,000 tons of waste annually and spends approximately £350,000 on waste management each year. Waste and recycling continue to be the institution's sustainability priority for staff, students and visitors and is one of the most visible areas in the sustainability agenda. The increment in recycling from 29% in 2009 to 34% in 2016 enabled the organization make great cost saving and improve their competitiveness. The importance attached to recycling can be demonstrated by the institution's investment into a new £71,000 storage facility at Duryard Barn which was brought in line to store good quality office furniture for future use across campus. Within the first 6 months of the facility being operational £37,000 worth of quality furniture was reused across the estate. There has been a total of 10 tons of furniture re used across the campus during 2015.

A study by Leah and Eric (2022) established that recycling has a positive and significant effect on performance of food and beverage firms in Nairobi City County. The study found that incentives of recycling, material recovery and sustainable life cycle strategies influence performance of food and beverage firms in Nairobi City County. In Kenya, according to NEMA (2017) National Waste Management strategy, Recycling is one of the strategies that institutions will use in managing waste as part of Vision 2030. According to the authority, Recovery, re-use and recycling comprise the second step in the waste hierarchy. Recovery, reuse and recycling are very different physical processes, but have the same aim of reclaiming material from the waste stream and reducing the volume of waste generated that moves down the waste hierarchy. In their strategy, NEMA recognizes potential cost saving out of recycling waste as much as possible.

A study was conducted by Okemba and Namusonge (2014) to establish whether reverse logistics as green supply chain management practices determine supply chain performance in Kenya's manufacturing firm. The study findings revealed that the firms in focus had adopted GSCM practices to a great extent. Nevertheless, there was a disconnect between adoption and practice because the respondents reviewed that they had incorporated recycling products as well as ensuring reusing of their packaging. However, when it comes to collecting the same used packages under reverse logistics, a significant percentage (46%) was non-committal on whether they collect from customers.

2.4.3 Reverse Product flow Practice

Mwaura et al, (2015) in their study found that Reverse Logistics concerns activities associated with the handling and management of equipment, products, components, materials or even entire technical systems to be recovered back through the supply chain. There are many known direct economic benefits that can be gained from product returns. The financial impact of reverse logistics can be related to costs, revenues and assets. Some examples illustrate direct economic benefits of reverse logistics: A study carried out by order of the UK department of Transport in 2005 estimated that cost for managing returns could be reduced in the order of 20% to 40% of the estimated 500 million pounds spent (Wild, 2017). The researchers argued that this may even underestimate the full potential since most firms do not measure the total opportunity costs associated with reverse logistics.

Chhaya (2017) purported that, actors in reverse logistics networks can be divided into internal actors such us OEMs, suppliers, distributors, customers, service providers and external actors like governmental, non-governmental and industrial organizations. Each actor has varying degrees of power in reverse supply chain. The roles and degree of participation of different actors in reverse supply chain are characterized with three main levels: managing level, operating level, and market level (Chardine-Baumann & Botta-Genoulaz, 2018). Any party can be a returnee including customers, distributors and even OEMs that are preventative for supply side of returned products in reverse logistics network. Receivers that can be found in the whole supply chain present the demand side of recovered products/materials including customers, suppliers, OEMs, and distributors.

A study by (Laudon & Laudon, 2016) established that proactively managing products returns makes it easier for companies to deal with regulatory issues and evaluate returned stock for possible secondary sales channels. Processors participating in repairing, refurbishing, remanufacturing and recycling may be manufacturers if they set up their own recovery systems. They can also act as independent third-party service providers who offer recovery services which include repair centers, logistics service providers, remanufacturers, dismantlers and recyclers. Bai, Sarkis, Yin and Dou (2020) argued that retailers are not as good in performing reverse logistics compared to their ability in handling forward flows. Therefore, partnerships with manufacturers and logistics service providers can support them in dealing with returned products more effectively and efficiently.

2.4.4 End-of-Life management practice

A study by Kiilu, (2018) found that countries have gone to extent of charging manufacturer for the entire life cycle of their product. In near future the world is going to witness explosive growth of product recovery activities and at the same time companies are recognizing opportunity to access this new market segment combining with environmental stewardship. End-of-Life products are composed of waste and is an emerging stream of disposal challenge in Kenya. Attempts by the government to manage industrial waste in Kenya have suffered from a number of drawbacks. These include; incorrect consumer perceptions of waste, lack of waste financial management resources and models, lack of appropriate waste recycling technology, illegal imports, inadequate legislation and laxity in enforcing existing regulations. The consequences of these situations are that: toxic materials enter the waste stream with no special precautions to avoid the known adverse effects on the environment and human health, resources are wasted when economically valuable materials are dumped and unhealthy conditions are developed during informal recycling.

In the case of e-wastes the Communications Commission of Kenya has implemented a Universal Licensing Framework that requires telecommunication operators to take responsibility for their discarded technology. However, there was limited capacity to collect and process e-waste, and no mechanism to separate it from solid waste (Afroz *et al*., 2019). National Environmental Management Authority (NEMA) and Ministry of Environment and Mineral Resources 2015) guidelines for waste management in Kenya identified producers, manufacturers, importers, assemblers, distributors, consumers, government institutions and refurbishers or recyclers as target groups for managing waste.

Al-Sabawi, (2019) in his study established that firms willing to adopt reverse logistics have to develop their expertise through training and numerous education programs for promoting environmental awareness in their firm. This study showed that there are benefits of implementing RL. Globally, RL is receiving attention because of its integral advantages for reducing the impact of hazardous materials on the environment and human life. Kenya Association of Manufacturers launched the Strategic Business Plan for the establishment of a Plastic Producer Responsibility Organization in Kenya (KAM, 2020). This will drive collective Extended Producer Responsibility in the country, whereby a producer’s responsibility for a product is extended to the post-consumer stage of a product’s life cycle, whilst turning plastic waste into valuable resources. KAM signed a Memorandum of Understanding with Recycling Marketplace, to connect businesses to reuse and offer recycling solutions in Kenya, geared towards enhancing waste management in the country.

2.4.5 Firm Resources

According to Global Logistics Research Team 2015, Information Technology (IT) refers to "the hardware, software, and network investment and design to facilitate processing and exchange." IT was described by Chergarova *et al*. (2019) as a critical tool for effective logistics and supply chain management to create efficient business processes. Most IT is designed and installed for forward logistics in mind. Nevertheless, due to the increased cases of returned products and the complex nature of reverse flows, IT is being used more and more in reverse logistics management as it was found by Bahari *et al*. (2018).

Financial constraints are a key barrier to good reverse logistics programs (Zhu & Geng, 2013). Cost considerations are a prime challenge in commercial recycling. Finance is essential to support the infrastructure and manpower requirements of the reverse logistics. Companies require allocation of funds and other resources for the implementation of reverse logistics. The success of an effective implementation of reverse logistics relies on key factors (Nakiboglu, 2019) such as the ability to: develop a flexible organization, customer focus, reduce inventory and cost, seek total supply chain coordination, gather quality data and reporting, establish a management leadership strategy, develop an overall human resource management policy, and enhance communication to reduce uncertainty and inventory. To be able to achieve the aforementioned, companies require human resources who have a broad level of skills in team-building, problem solving, leadership and are flexible in their roles, innovative and adaptable to reorganization (Wambui *et al*., 2016).

2.5 Critique of Existing Literature

Christopher (2018) was one of the first authors who used the term "reverse logistics" as such. He used "reverse distribution" as an equivalent term and defined it as the "movement of goods from a consumer towards a producer in a channel of distribution." Kotler (2015) drew attention to the concept of reverse logistics and mentioned that recyclable material does not always flow backwards through the same channel. He did not capture the aspect of value addition fully as will be done in this study. Armstrong and Taylor (2020) coined the term "Product Recovery Management" (PRM) to describe all those activities that encompass the management of all used and discarded products, components and materials that fall under the responsibility of a manufacturing company. Although they did not use the term "reverse logistics," a parallel can be drawn from the mention of the activities included within the scope of product returns (Bhattacharya, Kaul & Amit, 2018). All these studies failed to explain properly what is entailed in proper reverse logistics.

Mutuku & Moronge, (2020) examined the influence of Reverse Logistics on Performance of Food and Beverage Manufacturing Firms in Kenya. The findings of the study indicated that product returns management, recycling management, disposal management and product repackaging have a positive relationship with performance of food and beverage manufacturing firms in Kenya. However, literature on these variables was relatively shallow and did not articulate properly how they relate with the firm performance.

Research articles on reverse logistics may be classified into the following three categories: first, general literature on reverse logistics, second, transportation and packaging literature, and third, purchasing literature. Agrawal and Singh (2020) have done an exhaustive literature review of reverse logistics and have focused distribution of end-of-life products, production planning, inventory management issues and product return management. Govindan, Soleimani and Kannan (2015) in their research considered environmental issues regarding product design, product life extension, product recovery and studied the interactions between sustainability and supply chains. Reverse logistics has also been analyzed in the context of recovery process for waste management (Bahari *et al*., 2018). These studies left out some important aspects on reverse logistics such as disposition, recycling and end-of-life products.

Literature review reveals that authors have emphasized integration of manufacturing and remanufacturing operations in reverse logistics (Adebayo, 2022). Krykawskyy and Fihun (2015) have stressed the need to look at reverse logistics with modularity in product structure. Saruchera and Asante-Darko (2021) tested hypotheses related to importance of product returns and recovery values in the context of reverse supply chains. Researchers have stressed use of IT to assist in coordination of reverse logistics activities. Many companies have started developing reverse logistics programs encompassing design for environment. They have analyzed the benefits of reverse logistics on customer relationship issues such as customer retention, customer satisfaction through liberalized returns policies. Though these studies were done in different areas they never mentioned anything to do with the value addition aspect of reverse logistics.

Ergüzel, Tunahan and Sinan (2019) presented the results of a pilot survey with follow-up interviews, which was conducted for investigating the practices of reverse logistics in an industry. A questionnaire survey was sent to the industrial participants, and follow-up interviews were conducted with the respondents. They concluded that even if reverse logistics systems are important to the industry, the low level of importance of reverse logistics relative to the other issues is still a major barrier in realizing reverse logistics systems. By underlying that most research in reverse supply chain management (RSCM) has relied on case studies and optimization models, Taticchi, Tonelli and Pasqualino (2017) indicated the existing opportunities to use survey-based research methods to explain current practices, predominant and critical issues, and managerial techniques used to manage the reverse supply chain. Since the study findings were only from case studies its difficult to rely on them as the scope was too low.

Samson, D. K. (2018) Studied the Effects of Reverse Supply Chain Logistics on Performance of Imported Furniture Distributing Firms in Nairobi County. In this study some of the independent variables like reverse storage constraints had very few indicators while the dependent variable had very many indicators. With this kind of relationship, it was not clear how such a variable would contribute so much on the performance of the distributing firm. The study did not mention clearly how reverse supply chain logistics is able to boost the sales of furniture distributing firm.

2.6 Research Gaps

Even though some literature can be found that focuses on strategic questions related to reverse logistics, a review of existing literature shows that little has been published on analytical evaluation towards reverse logistics practices. Chardine-Baumann and Botta-Genoulaz (2018) stressed the need for more thorough research in this area. There have been only a few or no empirical studies on reverse logistics in the developing nation's context. From the review of literature of reverse logistics, the following observations are noted: Most of available literature on reverse logistics consists of case studies specific to some aspects of reverse logistics such as remanufacturing and recycling. Literature lacks a comprehensive survey on key issues needed for successful implementation of reverse logistics programs. Thus, research in this regard would be useful to both the industry as well as the academia.

There is little literature on empirical analysis of data with reverse flows (Ahi & Searcy, 2017). Coupled with the rapidly increasing return volumes, the complexity of return logistics becomes problematically complex. Bouzon, Govindan and Rodriguez (2018) suggested that a RL chain that depends on product life cycle (PLC), industry and design of RL network needs to be available for customer service. Companies take pains to develop efficient logistics processes for new goods. Similarly, they must do the same for returned goods, understanding that the processes may be quite different from those defined for forward distribution (Kirzner, 2015). The fact that there may be little or no historical data available, Kotler (2015) calls for a need to forecast return flows by developing appropriate models and techniques. Christopher (2018) also sees forecasting models to predict return rates and volumes as a major research issue.

In their study (Anne et al., 2016) found that, the adoption of reverse logistics practices would enhance the competitiveness of Kenya's food manufacturing firms. However, due to lack of awareness on the importance of sustainability, there is a low level of adoption of reverse logistics practices in Kenya. Another reason is that companies' priorities in forward and reverse flows differ. Therefore, even efficiency and effectiveness metrics for both these flows should be different (De Oliveira, Sousa & De Campos, 2019). The performance measurement literature provides limited guidance for selecting the right measures to provide the required insight on RL practices. The field of RL is very immature and it has just recently been receiving attention. For companies, measuring RL performance, its costs, benefits, and effects, as well as other performance criteria, is a very difficult issue.

A study by He *et al*., (2016) highlights our limited understandings on the nature of reverse supply chains in the service sector. Recognizing the heterogeneity of services, their study attempts to clarify the characteristics of forward and the corresponding reverse supply chains in different service sectors. Recently, however, demand management as a key strategy for upgrading the reverse logistics service has become an increasingly important force in companies to satisfy consumer demands for exchange. Due to the technology gaps, there are a number of critical challenges for reverse logistics management such as lack of visibility from initiation of return to ultimate disposition, inadequate collaboration with lack of monitoring, control of service providers and highly labor-intensive requirement of returns processes.

2.7 Summary of Literature Reviewed

Due to numerous roles of players in reverse logistics, a high level of coordination and collaboration among them seems to be imperative. Hence, a clear and effective cooperation mechanism and contractual agreement on different terms and conditions between the involved entities should be defined. The foregoing review has revealed very important aspects of reverse logistics among them the growing demand for firms to practice disposition and recycling because of their easy adaptability. Product recalls and warranty claims give customers incentives and they become royal to the company. However, most of the firms have their logistics configured in the forward mode and the fact that in the developed economies as well as developing countries the predictability of product recall is uncertain. Increasing the environmental concerns and governmental legislations enforce all the players in reverse logistics such as manufacturers, OEM, 3rd party reverse logistics players, and recyclers to embed these concerns into their reverse logistics policies and strategies to achieve an efficient and effective Reverse Logistics model which has value addition.

From the sustainability point of view, the social aspect of reverse logistics needs to be taken into account. Over the recent years, the economic aspect of reverse logistics processes through different cost-benefit analyses have been modeled and argued, while the social impacts of reverse logistics and its determinant factors and essential criteria have never been analyzed in-depth.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter deals with the description of the methods that were used in carrying out the study. The research methodology outlines how the study answers the research questions systematically. The focus of the chapter was the collection of data that concerns the variables under study and the analysis of the same to verify whether the hypotheses are true or not. It covered the following areas: Research Design and Philosophy, target population, sample frame, sample size and sampling Technique, data collection instruments, data collection procedure, pilot study, diagnostic Tests and data analysis.

3.2 Research Design

According to Bryman (2015), research design is the scheme, outline or plan that is used to generate answers to research questions. It is the ‘’glue’’ that holds all the elements in a research study together. The research design also serves as the conceptual framework within which research is conducted and it constitutes the blue print for the collection, measurement and analysis of the data (Merriam & Tisdell, 2015). The study adopted a Descriptive research design. Creswell and Creswell (2017) assert that a descriptive research design is used when data is collected to describe persons, organizations, settings or phenomena. It was appropriate for this study because it allowed the collection of information for independent and dependent variables using interview and questionnaires (Orodho, 2009).

The descriptive approach was appropriate for this study not only in validating findings but also in the formulation of knowledge and providing solutions to the problems. The study used this approach since it involves data collection, measurement, classification, analysis, comparison and interpretation to provide report summary such as measures of central tendency and correlation between variables. According to Leiner (2019), this method focuses on obtaining subjective opinions from respondents. The opinions of the study population concerning the research topic were collected through administration of questionnaires that asked questions related to the contributions of reverse logistics practices on manufacturing firm performance in Kenya. The method was adopted because it gives information concerning the status of a phenomenon with respect to variables on conditions in the situation being studied.

Leiner (2019) argues that a descriptive research design is a systematic research method for collecting data from a representative sample of individuals using instruments composed of closed-ended and/or open-ended questions, observations, and interviews. Kothari (2013) describe a descriptive design as a design that seeks to portray accurately the characteristics of a particular individual, situation or a group. According to Polit and Beck (2003), in a descriptive design, the study observes, counts, delineates, and classifies.

3.2.1 Research Philosophy

Research Philosophy is a belief that explains the way in which data about a phenomenon should be gathered, analysed and used (Corbin, & Strauss, 2014). According to Gorski, (2013) research philosophy can be divided into three categories namely; positivism, interpretivism and realism. Positivism relates to the philosophical stance of the natural scientist. This entails working with an observable social reality and the end product can be law-like generalizations similar to those in the physical and natural sciences. The essence of realism is that what the senses show us as reality is the truth that objects have an existence independent of the human mind. The theory of realism is that there is a reality quite independent of the mind. Interpretivism is focused to the assessment of differences between humans as social actors. The issue of difference is emphasized on the difference between conducting research among people rather than objects such as medicines and computer. Interpretivism is concerned with the meaning that people attach to norms, rules and values that regulate their interactions (Saunders *et al.*, 2012).

This study adopted the positivist philosophical orientation. According to Albert (2014), for positivism, all factual knowledge is based on positive information gained from observable experiences, and only analytical statements are allowed to be known as true through reason. The positivist philosophy will be used because it puts emphasis on highly structured methodology to facilitate replication and offer quantifiable observations that can be analyzed statistically. Positivism is directly associated with the idea of objectivism. In this kind of philosophical approach, scientists give their viewpoint to evaluate social world with the help of objectivity in place of subjectivity (Albert 2014). The philosophy assumes that the one doing the study is independent and neither affects nor is affected by the subject of the research.

3.3 Target Population

The study population covers all the manufacturing firms in Kenya while the target population was the large-scale manufacturing firms operating in Nairobi County. The firm size is measured by their total assets. Large-sized companies are the companies with total assets above Kshs100 million, medium-sized have total assets of Kshs 40 million to Kshs 100 million; whereas small companies are those companies having total assets under Kshs 40 million (KAM 2018). The study embarked on manufacturers that have large business size because large organizations may be more likely than small ones to have well-structured reverse logistics management. This target population was chosen here due to the fact that Nairobi County has the highest concentration of manufacturing firms in Kenya (KAM, 2018). This high concentration of firms, in a given locality makes them highly adoptive and adaptive to innovations in order to improve their relative overall performance (Strange, 2011).

Population is a well-defined group of things or set of people or households that are being investigated. The target population is a group of individuals, objects or items from which samples are taken for measurement. According to Rea and Parker (2014), the target population should have some observable characteristics, from which the study intends to generalize the results. The target population for this study was 240 large scale manufacturing firms in Nairobi County which are registered members of KAM. Kenya association of manufacturers (KAM) membership constitutes of manufacturing value-add industries in Kenya and comprises of small, medium and large enterprises (KAM, 2018).

3.4 Sampling Frame

The sampling frame describes a list of all population units from which the sample was selected (Cooper & Schindler, 2011). A sampling frame is a complete listing of all the units of the population which is used to draw samples. It is a physical representation of the target population and comprises all the units that are potential members of a sample (Kothari, 2013). The definition encompasses the purpose of sampling frames, which is to provide a means for choosing the particular members of the target population that are to be interviewed in the survey. The study's sampling frame was KAM registered large scale manufacturing firms operating within Nairobi County as of 2018. In this research, a list of large manufacturing firms in the 12 main industrial subsectors of the manufacturing sector in Kenya was the sampling frame.

3.5 Sample and Sampling Technique

A sample size refers to the actual respondents the study aims to interview (Babbie, 2010). Bryman and Bell (2015) argued that when selecting a sample size, the study should ensure that the right procedures are followed so as to get the most adequate number of respondents.

A sample is the actual number of elements to be physically reached by the study to extract data. The sample size was picked from large manufacturing firms based in Nairobi County which are registered with KAM.

With a confidence interval of 95 percent, the sample size was determined using the formula given by Miller and Brewer (2006) as shown below (Saunders et al. 2009).

$$n = \frac{N}{1 + N(\alpha)^2}$$

Where:

n = the sample size,

N = the sample frame (population)

A = the margin of error (0.05%).

A sample size of 150 manufacturing firms was calculated as follows:

$$= \frac{240}{1 + 240\,(0.05)^{2}}$$

$$= 150$$

Using proportional allocation, the proportion of each manufacturing firm category to be studied was worked out as shown in the Table 3.1

Table 3.1: Sample size

Sector	**Target population**	**Sample (63%)**
Electrical, Electronics & Energy	10	6
Metal & Allied Sector	35	22
Plastics and Rubber	25	16
Motor Vehicle & Machineries	20	12
Chemical	30	19
Building	15	9
Food Products	40	25
Paper	20	13
Textile and Apparel	15	9
Wood Products	10	7
Pharmaceuticals	15	9
Leather and Footwear	5	3
Total	**240**	**150**

Sampling techniques are composed of two major classes, namely probability and nonprobability sampling. Probability sampling is a technique in which every member of the population has a known nonzero probability of selection. Nonprobability sampling, however, is a technique in which units of the sample are selected on the basis of personal judgments or convenience (Zikmund *et al*., 2010).

The study used purposive sampling method to pick the sample. Ritchie *et al*. (2003) defines this sampling approach as a strategy where "Members of a sample are chosen with a purpose to represent a location or type in relation to the criterion". Purposive sampling, also known as judgmental**,** selective or subjective sampling, is a type of non-probability sampling technique**.** Non-probability sampling focuses on sampling techniques where the units that are investigated are based on the judgment of the study. The study used purposive sampling technique, specifically judgmental sampling method to identify and select eligible manufacturing companies. According to Sekaran and Bougie (2010), judgmental sampling involves the choice of subjects who are most advantageously placed in the best position to provide information required. Purposive sampling allowed the study to use cases that have the required information with respect to the study objectives (Mugenda & Mugenda, 2012).

3.6 Research Instruments and data collection procedure

There are several research instruments that can be used in the process of collecting data for a study. Among the readily available instruments include questionnaires, interviews, focus groups, observations, historical reviews and recordings (Rea & Parker, 2014). Each of these instruments is applied according to the kind of data the study needs, the design used, the ease of applicability, the study preference and the kind of questions asked. Since the study aimed at collecting information that assesses the reverse logistics practices and the performance of large manufacturing firms in Kenya, collecting precise and accurate data was of great essence. Data was collected from primary sources through survey method by use of questionnaires. The study used a five-point Likert scale (5 = strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree and 1 = strongly disagree).

According to Kothari, (2013) data collection procedures specify the process of data collection. Data can be classified into primary and secondary data. Primary data is information that is collected directly from the field specifically for the purpose of a research project (Romero & Ventura, 2013). Secondary data is the data that has been already collected before and is readily available from other sources. Regarding data collection procedure, the study developed a timetable for data collection and scheduled appointments with the respondents, specifying in detail the date, time and place where the data was to be collected. Procurement managers or the Production manages were considered key informants and respondents to the questionnaire due to their knowledge and skills in the key areas of the study and therefore gave reliable information. Consequently, the unit of analysis was 150 large manufacturing firms while the unit of observation was 150 Procurement managers.

The questionnaires were hand delivered by a research assistant to the respondents who were expected to answer the questions and return the questions back later (drop and pick questionnaire). The questions were close ended where a number of alternative answers were chosen by the respondent. The respondents were required to give their independent view regarding the contributions of reverse logistics practices on manufacturing firm performance in Kenya. Questionnaires were used to collect primary data for the study while secondary data was provided by the respondents. A questionnaire is a research instrument consisting of a series of questions and prompts responses for the purpose of gathering information from respondents (William *et a*l., 2013). Primary data was collected using a self-administered questionnaire. The questionnaire was supposed to explore the selected respondent's observations, views and opinions on the variables under study. This method was preferred because of the technical nature of items in the scale and the need to ensure reliability of responses from the respondents.

3.7 Pilot Study

According to Baskarada (2014), a pilot study is always necessary in order to test the reliability and validity of the data collection instruments. A pilot study was undertaken for the purpose of pre-testing the data collection instruments for reliability and validity. The pilot study was conducted from procurement managers of manufacturing firms in Thika region. Thika region borders Nairobi County on the eastern side. It has a good communication network suitable for industrial growth. This has led to many industries transferring from Nairobi to Thika. The study therefore found it as an ideal area for pilot study.

The firms used in the pilot study did not participate in the final study. The purpose of the pilot study was to check on the suitability and clarity of the design, relevance of the information being sought, the language used and the content validity of the instruments from the responses received and the reliability of the research instruments. The pilot study was also used to identify any item in the questionnaire that may be ambiguous or unclear for the respondents. Such items were changed thereby improving the validity. Saunders *et al*., (2009) indicates that the ideal pilot study can be computed by taking 10% of the sample size.

3.7.1 Validity of the Research Instruments

Validity is the accuracy and meaningfulness of interference which are based on the research results (Rea & Parker 2014). It refers to the extent to which an instrument measure what it is supposed to measure. To ensure face validity the study critically examined each question against study objectives and how they were answered by the supply chain procurement manager's then the necessary adjustments were made. The content validity of the data collection instruments was determined through discussing the research instrument with the supervisors. The questionnaire was formulated and operationalized as per the study variables to ensure adequacy and representativeness of the items in each variable in relation to the purpose and objectives of the study. Construct validity refers to how well you translated or transformed a concept, idea, or behavior (construct) into a functioning and operating reality that is the operationalization (Trochim, 2006). Construct validity was achieved through restricting the questions to conceptualization of the variables and ensuring that indicators of each variable fell with the same construct. The purpose of this check was to ensure that each measure adequately assessed the construct it purported to assess.

3.7.2 Reliability of the Research Instruments

Reliability is consistency of measurement or stability of measurement over a variety of conditions in which basically the same result should be obtained (McKinney & Abbott 2013). They stated that reliability is the extent to which a given measuring instrument produces the same result each time it is used. This study adopted the internal consistency method to estimate test reliability. Internal consistency is tested using the Cronbach's alpha.

Cronbach's alpha measures consistency within the instrument and questions how well a set of items measure a particular behavior or characteristic within the test. Cronbach's alpha is a reliability coefficient that indicates how well items in a set are positively correlated to one another. The Cronbach's alpha coefficient should range between 0 and 1. Higher alpha coefficient values means that scales are more reliable. Acceptable alpha should be at-least 0.70 or above. Using the formulae below, which is Cronbach‘s alpha basic equation and an extension of the Kuder-Richardson formula 20 (KR-20), reliability coefficient of internal consistency was determined.

$$KR - 20 = \frac{(K)\ (S2 - \Sigma S2)}{(S2)\ (K - 1)}$$

Where:

KR-20 = Reliability coefficient of internal consistency

K = Number of questions used to measure the reliability

ΣS2 = Total variance of overall scores on the entire test

S2 = Variance of scores on each question.

3.8 Data Analysis and Presentation

Data analysis involves goals, relationships, decision making, and ideas in addition to working with the actual data itself. Simply put, data analysis includes ways of working with data to support the goals and plans of research. Data analysis can be categorized into descriptive (describes a set of data), exploratory (analyzing data sets to find previously unknown relationships), inferential (use a relatively small sample of data to say something about a bigger population); predictive (analyze current and historical facts to make predictions about future events), causal (To find out what happens to one variable when you change another) and mechanistic (Understand the exact changes in variables that lead to changes in other variables for individual objects).

The study adopted both descriptive and inferential data analysis. Descriptive statistics was used to summarize the basic features of data sets through measures of central tendency (mean, mode and median), dispersion (standard deviation, range, variance and quartiles) and distribution (skewness and kurtosis) as explained by (O'Leary, 2005). Descriptive statistics allow the study to describe variables numerically (Saunders et al., 2012). The goal of inferential statistics is to draw conclusions that extend beyond immediate data. Inferential analysis is concerned with the various tests of significance for testing hypotheses in order to determine with what validity data can be said to indicate conclusions. It is also concerned with the estimation of population values.

Descriptive data analysis was adopted for this study in order to describe the basic features of the data. The study also adopted inferential data analysis in order to enable it reach conclusions that extended beyond the immediate data alone to infer from the sample data about the population. Inferential statistics facilitate inferences from sample data to population conditions (Cressie, 2015). Qualitative data was analysed using Content Analysis. This is a method used to analyze and interpret verbal data, or behavioral data. Content analysis is a research technique used to make replicable and valid inferences by interpreting and coding textual material. By systematically evaluating texts or oral communication, qualitative data can be converted into quantitative data.

3.8.1 Statistical measurement model

The study used SPSS to facilitate the analysis of data. The study utilized SPSS to develop a multiple regression model to make inferences on the effect of each of the independent variables on the dependent variable. Both Correlation and Multiple Regression analysis were used to test the relationship between the independent variables and the dependent variables. Regression model equation was expressed as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

Where: Y = Manufacturing firm performance

β_0 = Y intercept

X_1 = Disposition

X_2 = Recycling

X_3 = Reverse Product flow

X_4 = End-of-Life Management

ε = Error term

β_{1-n} is the regression co-efficient or change induced by X_1, X_2, X_3, and X_4, on Y. It determines how much each (X_1, X_2, X_3, and X_4) contribute to Y. These coefficients indicate the value of the respective dependent variable when the independent variable is equal to zero. The various research hypotheses were tested using t- tests. If the p value ≥ 0.05, the research hypothesis was accepted.

3.8.2 Moderating Model

Firm resources are variously measured in terms of human resource, infrastructure, technology, finance or market value of equity. Firm resources moderated the relationship between organization learning, organizational innovation and organizational performance (Kannadhasan and Nandagopal, 2011). However, the relationship is more pronounced in large firms than that of smaller firms (García-Zamora *et al.*, 2013). The moderating model tests whether the prediction of a dependent variable Y, from an independent variable X, differs across levels of a third variable. Z Moderator variables affect the strength and/or direction of the relation between a predictor and an outcome: enhancing, reducing, or changing the influence of the predictor. Detailed descriptions of moderator effects and a framework for their estimation and interpretation were presented (Hayes, 2013). The following regression equation was used to express the indirect relationship between the independent variables, moderating variables and the dependent variable.

The regression model after moderation was as follows:

$$Y = \beta_0 + \beta_1 X_1{*}Z + \beta_2 X_2{*}Z + \beta_3 X_3{*}Z + \beta_4 X_4{*}Z + \varepsilon \text{ ....(ii)}$$

Where:

Y = Dependent Variable, Manufacturing firm performance

β_0 = Y intercept (constant)

X_1 = Disposition

X_2 = Recycling

X_3 = Reverse Product flow

X_4 = End-of-Live Management

ε =Error term

Z = the hypothesized moderator (Firm resources)

B_1Z is the coefficient of X_1Z the interaction term between firm performance and each of the independent variables for 1=1, 2, 3, 4

3.9 Diagnostic Tests

Lewis-Beck & Lewis-Beck (2015) indicated that in order to have a regression model and estimates that mean something we should be sure that the assumptions are reasonable and that the sample data appear to be sampled from a population that meets the assumption. For this purpose, Field (2013) recommended that normality, linearity and heteroscedasticity should be conducted when checking for relationship between the independent and dependent variable. Other tests to be conducted for this study will be confirmatory factor analysis and Multicollinearity.

3.9.1 Multicollinearity Test

Multicollinearity is a case of multiple regression in which the predictor variables are themselves highly correlated. The presence of Multicollinearity has a number of potentially serious effects on the least squares estimates of the regression coefficients the most significant of which is leading to the acceptance of the null hypothesis more readily (Cohen, *et al*., 2013). Multicollinearity diagnostics are conducted using variance inflation factor (VIF) and tolerance statistics. The variance inflation factor (VIF) for each term in the model measures the combined effect of the dependences among the regressors on the variance of that term. A VIF of greater than 5 is generally considered evidence of Multicollinearity. While a tolerance statistic of less than 0.20 is also taken as a course for Multicollinearity concern.

3.9.2 Normality Test

A test for outliers within the constructs will be done and the ones identified will be dropped. Outliers are cases or observations showing characteristics or values that are markedly different from the majority of cases in a data set and should be dropped (Sarstedt & Mooi, 2014). This is because they distort the true relationship between variables, either by creating a correlation that should not exist or suppressing a correlation that should exist (Abbott & McKinney, 2013). To test for outliers Mahalanobis d-squared will be used for multivariate testing on the dependent and independent variables.

3.9.3 Linearity Test

The linear relationship of the independent variables to the dependent variables was tested using Pearson's correlation coefficient between the manufacturing firm performance and each of the hypothesized explanatory variables as proposed by (Mahmood, Qadeer & Ahmed, 2014). Correlation coefficient shows the strength as well as the direction of the linear relationship. A negative correlation indicates an inverse relationship where an increase in one variable causes a decrease in the other, whereas a positive correlation indicates a direct influence, where an increase in one variable causes an increase in the other variable (Field, 2013).

3.9.4 Heteroscedasticity Test

One of the problems commonly encountered in cross-sectional data is heteroscedasticity (unequal variance) in the error term. There are various reasons for heteroscedasticity, such as the presence of outliers in the data, or incorrect functional form of the regression model, or incorrect transformation of data, or mixing observations with different measures of scale.

Heteroscedasticity was tested using Breush-Pagan test as recommended by Melanie and Eriikka (2013). This tested the null hypothesis that the error term has constant variance versus the alternative, and that the error term variances are not constant. This means that the error terms are multiplicative function of one or more variables. P value ≤ 0.05 would imply there will be heteroscedasticity (no constant variance in the error term) and would lead to rejection of null hypothesis at 5 percent level of significance.

3.9.5 Confirmatory Factor Analysis

Factor analysis acts as a gauge of the substantive importance of a given variable to the factor and it is used to identify and remove hidden constructs or variable items that do not meet the objectives of the study and which may not be apparent from direct analysis (Ragin, 2014). Communalities will be used to indicate the substantive importance of variable factors where a loading value of 0.7 as a rule of thumb is believed to be satisfactory (Timothy, 2015).

3.10 Operationalization and Measurement of Variables

The dependent variable in this study was performance of manufacturing firm while reverse logistic practices formed the independent variables. Table 3.2 presents a description of the study variables and how they were operationalized.

Table 3.2: Operationalization of the Research Variables

Variable	Nature	Operationalization	Measurement
Disposition Practice	Independent variable	• Refurbishing. • Remanufacturing. • Repackaging • Reconditioning	Aggregated index of management judgment on 1-5 scale
Recycling Practice	Independent variable	• Returnable packages • Recalls • Trade in's • Product recoveries	Aggregated index of management judgment on 1-5 scale
Reverse Product flow Practice	Independent variable	• Manufacturing. • Distribution • Retailing • Warranty	Aggregated index of management judgment on 1-5 scale
End-of-Life Management Practice	Independent variable	• Product characteristics • Waste Material handling • Environmental legislation • Waste Disposal	Aggregated index of management judgment on 1-5 scale
Firm Resources	Moderating Variable	• Technology • Finance • Manpower • Infrastructure	Aggregated index of management judgment on 1-5 scale
Performance of Large Manufacturing firms	Dependent Variable	• Customer Satisfaction • Productivity • Cost	Aggregated index of management judgment on 1-5 scale

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter covers the interpretations of the findings of the study objectives. The study sought to investigate the relationship between reverse logistics practices and the performance of large manufacturing firms in Kenya. The first section covers results of the response rate, diagnostic tests, bio data of the organizations that responded to the questionnaire and descriptive statistics. The second section covers inferential statistics on each variable of the study, hypothesis tests results and their interpretation to show extent to which reverse logistics practices contribute to the performance of the manufacturing firms in Kenya, multiple regression results and finally the adopted model from the study.

4.2 Response Rate

Out of the 150 firms sampled, 129 were responsive which represents a response rate of 86 percent. According to Kamel & Lloyd (2015) response rate of above 50 percent in business management research should be considered good. Therefore, the 86 percent response rate reported for this study formed an acceptable basis for drawing conclusions. However, the non-response rate of 14 percent could introduce a bias in estimates and also contribute to an increase in the total variance of estimates since the sample size observed was reduced from that originally sought. To correct the bias, the sample weighting procedure was used to assign a weighting factor to every contacted person by which the corresponding data was multiplied (Chris & Ben, 2012). This ensured that the regression coefficients would be estimated consistently since the effect of missing data was eliminated. Data was coded and then cleaned through extensive checks for consistency. Secondary data especially published financial statements were particularly useful for validating the managers responses on the questionnaire. Data analysis was conducted using a set of descriptive and inferential statistics by the statistical package of social sciences (SPSS).

Table 4.1: Response Rate

Response rate	Sample size	Percentage %
Returned questionnaires	129	86
Un-returned questionnaires	21	14
Total	**150**	**100**

4.3 Pilot study results

The purpose of the pilot study was to test the reliability of the research instruments. Reliability of an instrument refers to its ability to produce consistent and stable measurements. According to Baskarada (2014), a pilot study is always necessary in order to test the reliability and validity of the data collection instruments. A pilot study was undertaken for the purpose of pre-testing the data collection instruments for reliability and validity.

4.3.1 Reliability Analysis

The most common reliability coefficient is the Cronbach's Alpha which estimates internal consistency by determining how all items on a test relate to all other items and to the total test, internal coherence of data. The reliability is expressed as a coefficient between 0 and 1. The higher the coefficient, the more reliable the test is. To ensure the reliability of the instrument, Cronbach's Alpha was used to test the reliability of the proposed constructs.

The study adopted the internal consistency method. Reliability is consistency of measurement (Bollen, 1989), or stability of measurement over a variety of conditions in which basically the same results should be obtained. The internal consistency method was adopted because it is more stable than the other methods (Cooper & Schindler, 2011). Internal consistency is tested using the Cronbach's Alpha statistic. For a test to be internally consistent, Drost (2011) suggests that estimates of reliability should be based on the average inter correlations among all the single items within a test. Pallant (2010) advises that where Cronbach's Alpha coefficient is used for reliability test; the value should be above 0.7.

The reliability of the individual items was measured by examining the internal consistency values of the items on their corresponding constructs. Cronbach's Alpha (Cronbach, 1979) measure of internal consistency was done to check the consistency of construct items. Reliability was conducted on each scale of the constructs. The Cronbach's Alpha value for the variables ranged from 0.740 to 0.943 as indicated in table 4.2. All the retained scale items for the study variables were therefore maintained for further analysis as they achieved the required thresholds for reliability.

Table 4.2: Reliability Test of the Instruments

Composite Variable	Cronbach's Alpha	Number of items	Conclusion
Disposition Practice	0.740	12	Reliable
Recycling Practice	0.768	16	Reliable
Product flow Practice	0.924	12	Reliable
End-of-Life management Practice	0.943	13	Reliable
Firm resources	0.879	12	Reliable
Firm performance	0.794	7	Reliable

To ensure validity the study critically examined each question against study objectives and how they were answered by the supply chain procurement manager's then the necessary adjustments were made.

4.4 Demographic Information of the Respondents

Demographic data is information about groups of people according to certain attributes such as age, sex, and place of residence. It can include socioeconomic factors such as occupation, family status, or income. Demographics comprise an array of socioeconomic information, including the breakdown of a population by gender, age, markets served, income, employment status, company ownership foreign or local and years in operation.

4.4.1 Ownership of the company

The study sought to find out the distribution of ownership of companies. Business ownership refers to the legal control over a business. It gives the owner the legal capacity to dictate the business operations and dealings. The results indicated on Table 4.3 shows that majority 47% of companies were both foreign and locally owned. 43% of the firms were foreign owned and 10% were locally owned. This indicates that most large manufacturing companies in Kenya are partly owned by Kenyans and the rest by foreigners. There is likelihood that most of the income goes to the foreign members.

Table 4.3: Ownership of the Company

Type	Frequency (n)	Percentage %
Local	10	10
Foreign	59	43
Foreign and Local	60	47
Total	**129**	**100**

4.4.2 Markets Served

The study sought to establish the distribution of market served. Markets served are that part of the total market which a company decides to target, also called the Target Market. Table 4.4 shows the distribution of market sharing from different companies. The findings revealed that 46% of the companies served both domestic and foreign markets while 45% served domestic market only. Only 9% served foreign markets. Large scale firms have the capacity to serve local and foreign markets. When their performance is improved, they bring more foreign exchange.

Table 4.4: Marked Served

Type	Frequency (n)	Percentage %
Domestic markets only	58	45
Foreign Market only	12	9
Domestic and Foreign	59	46
Total	**129**	**100**

4.4.3 Number of years the organization has been in operation in Kenya

The study sought to establish the existence of the organization in Kenya. Everything that happens within a company to keep it running and earning money is referred to collectively as business operations. Year of operation means the period from January in one year to 31st December the end of year or such other yearly accounting period as the Association may from time to time adopt in general meeting. Table 4.5 indicates that majority 60.5 % of the organization were in existence for more than 30 years, 12.4% were in existence between 21 to 30 years, 17.1% between 11 to 20 years while 10.0% were less than 10 years.

Table 4.5: Number of years the organization has been in operation in Kenya

Existence	Frequency	Percentage (%)
Less than 10 years	13	10.0
11 to 20 years	22	17.1
21 to 30 years	16	12.4
More than 30 years	78	60.5
Total	**129**	**100.0**

4.4.4 Reverse logistics activities in-house.

Organizations use reverse logistics when goods move from their destination back through the supply chain to the seller and potentially back to the suppliers. The goal is to regain value from the product or dispose it of. Worldwide, returns are worth almost a trillion dollars annually, and have become increasingly common with the growth of ecommerce. The results presented in figure 4.1 indicate that majority 86% of the organizations perform their Reverse logistics activities in-house while 14% don’t.

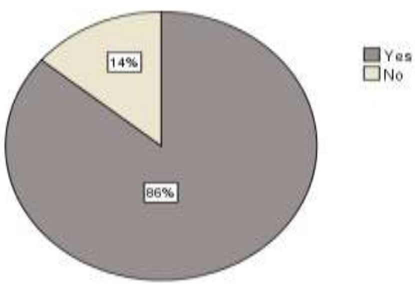

Figure 4.1: Reverse logistics activities in-house

4.4.5 Annual Turnover.

Turnover is a measure of total income from sales, whereas profit is total income minus expenses. Turnover is a concept in accounting that shows how quickly a company runs its business. The results presented in Table 4.6 indicate that majority of the firm 99.22% had an annual turnover of above 101M.

Table 4.6: Annual turnovers

Annual turnover	Frequency (n)	Percentage (%)
Below Kshs 50 million (small)	0	0.00
Between Kshs 51M and 100M (medium)	1	0.78
Above Kshs 101M (large)	128	99.22
Total	**129**	**100.0**

4.5 Descriptive Analysis of the Study

This section presents descriptive analysis for the study variables. Descriptive statistics are used to summarise the basic features of data sets through measures of central tendency: mean, mode, median, dispersion, standard deviation, range, variance, quartiles, distribution, skewness and kurtosis (O'Leary, 2005). Descriptive statistics allow the study to describe variables numerically (Saunders et al., 2012). The purpose of descriptive statistics is to enable the researcher, to meaningfully describe a distribution of scores or measurements using indices or statistics.

4.5.1 Disposition Practice

The variable consisted of twelve items. Each scale was rated on a five-point Likert type scale ranging from 1 for "Strongly Disagree (SD)," to 5 denoting "Strongly Agree (SA)". In statistics, the range is the spread of data from the lowest to the highest value in the distribution. It is a commonly used measure of variability. Along with measures of central tendency, measures of variability give the descriptive statistics for summarizing the data set. The average mean scale ratings ranged from 3.829 to 4.907. This indicated that the respondents believed that Disposition Practice exhibit moderate to high levels of implementation as part of reverse logistics. The highest mean rating was 4.907 for the statement “Remanufacturing aims to make the product’s quality standard.” (SD= 0.363, n = 129). The statement with the lowest mean rating of 3.829 was “Refurbishing offers reduction in unit cost of product” (SD = 0.588, n = 129). The composite average of Disposition Practice was 4.373 (SD =0.538) which was a high rating indicating that on average, Disposition Practice is highly implemented as part of reverse logistics.

The study further showed that 63% of the respondents agreed that refurbishing offer reduction in unit cost of product, 27% of the respondents were non-committal while none of the respondents disagreed. Also, 98% of the respondents agreed that remanufacturing aims to make the product’s quality standard 2% of the respondents were non-committal while none of the respondents disagreed as shown Table 4.7. It was evident that respondents overwhelmingly agreed by over 70% that disposition practice has an influence on manufacturing firm performance. These findings were in line with Arrieta (2015) who in his study highlighted that if the product has sufficiently high value and the quality of returned product is good enough for recapturing value, then product can be remanufactured because of higher re-sale value. The option of reconditioning parts had an average response as only 47% strongly agreed that it makes the product perform better. In terms of repackaging, more than 50% of the respondents accepted that it gives the product a new face which is more attractive to customers.

Table 4.7: Disposition Practice

Disposition Practice	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	Std. Dev.
Refurbishing offers reduction in unit cost of product.	0	0	27	63	10	3.829	0.588
Reconditioning aims at improving the product's performance.	0	0	9	45	47	4.380	0.640
Reconditioning extends the service life of product	0	0	17	66	17	4.000	0.586
Refurbishing brings product quality to an acceptable level.	0	0	24	30	46	4.217	0.810
Remanufacturing brings Reduced material acquisition cost.	0	0	2	77	21	4.186	0.447
Remanufacturing aims to make the product's quality standard.	0	0	2	5	93	4.907	0.363
Remanufacturing makes product performance like that of a new one.	0	0	3	62	35	4.318	0.530
Remanufacturing aims to capture value from the returned products.	0	0	2	31	67	4.643	0.527
Repackaging changes the entire look of the products	0	0	0	47	53	4.527	0.501
Repackaging can occur as a result of complaints from consumers	0	0	0	39	61	4.612	0.489
Repackaging makes the product more suitable and appealing to their customers	0	0	0	66	34	4.341	0.476
Repackaging helps firms assess their consumer needs and repackage their products into more convenient way.	0	0	0	49	51	4.512	0.502
Composite						**4.373**	**0.538**

From the two statements below the views of the respondents show that large manufacturing firms understand and make use of disposition practice as part of reverse logistics. Hence, they understand the fact that there is more value in products that have been repaired or refurbished as compared to those that are sold as scrap or salvage.

Disposition Practice in reverse logistics has some contribution to the overall success of the firm operations.

	Frequency	Percent	Cumulative %
Yes	129	100.0	100.0

Rate your firm's implementation of disposition Practice as part of reverse logistics

	Frequency	Percent	Cumulative %
Good	53	41.1	41.1
Excellent	76	58.9	100.0
Total	129	100.0	

4.5.2 Recycling Practice

The Recycling Practice variable consisted of sixteen items. Each scale was rated on a five-point Likert type scale ranging from 1 for "Strongly Disagree (SD)," to 5 denoting "Strongly Agree (SA)". In statistics, the range is the spread of data from the lowest to the highest value in the distribution. It is a commonly used measure of variability. Along with measures of central tendency, measures of variability give the descriptive statistics for summarizing the data set. Table 4.8 shows that the average scale ratings ranged from 3.829 to 4.806. This indicated that the respondents believed that Recycling Practices exhibit moderate to high levels of implementation as part of reverse logistics.

The highest mean rating was 4.806 for the statement "The Firm allows packages to be returned to the manufacturers for recycling instead of becoming waste." (SD = 0.452, n = 129). The statement with the lowest mean rating of 3.829 was "Returnable packages provides proper Obsolete." (SD = 1.039, n = 129). The composite average of Recycling Practices was 4.285 (SD = 0.786) which was a high rating indicating that on average, Recycling Practices is highly implemented as part of reverse logistics. The recovery process consists of several highly inter-related sub-processes: product acquisition, reverse logistics, inspection and disposition, distribution and selling of the recovered products (Ait-Kadi et al., 2012). Majority of the respondents 82.9% confirmed that recycling practice contributes to the performance of the firm. This implies that firms should return any unused or defective product for recycling purposes. The study findings clearly indicate that not all packages which are returned can be used for recycling. Only 33% agreed that such returned packages can be made to be useful products to avoid waste. As for product recalls 70% of the respondents strongly agreed that their firms recall products to avoid the risk of legal action if the customers are harmed by the products as most of such products have a defect in them. The study found that 62% of the respondents strongly agreed to the fact that Trade-ins increase overall margins and average sale size, and help recycle used merchandise. Only 50% of the respondents agreed that recovery prevents waste by diverting materials from landfills and conserves natural resources. This is an indicator that not all recoverable materials can be recycled.

Table 4.8: Recycling Practice

Recycling Practice	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	S.Dev
Returnable packages provide proper obsolete product disposition	0	0	9	45	47	4.380	0.640
Returnable packages facilitate the process of recycling to avoid wastage of useful products.	0	13	24	29	33	3.829	1.039
The Firm allows packages to be returned to the manufacturers for recycling instead of becoming waste.	0	0	2	15	83	4.806	0.452
Returnable packages have allowed the firm to save on the cost of production by the use of the already available packaging devices.	0	0	28	26	47	4.186	0.846
The firm recalls products dispatched to customers due to faults detected on the products.	0	0	32	15	53	4.217	0.901
The Firms recalls products dispatched to customers due to risks posed to consumers if they use them.	0	1	29	34	36	4.047	0.828
The firm recalls products to avoid the risk of legal action if the customers are harmed by the products	0	0	13	17	70	4.566	0.716
The firm has a system of trading in products which the customer would want to dispose	0	5	20	39	36	4.070	0.868
The process of trade-ins allows the firm to receive discounts on the initial sale.	0	2	2	55	40	4.333	0.641
Trade-ins increase overall margins and average sale size and merchandise	0	2	19	16	62	4.380	0.877
The firm has a trade-in facility on prices of new item in exchange for older item.	0	2	7	58	33	4.209	0.669

Use of trade-in systems creates customer satisfaction.	5	0	2	36	57	4.411	0.924
Use of production recoveries improves the lead time of production process	2	0	12	49	36	4.171	0.821
Use of production recoveries reduces waste and increases profitability	0	2	8	65	25	4.124	0.637
Product recovery aims at recovering the residual value of used products.	0	0	12	30	58	4.465	0.696
Recovery prevents waste by diverting materials from landfills and conserves natural resources	0	0	7	50	43	4.364	0.612
Composite						**4.285**	**0.760**

From the two statements the below views of the respondents show that large manufacturing firms understand and make use of recycling practice as part of reverse logistics. Hence, they understand the fact that there is more value in products that have been recycled as compared to those that are sold as scrap or salvage.

Recycling Practice contributes to the overall success of the firm operations.

	Frequency	Percent	Cumulative %
Yes	107	82.9	82.9
No	22	17.1	100.0
Total	129	100.0	

Rate your firm's implementation of Recycling Practice as part of reverse logistics

	Frequency	Percent	Cumulative %
Terrible	22	17.1	17.1
Fair	25	19.4	36.4
Good	50	38.8	75.2
Excellent	32	24.8	100.0
Total	129	100.0	

4.5.3 Reverse Product Flow Practice

The Reverse Product Flow Practice variable consisted of twelve items. Each scale was rated on a five-point Likert type scale ranging from 1 for "Strongly Disagree

(SD),” to 5 denoting “Strongly Agree (SA)”. The range is the spread of data from the lowest to the highest value in the distribution. It is a commonly used measure of variability. Along with measures of central tendency, measures of variability give the descriptive statistics for summarizing the data set. Table 4.9 shows that the average scale ratings ranged from 4.008 to 4.736. This indicated that the respondents agreed that Reverse Product Flow Practice exhibit high levels of implementation as part of reverse logistics.

The highest mean rating was 4.736 for the statement “Distribution returns are initiated by a supply chain actor during distribution, after the product has been made (SD = 0.442, n = 129). The statement with the lowest mean rating of 4.008 was “The firm returns final products that fail quality checks.” (SD = 0.843, n = 129). The composite average of Reverse Product flow Practice was 4.345 (SD = 0.674) which was a high rating indicating that on average, Reverse Product flow practice is highly implemented as part of reverse logistics. The findings concur with the study done by Chhaya, (2017), which purported that, actors in reverse logistics networks can be divided into internal actors such as OEMs, suppliers, distributors, customers, service providers and external actors like governmental, non-governmental, and industrial organizations. The study findings indicate that reverse product returns start at the manufacturing level. At this level 77% of the respondents strongly agreed that the production leftovers are returned for recycling purposes while 51% agreed that the firm returns products found with defects during production phase. This is a clear indicator that reverse logistics starts right from the point of production down to the end user. It was found that 74% of the respondents strongly agreed to the fact that distribution returns are initiated by a supply chain actor during distribution, while at the same time 71% agreed that distribution returns in the reverse supply chain take place between the distributor and the manufacturer. Only 48% of the respondents agreed that end user returns are those that are initiated by the user of the product as a result of consumption. This was because some of the returns at the retail level were due to manufacturing defects which were not detected.

Table 4.9: Reverse Product Flow Practice

Reverse Product Flow Practice	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	S.Dev
The firm returns products found with defects during production phase	0	5	5	51	40	4.256	0.753
The firm returns final products that fail quality checks	2	5	7	62	24	4.008	0.843
The production leftovers are returned for recycling purposes.	0	0	7	16	77	4.698	0.594
The by-products and scraps are returned for recycling or proper disposal.	0	0	7	70	23	4.163	0.527
Distributors receive goods for repair to return which can then be resold to the retailer or customer	0	5	7	41	47	4.310	0.798
Distribution returns in the reverse supply chain take place between the distributor and the manufacturer	0	0	7	71	22	4.147	0.517
Distribution returns are initiated by a supply chain actor during distribution, after the product has been made.	0	0	0	26	74	4.736	0.442
The firm returns products found with defects during distribution process	0	0	0	36	64	4.636	0.483
Retailers accept product returns from the end customers and distribute them back into the reverse supply chain,	0	2	7	53	37	4.256	0.688
The retailers also participate in reselling the repaired or refurbished products.	0	5	0	45	50	4.411	0.725
User returns are those that are initiated by the user of the product as a result of consumption.	2	5	7	48	38	4.147	0.911
The firm returns products found with defects at the retailing level	0	7	0	42	51	4.372	0.811
Composite						**4.345**	**0.674**

From the statements below the views of the respondents show that large manufacturing firms understand and make use of Reverse Product Flow Practice as part of reverse logistics. Hence, they understand the fact that there is more value in products that have been returned reprocessed as compared to those that are sold as scrap or salvage. There is also a market for harvesting product components and selling them as spares (Kotler, 2015).

Reverse product flow contributes to the overall success of the firm operations.

	Frequency	Percent	Cumulative %
Yes	129	100.0	100.0

Rate your firm's implementation of Reverse Product Flow Practice as part of reverse logistics.

	Frequency	Percent	Cumulative %
Good	22	17.1	17.1
Excellent	107	82.9	100.0
Total	129	100.0	

4.5.4 End-of-Life Management Practice

The End-of-Life Management Practice variable consisted of twelve items. Each scale was rated on a five-point Likert type scale ranging from 1 for "Strongly Disagree (SD)," to 5 denoting "Strongly Agree (SA)". In statistics, the range is the spread of data from the lowest to the highest value in the distribution. It is a commonly used measure of variability. Along with measures of central tendency, measures of variability give the descriptive statistics for summarizing the data set. Table 4.10 shows that the average scale ratings ranged from 4.101 to 4.651. This indicated that the respondents agreed that End-of-Life Management Practice exhibit high levels of implementation as part of reverse logistics.

The highest mean rating was 4.651 for the statement "Our firm has a system of waste material handling through which waste is properly disposed (SD = 0.608, n = 129). The statement with the lowest mean rating of 4.101 was "EOL concerns include disposing of the existing product responsibly." (SD = 0.748, n = 129). The composite average of End-of-Life Management Practice was 4.363 (SD = 0.680) which was a high rating indicating that on average, End-of-Life Management Practices is highly implemented as part of reverse logistics. The findings are in line with the study carried by Guerrero, Maas and Hogland (2017) which outlined the importance of recycling as a waste management strategy due to its ability to reduce disposal costs and waste transport costs and to prolong the life span of sanitary landfill sites. Only 55% of the respondents agreed to the fact that waste from firms includes different waste streams arising from production processes. This is because waste can be generated at any level of the supply chain. Majority of firms had waste material handling in place as 74% of the respondents strongly agreed that their firm had a system of waste material handling through which waste was properly disposed. Only 52% of the respondents agreed that their firm had implemented the environmental legislation requirements dealing with waste handling while 52% agreed proper disposal eliminates customer reluctance to handle hazardous substances in EOL product.

Table 4.10: End-of-Life Management Practice

End-of-Life Management Practice	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	S. Dev
Product characteristics should be considered before disposal or return.	0	7	2	64	26	4.101	0.748
Products are sorted and categorized during return process.	0	2	9	33	55	4.411	0.756
Waste handling involve; collection, transportation and disposal of different kinds of waste.	0	2	25	32	41	4.116	0.863
Some of the waste material is recycled to produce different products.	0	0	12	47	42	4.302	0.669
Waste from firms includes different waste streams arising from production processes.	0	0	5	55	40	4.357	0.570
Our firm has a system of waste material handling through which waste is properly disposed	0	0	7	21	72	4.651	0.608
Adherence to disposal regulations increases the firm corporate image	0	2	2	30	65	4.581	0.658
Waste disposal creates benefits to the environment	0	2	5	29	64	4.543	0.696
Our firm has implemented the environmental legislation requirements dealing with waste handling	0	2	9	52	37	4.240	0.705
Implementing proper waste disposal practice has improved the relationship with stake holders	0	0	12	21	67	4.558	0.695
Implementing proper waste disposal practice has created a conducive working environment	0	0	9	30	60	4.512	0.663
Our firm uses different disposal methods for different waste material	0	0	7	74	19	4.116	0.494
Proper disposal eliminates customer reluctance to handle hazardous substances in EOL product	0	2	9	51	37	4.233	0.713
Composite						**4.363**	**0.680**

From the two statements below the views of the respondents show that large manufacturing firms understand and make use of recycling practice as part of reverse logistics. Hence, they understand the fact that there is more value in products that have been recycled as compared to those that are sold as scrap or salvage.

End-of-Life Management practice in reverse logistics has some contribution to the overall success of the firm operations.

	Frequency	Percent	Cumulative %
Good	82	63.6	63.6
Excellent	47	36.4	100.0
Total	129	100.0	

Rate your firm's implementation of End-of-Life Management Practice as part of reverse logistics.

	Frequency	Percent	Cumulative %
Yes	103	79.8	79.8
No	26	20.2	100.0
Total	129	100.0	

4.5.5 Firm Resources

The Firm Resources variable consisted of twelve items. Each scale was rated on a five-point Likert type scale ranging from 1 for "Strongly Disagree (SD)," to 5 denoting "Strongly Agree (SA)". In statistics, the range is the spread of data from the lowest to the highest value in the distribution. It is a commonly used measure of variability. Along with measures of central tendency, measures of variability give the descriptive statistics for summarizing the data set. Table 4.11 shows that the average scale ratings ranged from 3.969 to 4.550. This indicated that the respondents agreed that level of resources Practices exhibit high levels of implementation as part of reverse logistics.

The highest mean rating was 4.550 for the statement "The firm level of manpower influences the extent to which reverse logistics practices are implemented." (SD = 0.625, n = 129). The statement with the lowest mean rating of 3.969 was "IT makes transaction of returns flow easier and more transparent than paper-based methods (SD = 0.585, n = 129). The composite average of Firm Resources Practice was 4.238 (SD = 0.669) which was a high rating indicating that on average, Firm Resources Practice is highly implemented as part of reverse logistics. The findings concur with other studies which found that the success of an effective implementation of reverse logistics relies on key factors (Nakiboglu, 2019) such as the ability to: develop a flexible organization, be customer focus, seek total supply chain coordination, develop an overall human resources management policy and enhance communication to reduce uncertainty and inventory. From the study findings 60% of the respondents agreed that the firm level of technology influences the extent to which reverse logistics practices are implemented. At the same time 49% of the respondents strongly agreed the firm level of finance influences the extent to which reverse logistics practices are implemented. Similarly, 62% of the respondents strongly agreed the firm level of manpower influences the extent to which reverse logistics practices are implemented. The firm level of infrastructure has very little influence on reverse logistics practices as only 28% of the respondents strongly agreed is had an impact.

Table 4.11: Firm Resources

Firm Resources	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	S.Dev
The firm level of technology influences the extent to which reverse logistics practices are implemented	0	2	12	60	26	4.093	0.678
Technology level improves visibility from initiation of return to ultimate disposition,	0	5	9	49	37	4.186	0.788
IT makes transaction of returns flow easier and more transparent than paper-based methods	0	2	12	73	13	3.969	0.585
The firm level of finance influences the extent to which reverse logistics practices are implemented	0	5	2	44	49	4.372	0.751
Product recovery system are challenging due to costs involved in the returns process.	0	0	16	49	36	4.202	0.689
The level of finance is a limiting factor in reverse logistics.	0	0	12	32	57	4.450	0.696
The firm level of manpower influences the extent to which reverse logistics practices are implemented	0	0	7	31	62	4.550	0.625
The firm has adequate manpower to support RL implementation	0	0	7	71	22	4.147	0.517
HRM practices influences implementation of reverse logistics in the firm.	0	0	8	46	47	4.388	0.629
The firm level of infrastructure influences the extent to which reverse logistics practices are implemented	0	0	19	53	28	4.093	0.678
The firm has adequate networking to support RL implementation	0	0	21	41	38	4.171	0.751
The existence of good RL infrastructure provides a firm with the capability to handle returns.	0	0	12	53	36	4.240	0.647
Composite						**4.238**	**0.669**

From the two statements below the respondents agreed that level of resources has an impact on the performance of large manufacturing firms and it also contributes to the success of implementing reverse logistic practices.

Firm resources in reverse logistics have some moderating contribution to the overall success of the firm operations.

End of life management practice in reverse logistics has some contribution to the overall success of the firm operations

	Frequency	Percent	Cumulative %
Yes	103	79.8	79.8
No	26	20.2	100.0
Total	129	100.0	

Rate the extent to which firm resources contribute to the success of implementing reverse logistics

	Frequency	Percent	Cumulative %
Good	31	24.0	24.0
Excellent	98	76.0	100.0
Total	129	100.0	

4.5.6 Performance of Large Manufacturing Firms

The analysis for the performance of large manufacturing firm composite scores is displayed on table 4.12. In statistics, the range is the spread of data from the lowest to the highest value in the distribution. It is a commonly used measure of variability. Along with measures of central tendency, measures of variability give the descriptive statistics for summarizing the data set. The average mean scale ratings ranged from 3.4636 to 3.7814. This indicates that the respondents rated moderately to highly levels in manufacturing firm performance. The findings of the study were also in line with what Ravi and Shankar (2015) established. In their study they found that reverse logistics is one of the most important strategic management decisions that can assist organization improve performance through enhanced productivity.

To measure manufacturing firm performance in the logistics industry, firms need to incorporate parameters on operations, efficiency and service effectiveness to ensure that they have a balanced framework (Tripathi & Gupta, 2019). Jamwal et al. (2021) introduced the concept of the balanced scorecard (BSC), which integrates the strategic objectives of manufacturing firm with the financial and nonfinancial measures. The BSC has four perspectives, namely financial perspective, customer perspective, internal business processes perspective with learning and growth perspective. The aggregate mean of 3.6142 revealed that majority of the respondents agreed with most of the statements about performance of the firm. This means that the manufacturing firms have been experiencing growth in performance based on the level of customer satisfaction, cost and productivity.

Table 4.12: Descriptive Analysis for performance

Performance construct	**N**	**Mean**	**Std. Dev.**
Annual Productivity in metric tons	129	3.6884	0.35523
Total Production Revenue	129	3.7814	0.45514
Average Lead time in weeks	129	3.5535	0.36701
Total number of rejected Items per week	129	3.4977	0.55852
Total number of customer complaints in product performance	129	3.7550	0.55014
Total number of products returned by customers	129	3.4636	0.37831
Total number of product failures/rejects	129	3.5597	0.66539
Composite		**3.6142**	**0.4757**

4.6 Diagnostic Tests

This section displays how tests for assumption of multiple linear regressions were carried out. The results of the tests for the model assumptions are as herein presented. The diagnostic tests carried out in the study included the normality test, the linearity test, test for multicollinearity, and the test for heteroscedasticity. The findings are shown systematically per each test.

4.6.1 Test for Multicollinearity

Multicollinearity was performed on the data by examining VIF (variance inflation factor) and assessing the tolerance (1/VIF). Independent variables are considered collinear if the value of VIF exceeds 3 (Schwarz, Schwarz and black, 2014). Table 4.13 Presents VIF values ranged from 1.251 and 1.662 implying that multicollinearity is not a problem in the data.

Table 4.13: Test for Multicollinearity

Model	Collinearity Statistics	
	Tolerance	**VIF**
Disposition Practice	0.735	1.361
Recycling Practice	0.7 02	1.424
Reverse product flow Practice	0.702	1.425
End-of-Life management Practice	0.602	1.662
Level of Resources	0.799	1.251

a. Dependent Variable: Firm Performance.

4.6.2 Test for Normality

The graphical analysis results showed the line representing the actual data distribution closely follow the diagonal in the normal Q-Q plot as shown in figures 4.2 to 4.7, suggesting normal distribution (Hair, Tatham, Anderson & Black, 2006). In q-q plot, or the normal probability plot, the observed value for each score is plotted against the expected value from the normal distribution, where, a sensibly straight line suggests a normal distribution (Pallant, 2007). By and large, if the points in a q-q plot depart from a straight line, then the assumed distribution is called into question.

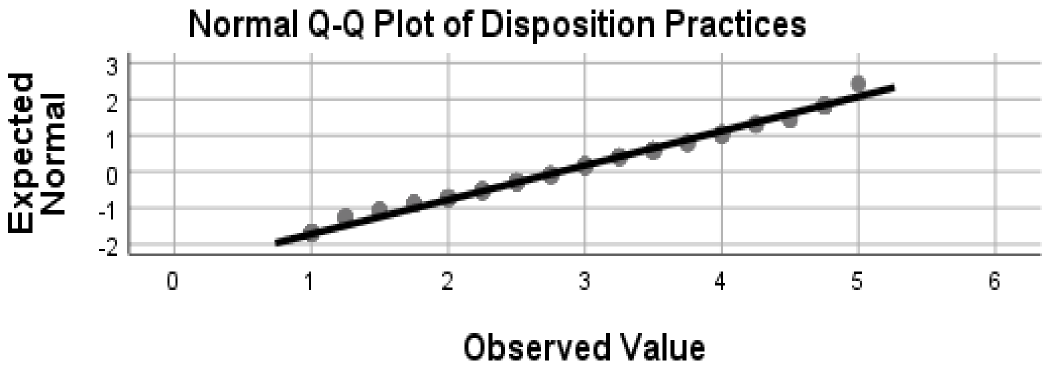

Figure 4.2: Normal Q-Q plot of Disposition practices

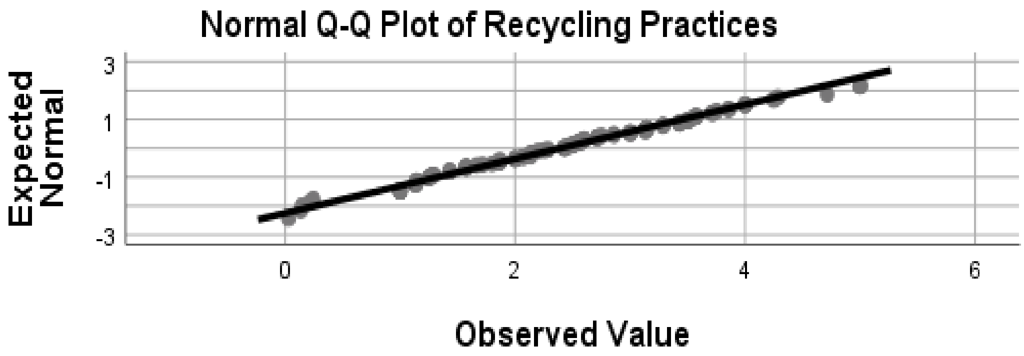

Figure 4.3: Normal Q-Q plot of recycling practice

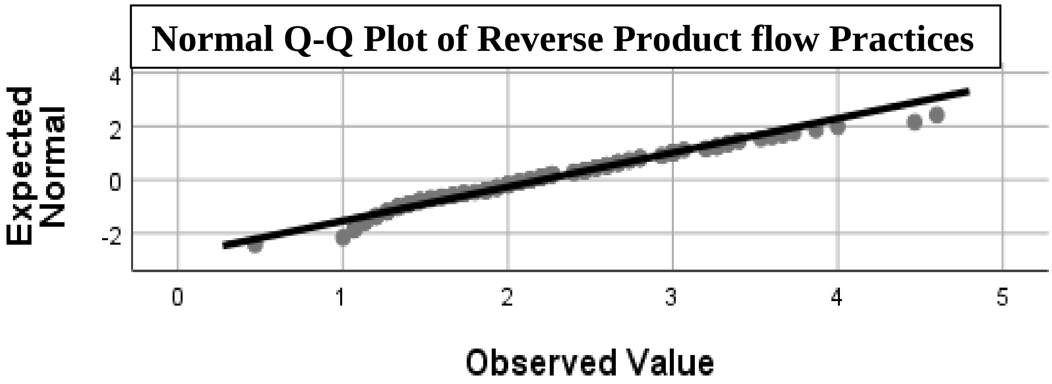

Figure 4.4: Normal Q-Q plot of Reverse product flow practice

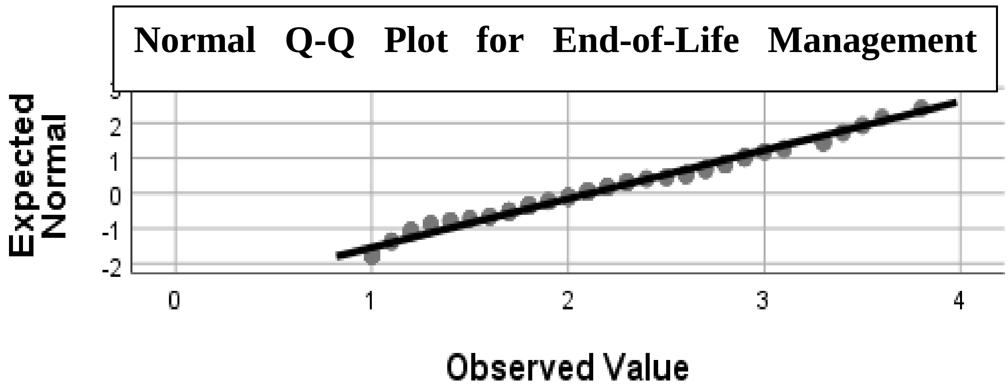

Figure 4.5: Normal Q-Q plot for End-of -Life management practice

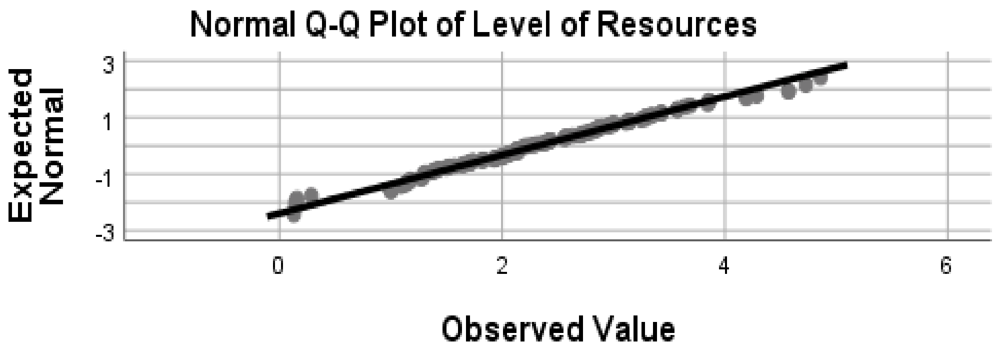

Figure 4.6: Normal Q-Q plot of firm resources

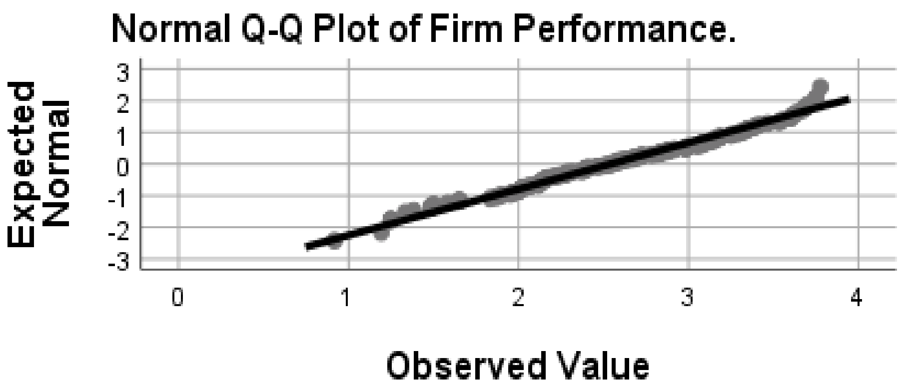

Figure 4.7: Normal Q-Q plot of firm performance

4.6.3 Test for Normality using Shaphiro Wilk

Shaphiro wilk test is a robust test for normality that generates a p-value that indicates whether the probability estimation follows normal distribution. Shaphiro wilk test is performed on all predictors and the dependent constructs. The test concludes that data is normal if the p-value is not less than 0.05 (Shapiro & Wilk, 1965). Table 4.14 Indicates that the significance levels of all the variables were more than 0.05, which is a clear indication that all the variables were normally distributed and therefore other statistical analysis would be carried out on the data.

Table 4.14: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	**Df**	**Sig.**	**Statistic**	**Df**	**Sig.**
Disposition Practice	0.074	129	0.082	0.969	129	0.079
Recycling Practice	0.057	129	0.200*	0.986	129	0.233
Reverse Product Flow Practice	0.072	129	0.095	0.974	129	0.105
End-of-Life Management Practice	0.076	129	0.066	0.964	129	0.062
Firm Resources	0.052	129	0.200*	0.988	129	0.292
Firm Performance.	0.058	129	0.200*	0.979	129	0.179

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

4.6.4 Test for heteroscedasticity

The study used Breusch-Pagan and Koenker test to estimate heteroscedasticity. Brusch-Pagan and Koenker tests the null hypothesis that the variances of the error terms are constant. The test rejects the null hypothesis when the significant value is less than 5% (Daryanto, 2013). Table 4.15 displays the results of Breusch-Pagan and Koenker test. The table presents significant values more than 5% indicating that heteroscedasticity was not a problem. Null hypothesis: heteroskedasticity not present (homoskedasticity) if sig-value is less than 0.05, reject the null hypothesis.

Table 4.15: Breusch-Pagan and Koenker test statistics and sig-values

LM		**Sig**
BP	5.104	0.403
Koenker	5.915	0.315

4.7 Factor Analysis

The goal of inferential statistics is to draw conclusions that extend beyond immediate data. Inferential statistics facilitate inferences from sample data to population conditions (Cressie, 2015). Factor analysis was carried out as part of assessing the consistency and sampling adequacy of the research instruments. The subsection shows the results of the factor analysis which comprises of KMO sampling adequacy and Bartlett's Sphericity tests, the variance explained by each of the questions and the communalities/factor loadings of the items.

4.7.1 Factor Analysis for Disposition Practice

Exploratory factor analysis was employed on Disposition Practice construct that was measured using subscales namely, refurbishing, remanufacturing, repackaging and reconditioning. Disposition practice test for suitability of structure detection was carried out. The study revealed as shown in table 4.16 that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.876 which was above 0.6. This meant that the sample was adequate for factor analysis. The Chi-Square value for Bartlett's Test of Sphericity was 2226.794 with degrees of freedom amount to 78 and p-value less than 0.05 indicating suitability of data for structure detection.

Table 4.16: KMO and Bartlett's Test for Disposition practice

Statistics		Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.876
Bartlett's Test of Sphericity	Approx. Chi-Square	2226.794
	Df	78
	Sig.	0.000

4.7.2 Communalities for Disposition Practice

Small values for communalities signify that the items of the construct do not fit well with the extracted factor solution and should certainly be dropped from further analysis. The extraction communalities for the retained items measuring Disposition Practices construct as shown on table 4.17 were all greater than 0.5 indicating that the retained items fitted well with other items for the Disposition Practices factor solution (Pallant, 2010).

Table 4.17: Communalities for Disposition Practice

	Initial	Extraction
DP1	1.000	0.741
DP2	1.000	0.807
DP3	1.000	0.735
DP4	1.000	0.634
DP5	1.000	0.633
DP6	1.000	0.727
DP7	1.000	0.643
DP8	1.000	0.758
DP9	1.000	0.561
DP10	1.000	0.586
DP11	1.000	0.684
DP12	1.000	0.509

Extraction Method: Principal Component Analysis.

4.7.3 Total Variance Explained for Disposition Practice

Based on Kaiser Criterion, three factors were imputed out of a total 12 factors. The three factors were able to explain 66.423% of the total variance in the study data as indicated in table 4.18. The three factors imputed attained eigenvalues in the initial solution greater or equal to 1.0. The cumulative variability explained by these imputed three factors in the extracted solution was 66.423%, showing that no explained variation by the initial eigenvalues is lost during the promax rotation of the Disposition Practice factor solution (Hair *et al*., 2010). When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Table 4.18: Total Variance Explained for Disposition Practice

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	5.459	41.990	41.990	5.459	41.990	41.990	4.542
2	1.798	13.828	55.818	1.798	13.828	55.818	3.762
3	1.379	10.605	66.423	1.379	10.605	66.423	3.617
4	0.733	5.635	72.059				
5	0.592	4.557	76.616				
6	0.554	4.263	80.879				
7	0.508	3.906	84.785				
8	0.454	3.492	88.277				
9	0.419	3.222	91.499				
10	0.369	2.841	94.340				
11	0.272	2.095	96.436				
12	0.216	1.661	100.000				

Extraction Method: Principal Component Analysis.

4.7.4 Pattern matrix for Disposition Practice

The pattern matrix on Table 4.19 shows the first component had four items (DP1, DP2, DP3 and DP4) whose factor loadings ranged from 0.782 to 0.921. The second component had four items (DP5, DP6, DP7 and DP8) whose loadings ranged from 0.804 to 0.893. The third component had five items (DP9, DP10, DP11, DP12 and DP13) whose loadings ranged from 0.612 to 0.898

Table 4.19: Pattern Matrix for Disposition Practices

	Component		
	Refurbishing	Remanufacturing	Repackaging
DP1	.895		
DP4	.921		
DP2	.843		
DP3	.782		
DP8		.804	
DP6		.893	
DP7		.711	
DP5		.878	
DP11			.612
DP9			.596
DP10			.898
DP12			.570

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

4.7.5 Factor analysis for Recycling Practice

Exploratory factor analysis was employed on Recycling Practice construct to test for Suitability of Structure Detection. The study revealed as shown in table 4.20 that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.861 which was above 0.6. This meant that the sample was adequate for factor analysis. The Chi-Square value for Bartlett's Test of Sphericity was 2228.984 with degrees of freedom amount to 91 and p-value less than 0.05 indicating suitability of data for structure detection.

Table 4.20: KMO and Bartlett's Test for Recycling Practice

Statistics		Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.861
Bartlett's Test of Sphericity	Approx. Chi-Square	2228.984
	Df	91
	Sig.	0.000

4.7.6 Communalities for Recycling Practice

Small values for communalities signify that the items of the construct do not fit well with the extracted factor solution, and should certainly be dropped from further analysis. The extraction communalities for the retained items measuring Recycling

Practice construct as shown on table 4.21 were all greater than 0.5 indicating that the retained items fitted well with other items in the for-Recycling Practice factor solution (Pallant, 2010).

Table 4.21: Communalities for Recycling Practice

	Initial	**Extraction**
R1	1.000	0.526
R2	1.000	0.525
R3	1.000	0.520
R5	1.000	0.592
R6	1.000	0.524
R7	1.000	0.510
R8	1.000	0.584
R9	1.000	0.642
R11	1.000	0.812
R12	1.000	0.789
R13	1.000	0.750
R14	1.000	0.623
R15	1.000	0.775
R16	1.000	0.747

Extraction Method: Principal Component Analysis.

4.7.7 Total Variance Explained for Recycling Practice

Based on Kaiser Criterion, three factors were imputed out of a total 14 factors. The four factors were able to explain 68.970% of the total variance in the study data as indicated in table 4.22. The four factors imputed attained eigenvalues in the initial solution greater or equal to 1.0. The cumulative variability explained by these imputed four factors in the extracted solution was 68.970%, showing that no explained variation by the initial eigenvalues is lost during the promax rotation of the Recycling Practice solution (Hair *et al.*, 2010). When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Table 4.22: Total Variance Explained for Recycling Practice

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	5.222	37.298	37.298	5.222	37.298	37.298	4.192
2	2.190	15.642	52.941	2.190	15.642	52.941	4.041
3	1.267	9.053	61.993	1.267	9.053	61.993	2.605
4	1.077	6.977	68.970	1.077	6.977	68.970	2.101
5	0.783	5.596	74.566				
6	0.642	4.589	79.155				
7	0.513	3.668	82.822				
8	0.464	3.313	86.135				
9	0.416	2.975	89.110				
10	0.384	2.742	91.852				
11	0.341	2.438	94.291				
12	0.322	2.300	96.591				
13	0.270	1.931	98.522				
14	0.207	1.478	100.000				

Extraction Method: Principal Component Analysis.

4.7.8 Pattern matrix for Recycling Practice

The pattern matrix in table 4.23 shows the first component had three items (R1, R2 and R3) whose factor loadings ranged from 0.755 to 0.914. The second component had four items (R8, R9, R11 and R12) whose loadings ranged from 0.667 to 0.759. The third component had four items (R13, R14, R15 and R16) whose loadings ranged from 0.678 to 0.879. The fourth component had three items (R5, R6 and R7) whose loadings ranged from 0.538 to 0.706

Table 4.23: Pattern Matrix for Recycling Practice

	Component			
	Returnable Packages	Trade in's	Product Recoveries	Product Recalls
R5				0.609
R6				0.706
R7				0.538
R8		0.759		
R9		0.715		
R11		0.667		
R12		0.744		
R1	0.755			
R2	0.914			
R3	0.887			
R14			0.715	
R13			0.678	
R15			0.879	
R16			0.831	

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

4.7.9 Factor analysis for Reverse Product flow Practice

Exploratory factor analysis was employed on reverse product flow construct to test for suitability of structure detection. The study revealed as shown in table 4.24 that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.785 which was above 0.6. This meant that the sample was adequate for factor analysis. The Chi-Square value for Bartlett's Test of Sphericity was 1590.113 with degrees of freedom amount to 45 and p-value less than 0.05 indicating suitability of data for structure detection.

Table 4.24: KMO and Bartlett's Test for reverse product flow practice

Statistics		Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.785
	Approx. Chi-Square	1590.113
Bartlett's Test of Sphericity	Df	45
	Sig.	0.000

4.7.10 Communalities for reverse product flow practice

Small values for communalities signify that the items of the construct do not fit well with the extracted factor solution, and should certainly be dropped from further analysis. The extraction communalities for the retained items measuring product flow management practice construct as show on table 4.25 were all greater than 0.5 indicating that the retained items fitted well with other items in the for reverse product flow practice factor solution (Pallant, 2010).

Table 4.25: Communalities for reverse product flow practice

	Initial	Extraction
PR1	1.000	0.605
PR2	1.000	0.757
PR3	1.000	0.832
PR4	1.000	0.702
PR6	1.000	0.701
PR7	1.000	0.684
PR8	1.000	0.727
PR9	1.000	0.561
PR10	1.000	0.803
PR12	1.000	0.810

Extraction Method: Principal Component Analysis.

4.7.11 Total Variance Explained for reverse product flow practice

Based on Kaiser Criterion, three factors were imputed out of a total 10 factors. The three factors were able to explain 71.822% of the total variance in the study data as indicated in table 4.26. The three factors imputed attained eigenvalues in the initial solution greater or equal to 1.0. The cumulative variability explained by these imputed three factors in the extracted solution was 71.822%, showing that no explained variation by the initial eigenvalues is lost during the promax rotation of the reverse product flow practice factor solution (Hair *et al*., 2010). When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Table 4.26: Total Variance Explained for reverse product flow practice

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3.936	39.356	39.356	3.936	39.356	39.356	3.295
2	1.790	17.898	57.254	1.790	17.898	57.254	2.765
3	1.457	14.568	71.822	1.457	14.568	71.822	2.346
4	0.704	7.035	78.857				
5	0.525	5.251	84.108				
6	0.403	4.026	88.135				
7	0.376	3.761	91.895				
8	0.349	3.489	95.385				
9	0.246	2.465	97.850				
10	0.215	2.150	100.000				

Extraction Method: Principal Component Analysis.

4.7.12 Pattern matrix for reverse product flow practice

The pattern matrix in table 4.27 shows the first component had four items (PR1, PR2, PR3 and PR4) whose factor loadings ranged from 0.762 to 0.912. The second component had three items (PR6, PR7 and PR8) whose loadings ranged from 0.786 to 0.837. The third component had three items (PR9, PR10 and PR12) whose loading ranged from 0.549 to 0.904.

Table 4.27: Pattern Matrix[a]

	Manufacturing	Component Distribution	Retailing
PR2	0.762		
PR1	0.863		
PR3	0.912		
PR4	0.808		
PR6		0.837	
PR8		0.814	
PR7		0.786	
PR12			0.549
PR10			0.895
PR9			0.904

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

4.7.13 Factor analysis for End-of-Life Management Practice

Exploratory factor analysis was employed on End-of-Life management practice construct to test for suitability of structure detection. The study revealed as shown in table 4.28 that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.902 which was above 0.6. This meant that the sample was adequate for factor analysis. The Chi-Square value for Bartlett's Test of Sphericity was 2037.112 with degrees of freedom amount to 81 and p-value less than 0.05 indicating suitability of data for structure detection

Table 4.28: KMO and Bartlett's Test for End-of-Life Management Practices

Statistics		Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.902
Bartlett's Test of Sphericity	Approx. Chi-Square	2037.112
	Df	81
	Sig.	0.000

4.7. 14 Communalities for End-of-Life Management Practice

Small values for communalities signify that the items of the construct do not fit well with the extracted factor solution, and should certainly be dropped from further analysis. The extraction communalities for the retained items measuring End-of-Life

Management Practice construct as shown on table 4.29 were all greater than 0.5 indicating that the retained items fitted well with other items in the Waste Management Practice factor solution (Pallant, 2010). When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Table 4.29: Communalities for End-of-Life management practice

	Initial	**Extraction**
WD1	1.000	0.541
WD2	1.000	0.647
WD3	1.000	0.812
WD4	1.000	0.567
WD5	1.000	0.817
WD6	1.000	0.672
WD7	1.000	0.867
WD8	1.000	0.777
WD9	1.000	0.587
WD10	1.000	0.586
WD11	1.000	0.829
WD12	1.000	0.682

Extraction Method: Principal Component Analysis.

4.7.15 Total Variance Explained for End-of-Life Management Practice

Based on Kaiser Criterion, four factors were imputed out of a total 12 factors. The four factors were able to explain 72.059 % of the total variance in the study data as indicated in table 4.30. The four factors imputed attained eigenvalues in the initial solution greater or equal to 1.0. The cumulative variability explained by these imputed four factors in the extracted solution was 72.059 %, showing that no explained variation by the initial eigenvalues is lost during the promax rotation of the End-of-Life Management Practice factor solution (Hair *et al*., 2010).

Table 4.30: Total Variance Explained for End-of-Life Management Practice

Compone	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	5.459	41.990	41.990	5.459	41.990	41.990	4.542
2	1.798	13.828	55.818	1.798	13.828	55.818	3.762
3	1.779	10.605	66.423	1.779	10.605	66.423	3.617
4	1.301	5.635	72.059	1.301	5.635	72.059	2.843
5	0.592	4.557	76.616				
6	0.554	4.263	80.879				
7	0.508	3.906	84.785				
8	0.454	3.492	88.277				
9	0.419	3.222	91.499				
10	0.369	2.841	94.340				
11	0.272	2.095	96.436				
12	0.216	1.661	100.000				

Extraction Method: Principal Component Analysis.

4.7.16 Pattern matrix for End-of-Life Management Practice

The pattern matrix in table 4.31 shows the first component had three items (WD10, WD11 and WD12) whose factor loading ranged from 0.596 to 0.898. The second component had two items (WD1 and WD2) whose loadings ranged from 0.895 to 0.921. The third component had three items (WD7, WD8 and WD9) whose loading ranged from 0.711 to 0.893. The fourth component had four items (WD3, WD4, WD5 and WD6) whose loadings ranged from 0.782 to 0.921.

Table 4.31: Pattern Matrix for End-of-Life Management Practice

	Component			
	Waste Materials Handling	**Environmental Legislation**	**Product characteristics**	**Disposal Methods**
WD11				0.612
WD12				0.596
WD10				0.898
WD2			0.921	
WD1			0.895	
WD8		0.893		
WD7		0.711		
WD9		0.878		
WD4	0.895			
WD5	0.921			
WD6	0.843			
WD3	0.782			

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

4.8 Correlation Analysis

Correlation analysis was used to determine both the significance and degree of association of the variables and predict the level of variation in the dependent variable caused by the independent variables. The correlation analysis was used to determine the relationship between the variables in terms of strength and direction.

4.8.1 Test for linearity for the relationship between Disposition Practice and firm performance.

The ANOVA table 4.32 Contains tests for the linear, nonlinear, and combined relationships between Disposition Practice and firm performance. The test for linearity had a significance F value with p-value less than 0.05 ($F = 126.534$, $P < 0.05$), indicating that there is a linear relationship between Disposition Practice and firm performance. The test for deviation from linearity (nonlinear) had insignificance F value, ($F = 1.461$, $P = 0.132$) which means that there is no nonlinear relationship in addition to the linear component.

Table 4.32: Linearity test for the relationship between Disposition Practice and firm performance

ANOVA TABLE

			Sum of Squares	Df	Mean Square	F	Sig.
Firm Performance. * Disposition Practices	Between Groups	(Combined)	36.019	16	2.251	4.992	0.000
		Linearity	26.134	1	57.059	126.534	0.000
		Deviation from Linearity	9.885	15	0.659	1.461	0.132
	Within Groups		23.944	112	0.451		
	Total		**59.963**	**128**			

4.8.2 Correlation between Disposition Practice and firm performance

The results for the effect of Disposition Practice and firm performance were assessed using Pearson correlation coefficient as shown in table 4.33. The output indicate that disposition practices had a strong positive relationship with firm

Performance (r =.660, p < 0.05)

Table 4.33: Correlations between Disposition Practice and firm performance

		Firm performance	Disposition practices
Firm performance	Pearson Correlation	1	0.660**
	Sig. (2-tailed)		0.000
	N	129	129
Disposition practices	Pearson Correlation	0.660**	1
	Sig. (2-tailed)	0.000	
	N	**129**	**129**

**. Correlation is significant at the 0.01 level (2-tailed).

4.8.3 Test for linearity of the relationship between Recycling Practice and firm performance

The ANOVA table 4.34 Contains tests for the linear, nonlinear and combined relationship between Recycling Practice and firm performance. The test for linearity has a significance F value smaller than 0.05 (F = 66.970, P < 0.05), indicating that there is a linear relationship between Recycling Practice and firm performance. The test for deviation from linearity (nonlinear) has insignificance F value, ($F = 1.363$, $P = 0.110$) which means that there is no nonlinear relationship in addition to the linear component.

Table 4.34: Linearity test for the relationship between Recycling Practice and firm performance

ANOVA

			Sum of Squares	**Df**	**Mean Squares**	**F**	**Sig**
Firm Performance Recycling Practice	Between Groups	(Combined)	37.554	49	0.766	2.702	0.000
		Linearity	18.996	1	18.996	66.970	0.000
		Dev. From linearity	18.558	48	0.387	1.363	0.110
	Within Groups		22.409	79	0.284		
	Total		**59.963**	**129**			

4.8.4 Correlation between Recycling Practice and firm performance

The results for the effect of Recycling Practice and firm performance were assessed using Pearson correlation coefficient as shown in table 4.35 The output indicate that Recycling Practice had a strong positive relationship with firm performance ($r = .563$, $p < 0.05$).

Table 4.35: Correlations between Recycling Practice and firm performance

		Firm performance	**Recycling Practice**
Firm performance	Pearson Correlation	1	0.563**
	Sig. (2-tailed)		0.000
	N	129	129
Recycling Practice	Pearson Correlation	0.563**	1
	Sig. (2-tailed)	0.000	
	N	129	129

**. Correlation is significant at the 0.01 level (2-tailed).

4.8.5 Test for linearity for the relationship between reverse product flow and firm performance

The ANOVA table 4.36 Contains tests for the linear, nonlinear, and combined relationship between reverse product flow and firm performance. The test for linearity has a significance F value smaller than 0.05 (F = 149.604, P < 0.05), indicating that there is a linear relationship between reverse product flow and firm performance. The test for deviation from linearity (nonlinear) has insignificance F value, (F = 1.022, P = 0.455) which means that there is no nonlinear relationship in addition to the linear component.

Table 4.36: Linearity test for the relationship between reverse product flow practice and firm performance

ANOVA Table

			Sum of Squares	**Df**	**Mean Squares**	**F**	**Sig**
Firm Performance Reverse product Flow Practice	Between Groups	(Combined)	41.380	42	0.985	4.560	0.000
		Linearity	32.326	1	32.320	149.60	0.000
		Dev. From linearity	9.054	41	0.221	1.022	0.455
	Within Group		18.583	86	0.216		
	Total		**59.963**	**128**			

4.8.6 Correlation between reverse product flow practice and firm performance

The results for the effect of product flow management practice and firm performance were assessed using Pearson correlation coefficient as shown in table 4.37 The output indicate that product flow management practice had a strong positive relationship with firm performance (r = 0.734, p < 0.05).

Table 4.37: Correlations between reverse product flow practice and firm performance

		Firm performance	Reverse product flow
Firm performance	Pearson Correlation	1	0.734**
	Sig. (2-tailed)		0.000
	N	129	129
Reverse product flow practice	Pearson Correlation	0.734**	1
	Sig. (2-tailed)	0.000	
	N	129	129

**. Correlation is significant at the 0.01 level (2-tailed).

4.8.7 Test for linearity for the relationship between End-of-Life Management Practice and firm performance

The ANOVA table 4.38 Contains tests for the linear, nonlinear, and combined relationship between End-of-Life Management Practice and firm performance. The test for linearity has a significance F value smaller than 0.05 (F = 109.868, P<0.05), indicating that there is a linear relationship between End-of-Life Management Practice and firm performance. The test for deviation from linearity (nonlinear) has insignificance F value, (F = 1.491, P = 0.085) which means that there is no nonlinear relationship in addition to the linear component.

Table 4.38 Linearity test for the relationship between End-of-Life Management Practice and firm performance

			Sum of Squares	Df	Mean Square	F	Sig.
Firm Performance. *End-of-Life management Practice	Between Groups	(Combined)	35.413	26	1.362	5.659	0.000
		Linearity	26.444	1	26.444	109.868	0.000
		Deviation from Linearity	8.969	25	0.359	1.491	0.085
	Within Groups		24.550	102	0.241		
	Total		**59.963**	**128**			

ANOVA TABLE

4.8.8 Correlation between End-of-Life Management Practice and firm performance

The results for the effect of End-of-Life Management Practice and firm performance were assessed using Pearson correlation coefficient as shown in table 4.39 The output indicate that End-of-Life management practice had a strong positive relationship with firm performance ($r = 0.660$, $p < 0.05$).

Table 4.39: Correlations between End-of-Life Management Practice and firm performance

Firm performance	Pearson Correlation	
	Sig. (2-tailed)	
	N	
End-of-Life Management Practice	Pearson Correlation	
	Sig. (2-tailed)	
	N	

**. Correlation is significant at the 0.01 level (2-tailed).

4.8.9 Linearity test for composite reverse logistics and correlation analysis

The ANOVA and Correlation table 4.40 Contains tests for the linear, nonlinear, and combined relationship between RL Practices and firm performance. The test for linearity has a significance F value smaller than 0.05 ($F = 258.845$, $P < 0.05$), indicating that there is a linear relationship between RL Practices and firm performance. The test for deviation from linearity (nonlinear) has insignificance F value, ($F = 0.865$, $P = 0.665$) which means that there is no nonlinear relationship in addition to the linear component.

The results for the effect of RL Practices and firm performance were assessed using Pearson correlation coefficient as shown in table 4.40 The output indicate that RL practices had a strong positive relationship with firm performance ($r = 0.837$, $p < 0.05$).

Table 4.40: ANOVA and Correlation Table

			Sum of Squares	Df	Mean Square	F	Sig.
Firm Performance. * Reverse Logistic Practices	Between Groups	(Combined)	59.151	123	0.481	2.962	0.111
		Linearity	42.019	1	42.019	258.845	0.000
		Deviation from Linearity	17.132	122	.140	0.865	0.665
	Within Groups		0.812	5	0.162		
	Total		**59.963**	**128**			

Correlation coefficients

		Firm Performance.	Reverse Logistic Practices
Firm Performance.	Pearson Correlation	1	0.837**
	Sig. (2-tailed)		.000
	N	129	129
Reverse Logistic Practices	Pearson Correlation	0.837**	1
	Sig. (2-tailed)	0.000	
	N	129	129

**. Correlation is significant at the 0.01 level (2-tailed).

4.9 Hypothesis Testing

Hypothesis testing was done to establish the effect of each independent variable on the performance of large manufacturing firms in Kenya. The study formulated the following hypotheses to test the relationship between the variables of the study:

There is no significant relationship between product disposition practice in reverse logistics and the performance of large manufacturing firms in Kenya. There is no significant relationship between recycling practice in reverse logistics and the performance of large manufacturing firms in Kenya. There is no significant influence between reverse product flow practice in reverse logistics and the performance of large manufacturing firms in Kenya. There is no significant impact between End-of-Life management practice in reverse logistics and the performance of large manufacturing firms in Kenya. There is no moderating effect of firm resources on the relationship between reverse logistics and the performance of large manufacturing firms in Kenya. Each hypothesis was tested and conclusion made.

4.9.1 Influence of Disposition Practice and firm performance

The first objective of the study was to establish the influence of product disposition and the performance of large manufacturing firms in Kenya. The following null hypothesis was formulated:

Hypothesis 1

> *H_0: There is no significant relationship between product disposition practice in reverse logistics and the performance of large manufacturing firms in Kenya.*

Table 4.41 shows that the R-squared is 0.436 meaning that the Disposition Practice was able to explain 43.6% variations in the firm performance while the rest are explained by the error term.

The F-statistic is 98.108 with a p-value < 0.05 which implies that the regression model is significant. Therefore, the T-statistics and p-values can reliably be used to test the significance of coefficients in the model. The T-test is a test used for hypothesis testing in statistics and uses the T-statistic, the T-distribution values, and the degrees of freedom to determine statistical significance. The regression equation obtained from this output is:

Performance = 1.339 + 0.428 Disposition Practice

The beta coefficient for Disposition Practice was 0.660. This indicates that a unit increase in Disposition Practice would result in 66.0 % increase in manufacturing firm performance. The T-statistics and corresponding p-value were 9.905 (0.000). Therefore, at $P < 0.05$ level of significance the null hypothesis is rejected implying that Disposition Practice has a significant influence on firm performance. On the basis of these statistics, the study concludes that there is significant positive relationship between Disposition Practice and firm performance. These findings concur with the study by Kazemi, Modak and Govindan (2019) which led to the conclusion that disposition has many benefits such as saving storage space besides freeing capital as it enabled efficient use of materials and reduced overall costs.

Table 4.41: Regression Model Summary on disposition

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.660[a]	0.436	0.431	0.51611

a. Predictors: (Constant), Disposition Practice

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	26.134	1	26.134	98.108	0.000[b]
	Residual	33.830	127	0.266		
	Total	**59.963**	**128**			

a. Dependent Variable: Firm Performance.

COFFICIENTS

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	1.339	0.123		13.603	0.000
	Disposition Practices	0.428	0.047	0.660	9.905	0.000

a. Dependent Variable: Firm Performance.

4.9.2 Influence of Recycling Practice and Firm performance

The second objective of the study was to determine the influence of recycling and the performance of large manufacturing firms in Kenya. The following null hypothesis was formulated:

Hypothesis 2

> *H_0: There is no significant relationship between recycling practice in reverse logistics and the performance of large manufacturing firms in Kenya.*

Table 4.42 shows that the R-squared is 0.317 meaning that the Recycling Practice was able to explain 31.7% variations in the firm performance while the rest are explained by the error term. The F-statistic is 58.891 with a p-value < 0.05 which implies that the regression model is significant. Therefore, the T-statistics and p-values can reliably be used to test the significance of coefficients in the model. The T-test is a test used for hypothesis testing in statistics and uses the T-statistics, the T-distribution values, and the degrees of freedom to determine statistical significance. The regression equation obtained from this output is:

Performance = 1.678 + 0.362 Recycling Practice

The beta coefficient for Recycling Practice was 0.563. This indicates that a unit increase in Recycling Practice would result in 56.3 % increase in manufacturing firm Performance. The T-statistics and corresponding p-value were 7.674 (0.000). Therefore, at $P < 0.05$ level of significance the null hypothesis is rejected implying that Recycling Practices has a significant relationship on firm performance. On the basis of these statistics, the study concludes that there is significant positive relationship between Recycling Practice and firm performance. The above findings are in line with the study carried by Guerrero, Maas and Hogland (2017) which outlined the importance of recycling as a waste management strategy due to its ability to reduce disposal costs and waste transport costs, and to prolong the life span of sanitary landfill sites. These activities have an effect of positively improving the performance of manufacturing firm's performance of manufacturing firms.

Table 4.42: Regression Model Summary on Recycling

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.563[a]	0.317	0.311	0.56795

a. Predictors: (Constant), Recycling Practice

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	18.996	1	18.996	58.891	0.000[b]
	Residual	40.967	128	0.323		
	Total	**59.963**	**128**			

a. Dependent Variable: Firm Performance.
b. Predictors: (Constant), Recycling Practice

COEFFICIENTS[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.678	0.123		13.603	0.000
	Recycling Practice	0.362	0.047	0.563	7.674	0.000

a. Dependent Variable: Firm Performance.

4.9.3 Influence of reverse Product Flow Practice and Firm Performance

The third objective of the study was to examine the influence of Product flow management Practice and the performance of large manufacturing firms in Kenya. The following null hypothesis was formulated.

Hypothesis 3

> *H_0: There is no significant influence between reverse product flow practice in reverse logistics and the performance of large manufacturing firms in Kenya.*

Table 4.43 shows that the R-squared is 0.539 meaning that the Product flow management Practice was able to explain 53.9 % variations in the firm performance while the rest are explained by the error term.

The F-statistic is 148.550 with a p-value < 0.05 which implies that the regression model is significant. Therefore, the T-statistics and p-values can reliably be used to test the significance of coefficients in the model. The T-test is a test used for hypothesis testing in statistics and uses the T-statistics, the T-distribution values, and the degrees of freedom to determine statistical significance. The regression equation obtained from this output is:

Performance = 1.128 + 0.642 Reverse Product flow Practice

The beta coefficient for Reverse Product flow Practice was 0.734. This indicates that a unit increase in Reverse Product flow Practice would result in 73.4 % increase in manufacturing firm performance. The T-statistics and corresponding p-value were 12.188 (0.000). Therefore, at $P < 0.05$ level of significance the null hypothesis is rejected implying that Reverse Product flow Practices has a significant influence on firm performance. On the basis of these statistics, the study concludes that there is significant positive relationship between Reverse Product flow Practice and firm performance. The findings indicate in line with other studies which found that managing return product flow is becoming increasingly important to the success of manufacturing firms, particularly as the volume of return flow substantially increases

(Guide Jr *et al.*, 2006)., the study results concur with those of Ramanathan (2011) who examined the relationships results between performance of companies in handling product returns and customer loyalty and found that handling product returns plays an important role Similarly in shaping customer loyalty for low-risk products.

Table 4.43: Regression Model Summary for reverse product flow

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.734[a]	0.539	0.535	0.46649

a. Predictors: (Constant), Reverse Product flow Practice

ANOVA[a]

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	32.326	1	32.326	148.550	0.000[b]
Residual	27.637	128	0.218		
Total	**59.963**	**128**			

a. Dependent Variable: Firm Performance.
b. Predictors: (Constant), Reverse Product flow Practice

COEFFICIENTS[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.128	0.123		9.165	0.000
Reverse Product flow Practice	0.642	0.053	0.734	12.188	0.000

a. Dependent Variable: Firm Performance.

4.9.4 Influence of End-of-Life Practice and firm performance

The fourth objective of the study was to establish the influence of End-of-Use Management Practice and the performance of large manufacturing firms in Kenya. The following null hypothesis was formulated.

Hypothesis 4

> *H0: There is no significant impact between End-of-Life management practice in reverse logistics and the performance of large manufacturing firms in Kenya.*

Table 4.44 shows that the R-squared is 0.441 meaning that the End-of-Life Management Practice was able to explain 44.1% variations in the firm performance while the rest are explained by the error term.

The F-statistic is 100.194 with a p-value < 0.05 which implies that the regression model is significant. Therefore, the T-statistics and p-values can reliably be used to test the significance of coefficients in the model. The T-test is a test used for hypothesis testing in statistics and uses the T-statistics, the T-distribution values, and the degrees of freedom to determine statistical significance. The regression equation obtained from this output is:

Performance = 1.211 + 0.630 End-of-Life Management Practice

The beta coefficient for End-of-Life Management Practice was 0.664. This indicates that a unit increase in End-of-Life Management Practice would result in 66.4% increase in manufacturing firm performance. The T-statistics and corresponding p-value were 9.905 (0.000). Therefore, at P < 0.05 level of significance the null hypothesis is rejected implying that End-of-Life Management Practice has a significant influence on firm performance. On the basis of these statistics, the study concludes that there is significant positive relationship between End-of-Life Management Practice and firm performance**.** The above results are closely related to the study done by Lee and Paik (2011) which stated that with the right attitude for waste management the strongest factor related to End-of-Life management behavior's, is to enhance sustainable pro-environmental attitudes which can improve organization performance.

Table 4.44: Regression Model Summary for End-of-Life management

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.664[a]	0.441	0.437	0.51374

a. Predictors: (Constant), End-of-Life Management Practice

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	26.444	1	26.444	100.194	0.000[b]
	Residual	33.519	127	0.264		
	Total	59.963	128			

a. Dependent Variable: Firm Performance.
b. Predictors: (Constant), End-of-Life Management Practice

COEFFICIENTS[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.211	0.141		8.612	0.000
End-of-Life Management Practice	0.630	0.063	0.664	10.010	0.000

a. Dependent Variable: Firm Performance.

4.9.5 Multiple Regression Model

After doing the analysis for each variable's effect on performance of manufacturing firms using simple regression, a multiple regression analysis was conducted in order to establish the combined effect of the four variables on performance. All the independent variables, that is, Disposition Practice, Recycling Practice, Reverse Product Flow Practice and End-of-Life Management Practice were used to fit the multiple linear regression model:

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

From Table 4.45, the R value was 0.837 and R^2 value was 0.701. The R^2 of 0.701 implied that 70.1% of the variation in the dependent variable (performance) was explained by the variation of the model, while the rest are explained by factors outside this model.

The F-statistic is 297.397 with a p-value < 0.05 which implies that the regression model is significant and is a good fit. Therefore, the T-statistics and p-values can reliably be used to test the significance of coefficients in the model. The T-test is a test used for hypothesis testing in statistics and uses the T-statistics, the T-distribution values, and the degrees of freedom to determine statistical significance.

The multiple regression equation obtained from this output is:

Performance = 0.534 + 0,428X_1 + 0.362X_2 + 0.642X_3 + 0.630X_4

The beta coefficient for each practice was 0.660, 0.563, 0.734 and 0.664 respectively. The t statistics and the corresponding p value were 9.905(0.000), 7.674(0.000), 12.188(0.000) and 10.010(0.004) respectively for each practice. On the basis of these statistics, the study concludes that there was significant positive relationship between individual RL Practice and firm performance.

On the basis of these statistics, the study concludes that there is significant positive relationship between RL Practices and firm performance. These results concur with the study by Ramirez (2012) who surveyed 284 Spanish firms and found that reverse logistics practices improve organizational performance conditioned by the creation of logistics knowledge.

Table 4.45: Multiple Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.837[a]	0.701	0.698	0.37589

a. Predictors: (Constant), Disposition Practice, Recycling Practice, Reverse Product flow Practice & End-of-Life Practice

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	42.019	1	42.019	297.397	0.000[b]
	Residual	17.944	127	0.141		
	Total	59.963	128			

a. Dependent Variable: Firm Performance.

b. Predictors: (Constant), Disposition Practice, Recycling Practice, Reverse Product flow Practice & End-of-Life Practice

COEFFICIENTS[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.534	0.126		4.240	0.000
	Disposition Practice	0.223	0.038	0.344	5.897	0.000
	Recycling Practice	0.140	0.037	0.218	3.825	0.000
	Reverse Product flow Practice	0.316	0.060	0.361	5.241	0.000
	End-of-Life Management Practice	0.266	0.058	0.020	4.586	0.000

a Dependent Variable: Firm Performance.

4.9.6 Moderation analysis:

The moderating model tests whether the prediction of a dependent variable, Y, from an independent variable, X, differs across levels of a third variable. Z Moderator variables affect the strength and/or direction of the relation between a predictor and an outcome: enhancing, reducing, or changing the influence of the predictor. The fifth objective was to find out the moderating effect of level of resources on the relationship between reverse logistics practice and the performance of large manufacturing firms in Kenya. The analysis was done by analyzing each variable's effects on performance after introducing the moderator variable.

4.9.7 Moderation of the relationship between Disposition Practice and firm performance by level of resources

To test the above hypothesis, linear regression was used to test the moderating effect of firm resources on the relationship between Disposition Practice and the performance of large manufacturing firms in Kenya. Path coefficients were used to determine the direction and strength while T = statistics provided information on the significance to the relationships. The results are presented in table 4.46

The R^2 for Model one was 0.502 implying that Firm Resources and Disposition Practice jointly explain 50.2 % variation in performance of large manufacturing firms in Kenya. This regression model one is a good fit as indicated by the significant F-statistic (Fvalue = 63.430, $p < 0.05$). Upon introduction of the interaction term presented as model two, the model is still significant (Fvalue = 64.928, $p<0.05$) inferring that Firm Resources, significantly moderates the relationship between Disposition Practice and performance of large manufacturing firms in Kenya.

The results indicate that the inclusion of the interaction term resulted into an R^2 change of .107, [$F(1, 125) = 34.348$, $p < 0.05$], showing presence of significant moderating effect. This implies that the moderating effect of farm resources gained 10.7 % variance in the performance of large manufacturing firms in Kenya, above and beyond the variance Disposition Practice. Thus, the study rejects the null hypothesis.

Model two reveals the details of the inclusion of the interactive term in the model. Firm Resources was found to be significant ($p = 0.05$, regression coefficient = 0.129) and DP*FR was also found to be significant ($p < 0.05$, regression coefficient = 0.132). The regression model obtained from the moderated effect of level of resources was:

Performance = 1.680 + 0.096 DP + 0.129FR + 0.132 DP*FR + error

Table 4.46: Moderation Model Summary for disposition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.708[a]	.502	.494	.48697	.502	63.430	2	126	.000
2	.780[b]	.609	.600	.43302	.107	34.348	1	125	.000

a. Predictors: (Constant), Firm Resources, Disposition Practice

b. Predictors: (Constant), Firm Resources, Disposition Practice, DP_X_FR

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	30.084	2	15.042	63.430	.000[b]
	Residual	29.879	126	.237		
	Total	59.963	128			
2	Regression	36.524	3	12.175	64.928	.000[c]
	Residual	23.439	125	.188		
	Total	59.963	128			

a. Dependent Variable: Firm Performance.

b. Predictors: (Constant), Firm Resources, Disposition Practice

c. Predictors: (Constant), Firm Resources, Disposition Practice, DP_X_FR

COEFFICIENTS[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	**Std. Error**	**Beta**		
1	(Constant)	1.033	.144		7.193	.000
	Disposition Practice	.380	.042	.587	8.975	.000
	Firm Resource	.188	.046	.267	4.081	.000
2	(Constant)	1.680	.169		9.952	.000
	Disposition Practice	.096	.031	.248	3.097	.002
	Firm Resources	.129	.028	.382	4.607	.000
	DP_X_LR	.132	.023	.781	5.861	.000

a. Dependent Variable: Firm Performance.

4.9.8 Moderation of the relationship between Recycling Practice and firm performance by level of resources

To test the above hypothesis, linear regression was used to test the moderating effect of level of resources on the relationship between Recycling Practice and the performance of large manufacturing firms in Kenya. Path coefficients were used to determine the direction and strength while T = statistics provided information on the significance to the relationships. The results are presented in table 4.47

The R^2 for model one was 0.400 implying that Firm Resources and Recycling Practice jointly explain 40.0% variation in performance of large manufacturing firms in Kenya. This regression model one is a good fit as indicated by the significant F-statistic (Fvalue = 43.621, $p < 0.05$). Upon introduction of the interaction term presented as model two, the model is still significant (Fvalue = 35.114, $p < 0.05$) inferring that Firm Resources, significantly moderates the relationship between Recycling Practices and performance of large manufacturing firms in Kenya.

The results indicate that the inclusion of the interaction term resulted into an R^2 change of .048, [$F(1, 125) = 11.104$, $p < 0.05$], showing presence of significant moderating effect. This implies that the moderating effect of level of resources gained 4.8 % variance in the performance of large manufacturing firms in Kenya., above and beyond the variance Recycling Practice. Thus, the study rejects the null hypothesis.

Model two reveals the details of the inclusion of the interactive term in the model. Firm Resources was found to be significant ($p = 0.05$, regression coefficient = 0.076) and RP*FR was also found to be significant ($p < 0.05$, regression coefficient = 0.094). The regression model obtained from the moderated effect of Firm Resources was:

Performance = 1.768 + 0.084 RP + 0.076 FR + 0.094 RP*FR + error

Table 4.47: Moderation Model Summary for recycling

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.640[a]	.409	.400	.53028	.409	43.621	2	126	.000
2	.676[b]	.457	.444	.51022	.048	11.104	1	125	.001

a. Predictors: (Constant), Firm Resources, Recycling Practice
b. Predictors: (Constant), Firm Resources, Recycling Practice, RP_X_FR
c. Dependent Variable: Firm Performance.

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	24.532	2	12.266	43.621	.000[b]
	Residual	35.431	126	.281		
	Total	59.963	128			
2	Regression	27.423	3	9.141	35.114	.000[c]
	Residual	32.540	125	.260		
	Total	59.963	128			

a. Dependent Variable: Firm Performance.
b. Predictors: (Constant), Firm Resources, Recycling Practice
c. Predictors: (Constant), Firm Resources, Recycling Practice, RP_X_FR

COEFFICIENTS[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.276	.146		8.711	.000
	Recycling Practice	.315	.045	.489	6.942	.000
	Firm Resources	.221	.050	.313	4.437	.000
2	(Constant)	1.768	.204		8.663	.000
	Recycling Practice	.084	.032	.230	2.625	.010
	Firm Resources	.076	.018	.223	4.222	.000
	RP_X_LR	.094	.028	.557	3.332	.001

a. Dependent Variable: Firm Performance.

4.9.9 Moderation of the relationship between Reverse Product Flow Practice and firm performance by level of resources

To test the above hypothesis, linear regression was used to test the moderating effect of Firm Resources on the relationship between Reverse Product Flow Practice and the performance of large manufacturing firms in Kenya. Path coefficients were used to determine the direction and strength while T = statistics provided information on the significance of the relationships. The results are presented in table 4.48.

The R^2 for Model one was 0.560 implying that Firm Resources and Reverse Product Flow Practice jointly explain 56.0 % variation in performance of large manufacturing firms in Kenya. This regression model one is a good fit as indicated by the significant F-statistic (F value = 82.351, $p < 0.05$). Upon introduction of the interaction term presented as model two, the model is still significant (F value = 60.422, $p < 0.05$) inferring that Firm Resources, significantly moderates the relationship between Reverse Product Flow Practice and performance of large manufacturing firms in Kenya.

The results indicate that the inclusion of the interaction term resulted into an R^2 change of .025, [F (1, 125) = 7.746, $p < 0.05$], showing presence of significant moderating effect. This implies that the moderating effect of Firm resources gained 2.5 % variance in the performance of large manufacturing firms in Kenya., above and beyond the variance Reverse Product Flow Practice. Thus, the study rejects the null hypothesis.

Model two reveals the details of the inclusion of the interactive term in the model. Firm Resources was found to be significant ($p = 0.05$, regression coefficient = 0.173) and RPFP*FR was also found to be significant ($p < 0.05$, regression coefficient = 0.106). The regression model obtained from the moderated effect of Firm Resources was:

Performance = 1.500 + 0.292 RPFP + 0.173 FR + 0.106 RPFP*FR + error

Table 4.48: Moderation Model Summary for Reverse Product Flow

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.753[a]	.567	.560	.45417	.567	82.351	2	126	.000
2	.769[b]	.592	.582	.44248	.025	7.746	1	125	.006

a. Predictors: (Constant), Firm Resources, Reverse Product Flow Practice
b. Predictors: (Constant), Firm Resources, Reverse Product Flow Practice, RPFP_X_FR
c. Dependent Variable: Firm Performance.

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	33.973	2	16.987	82.351	.000[b]
	Residual	25.990	126	.206		
	Total	59.963	128			
2	Regression	35.490	3	11.830	60.422	.000[c]
	Residual	24.473	125	.196		
	Total	59.963	128			

a. Dependent Variable: Firm Performance.
b. Predictors: (Constant), Firm Resources, Reverse Product Flow Practice
c. Predictors: (Constant), Firm Resources, Reverse Product Flow Practice, RPFP_X_FR

COEFFICIENTS[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	.963	.133		7.214	.000
	Product Flow Management Practice	.584	.055	.668	10.558	.000
	Firm Resources	.126	.045	.179	2.826	.005
2	(Constant)	1.500	.233		6.443	.000
	Reverse Product Flow Practice	.292	.118	.334	2.473	.015
	Firm Resources	.173	.084	.203	2.060	.041
	PRP_X_FR	.106	.038	.535	2.783	.006

a. Dependent Variable: Firm Performance.

4.9.10 Moderation of the relationship between End-of-Life Management Practice and firm performance by firm resources

To test the above hypothesis, linear regression was used to test the moderating effect of Firm Resources on the relationship between End-of-Life Management Practice and the performance of large manufacturing firms in Kenya. Path coefficients were used to determine the direction and strength while T = statistics provided information on the significance to the relationships. The results are presented in table 4.48

The R^2 for model one was 0.403 implying that Firm Resources and End-of-Life Management Practice jointly explain 40.3% variation in performance of large manufacturing firms in Kenya. This regression model one is a good fit as indicated by the significant F-statistic (F value = 42.493, $p < 0.05$). Upon introduction of the interaction term presented as model two, the model is still significant (F value = 53.071, $p < 0.05$) inferring that Firm Resources, significantly moderates the relationship between End-of-Life Management Practice and performance of large manufacturing firms in Kenya.

The results indicate that the inclusion of the interaction term resulted into an R^2 change of .157, [F (1, 125) = 44.731, $p < 0.05$], showing presence of significant moderating effect. This implies that the moderating effect of level of resources gained 15.7 % variance in the performance of large manufacturing firms in Kenya above and beyond the variance End-of-Life Management Practice. Thus, the study rejects the null hypothesis.

Model two reveals the details of the inclusion of the interactive term in the model. Level of resources was found to be significant ($p = 0.05$, regression coefficient = 0.132) and EoLMP*LR was also found to be significant ($p < 0.05$, regression coefficient = 0.188).

The regression model obtained from the moderated effect of level of resources was

Performance = 1.798 + 0.146 EoLMP + 0.132 FR + 0.188 EoLMP*FR + error

Table 4.49: Moderation Model Summary for End-of-Life management

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change
1	.635	.403	.393	.53311	.403	42.493	2	126	.000
2	.748	.560	.550	.45932	.157	44.731	1	125	.000

a. Predictors: (Constant), Firm Resources, End-of-Life Management Practice
b. Predictors: (Constant), Firm Resources, End-of-Life Management Practice EUMP_X_FR
c. Dependent Variable: Firm Performance.

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	24.153	2	12.077	42.493	.000[b]
	Residual	35.810	126	.284		
	Total	59.963	128			
2	Regression	33.591	3	11.197	53.071	.000[c]
	Residual	26.372	125	.211		
	Total	59.963	128			

a. Dependent Variable: Firm Performance.
b. Predictors: (Constant), Firm Resources, End-of-Life Management Practice
c. Predictors: (Constant), Firm Resources, End-of-Life Management Practice, EUMP_X_FR

COEFFICIENTS[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.
1	(Constant)	1.102	.164		6.737	.000
	End-of-Life Management Practice	.450	.066	.488	6.808	.000
	Firm Resources	.205	.051	.291	4.057	.000
2	(Constant)	1.798	.175		10.263	.000
	End-of-Life Management Practice	.146	.023	.250	6.348	.000
	Firm Resources	.132	.037	.237	3.568	.001
	EUMP_X_FR	.188	.028	.834	6.688	.000

a. Dependent Variable: Firm Performance.

4.9.11 Moderating effect of firm resources on relationship between reverse logistics practices and firm performance

The fifth objective was to find out the moderating effect of firm resources on the relationship between reverse logistics practice and the performance of large manufacturing firms in Kenya. The following hypothesis was formulated:

Hypothesis 5

> *H_0: There is no moderating effect of firm resources on the relationship between reverse logistics and the performance of large manufacturing firms in Kenya.*

After analyzing each variable's effects and the moderating effect on performance, analysis was done to determine the joint effect of the moderating variable and all the independent variables on performance. The independent variables, that is, Disposition Practice, Recycling Practice, Reverse Product Flow Practice and End-of-Life Management Practice were used to fit the multiple linear regression model:

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

To test the above hypothesis, multiple linear regressions were used to test the moderating effect of firm resources on the relationship between reverse logistics and the performance of large manufacturing firms in Kenya. Path coefficients were used to determine the direction and strength while t=statistics provided information on the significance of the relationships. The results are presented in table 4.50

The R^2 for Model one was 0.710 implying that Firm Resources and Reverse Logistic Practices jointly explain 71.0% variation in performance of large manufacturing firms in Kenya. This regression model is a good fit as indicated by the significant F-statistic (F value = 60.258, $p < 0.05$). Upon introduction of the interaction term presented as model two, R^2 increased to 0.780, (0.070 increase) and the model was still significant (F value = 46.991, $p < 0.05$) inferring that Firm Resources, significantly moderates the relationship between Reverse Logistic Practices and performance of large manufacturing firms in Kenya.

The results indicate that the inclusion of the interaction term resulted into an R^2 change of 0.070, [$F (4, 119) = 9.530$, $p < 0.05$], showing presence of significant moderating effect. This implies that the moderating effect of Firm Resources gained 7.0 % variance in the performance of large manufacturing firms in Kenya above and beyond the variance Reverse Logistic Practices. Thus, the study rejects the null hypothesis and concludes that: Moderating effect of firm resources

Positively influences the relationship between reverse logistics and the performance of large manufacturing firms in Kenya.

Model 2 reveals the details of the inclusion of the interactive term in the model.

Model $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + Z$

The regression equation obtained from this output was:

1: $\text{Performance} = 0.534 + 0.223X_1 + 0.140X_2 + 0.316X_3 + 0.266X_4 + 0.109Z$

After interaction the regression equation obtained from this output was:

2: $\text{Performance} = 1.241 + 0.227X_1 + 0.306X_2 + 0.371X_3 + 0.336X_4 + 0.295Z$

For model 1 the beta coefficient for each practice was 0.344, 0.218, 0.361, 0.020 and 0.127 respectively. The t statistics and the corresponding p value were 5.897(0.000), 3.825(0.000), 5.241(0.000), 4.586(0.000) and 2.946(0.004) respectively for each practice. On the basis of these statistics, the study concludes that there was significant positive relationship between individual Reverse Logistic Practice and firm performance.

For Model two after introduction of interaction term, the beta coefficient for each practice was 0.243, 0.292, 0.295, 0.309 and 0.276 respectively. The t statistics and the corresponding p value were 3.134(0.000), 4.371(0.000), 2.473(0.015), 3.294(0.001) and 3.782(0.001) respectively for each practice. On the basis of these statistics, the study concludes that there was significant positive relationship between individual RL Practice and firm performance. Close observation of the two models indicates that, upon introduction of the interaction term presented as model two, the model is still significant (F value = 46.991, $p < 0.05$). All the coefficient values increased significantly inferring that Firm Resources, significantly moderates the relationship between Reverse Logistic Practices and performance of large manufacturing firms in Kenya. The results were in agreement with the studies done by Kannadhasan and Nandagopal (2011) which found that firm resources moderated the relationship between organization learning, organizational innovation and organizational performance. However, the relationship is more pronounced in large firms than that of smaller firms (García-Zamora *et al*., 2013).

Table 4.50: Overall Moderated Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change
1	0.843a	0.710	0.698	0.37593	0.710	60.258	5	123	0.000
2	0.883b	0.780	0.764	0.33262	0.070	9.530	4	119	0.000

a. Predictors: (Constant), Firm Resource, Recycling Practice, Disposition Practice, End-of-Life Management Practice, Reverse Product flow Practice

b. Predictors: (Constant), Firm Resource, Recycling Practice, Disposition Practice, End-of-Life Management Practice, Reverse Product flow Practice, EUMP_X_FR, RP_X_FR, DP_X_FR, RPFP_X_FR

c Dependent Variable: Firm Performance.

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	42.580	5	8.516	60.258	0.000[b]
	Residual	17.383	123	0.141		
	Total	59.963	128			
2	Regression	46.797	9	5.200	46.999	0.000[c]
	Residual	13.166	119	0.111		
	Total	59.963	128			

a. Dependent Variable: Firm Performance.

a. Predictors: (Constant), Firm Resources, Recycling Practice, Disposition Practice, End-of-Life Management Practice, Reverse Product flow Practice

c. Predictors: (Constant), Firm Resources, Recycling Practice, Disposition Practice, End-of-Life Management Practice, Reverse Product flow Practice, EUMP_X_FR, RP_X_FR, DP_X_FR, RPFP_X_FR

COEFFICIENTS[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	T	Sig.
1	(Constant)	0.534	0.126		4.240	0.000
	Disposition Practice	0.223	0.038	0.344	5.897	0.000
	Recycling Practice	0.140	0.037	0.218	3.825	0.000
	Reverse Product flow Practice	0.316	0.060	0.361	5.241	0.000
	End-of-Life Management Practice	0.266	0.058	0.020	4.586	0.000
	Firm Resources	0.109	0.037	0.127	2.946	0.004
2	(Constant)	1.241	0.202		6.144	0.000
	Disposition Practice	0.257	0.082	0.243	3.134	0.002
	Recycling Practice	0.306	0.070	0.292	4.371	0.000
	Reverse Product flow Practice	0.371	0.150	0.295	2.473	0.015
	End-of-Life Management Practice	0.336	0.102	0.309	3.294	0.001
	Firm Resources	0.295	0.078	0.276	3.782	0.000

a. Dependent Variable: Firm Performance.

4.10 Optimal Model

The optimal model for the study is drawn from the overall model with the interaction effect of the moderating variable (Firm Resources). The generated equation is as shown:

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

$Y = 1.241 + 0.371X_1 + 0.336X_2 + 0.306X_3 + 0.227X_4 + 0.295Z$

Where:

Y = Manufacturing firm performance

β_0 = Y intercept

X_1 = Reverse Product flow

X_2 = End-of-Life Management

X_3 = Recycling

X_4 = Disposition

Z = Firm resources (Moderating Variable)

The revised conceptual framework is shown on figure 4.8 below.

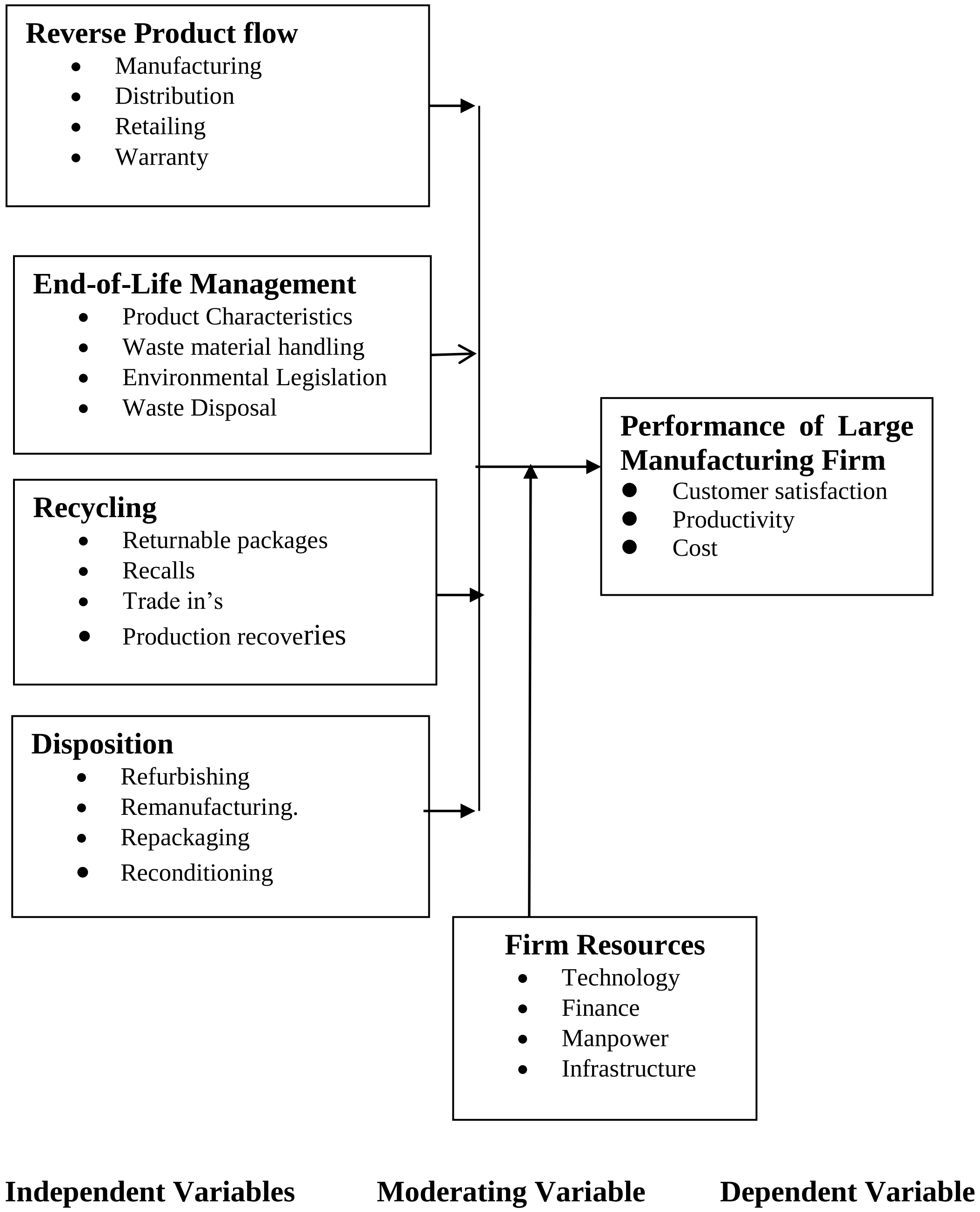

Figure 4.8: Revised Conceptual Framework

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the research work undertaken. It discusses the research findings, the conclusions that were drawn, recommendations made, knowledge gained and the suggested areas of further research based on the analyzed data related to the general and specific objectives of the study. The chapter further summarizes and gives suggestions for further research in the field of Supply Chain management. The recommendations will help the industry players on how they can improve the performance of manufacturing firms in Kenya for them to compete favorably in the dynamic global market.

5.2 Summary of Findings

The main objective of the study was to study reverse logistics practices and the performance of large manufacturing firms in Kenya. The study specifically determined the influence of product disposition and the performance of large manufacturing firms in Kenya, the influence of recycling and the performance of large manufacturing firms in Kenya, the influence of reverse product flow and the performance of large manufacturing firms in Kenya, the influence of End-of-Life management and the performance of large manufacturing firms in Kenya.

The study also examined the moderating effect of firm resources on the relationship between reverse logistics practices and the performance of large manufacturing firms in Kenya. The study established that there is a significant effect on the reverse logistics practices and the performance of large manufacturing firms in Kenya.

5.2.1 Disposition

The first objective was to establish the influence of product disposition and the performance of large manufacturing firms in Kenya. Disposition refers to the activities that place product back into inventory or temporary storage through the process of: repackaging, repair, refurbishing or remanufacturing. Finding from descriptive analysis found that remanufacturing was the most preferred form of disposition as it had the highest mean. This was followed by repackaging then refurbishing and finally reconditioning. All the four disposition options had an above average mean, hence its good for manufacturing firms to implement them. The findings also indicated that there was a linear relationship between Disposition Practice and firm performance. Pearson correlation coefficient test indicated that disposition practice had a strong positive relationship with firm performance.

5.2.2 Recycling

The second objective was to establish how recycling influences the performance of large manufacturing firms in Kenya. Recycling refers to the process through which waste products and materials are converted into new products and resold to the consumer. From descriptive statistics returnable packages was the most preferred form of recycling as it had the highest mean. This was followed by trade in's then recalls and finally product recoveries. The mean rating for the four recycling options was above average. This indicated that the respondents accepted that Recycling Practice exhibit moderate to high levels of implementation as part of reverse logistics. Further, test for linearity indicated that there is a linear relationship between Recycling Practice and firm performance. The test for correlation between Recycling Practice and firm performance indicated that Recycling Practice has a strong positive relationship with firm performance.

5.2.3 Reverse Product Flow

The third objective was to find out how reverse product flow practice influences performance in manufacturing firms. Reverse Product returns refer to all those returns that are initiated by a supply chain actor at any stage, after the product has been manufactured. From descriptive statistics the highest level of returned products are those emanating from distribution as it has the highest mean value. This is followed by retailers and finally manufacturing returns. They all have a mean value above average which means product returns is rated highly in manufacturing firms and therefore is worth implementing. Further tests indicated that there is a linear relationship between product flow management practice and firm performance. Correlation between reverse product returns practice and firm performance indicated that reverse product flow practice had a strong positive relationship with firm performance.

5.2.4 End-of-Life management

The fourth objective sought to find out how End-of-Life management influences the performance of manufacturing firms in Kenya. Waste management refers to all activities and actions required to manage waste from its inception to its final disposal. From descriptive statistics, environmental concerns as a result of waste handling were the most highly rated aspect of End-of-Life or waste management as it had the highest mean. This was followed waste disposal methods and finally product characteristics. This indicated that the respondent's concurred that End-of-Life Management Practice exhibit high levels of implementation as part of reverse logistics. Further tests indicated that there was a linear relationship between Waste Management Practice and firm performance. Correlation between Waste Management Practice and firm performance indicated that waste management practice had a strong positive relationship with firm performance.

5.2.5 Firm resources

The fifth objective was to examine how firm resources moderates the relationship between reverse logistics practices and the performance of large manufacturing firms. A resource is a specific asset under the custodian of a firm, which can be used to create a cost or differentiation advantage to other firm practices. From descriptive statistics the manpower aspect was the most preferred amongst others. This was followed by finance, technology and lastly infrastructure. They all had an above average mean scale rating. This indicated that the respondents agreed to the fact that firm resources exhibit high level of influence to success of as part of reverse logistics practice in their firms.

5.3 Conclusion

The general objective for this research was to study reverse logistics practices and the performance of large manufacturing firms in Kenya. The results of the study established that Disposition Practice was able to explain close to an average variation in the firm performance while the rest are explained by the error. The study findings also found that Disposition increases the level of manufacturing firm performance. In conclusion the null hypothesis was rejected implying that Disposition Practice had a significant influence on firm performance. On the basis of these statistics, the study concluded that there is significant positive relationship between Disposition Practice and firm performance.

In the case of Recycling the study established that Recycling Practice is able to explain only to a low extent the variations in the firm performance while the rest are explained by the error term. Further findings indicated that, an increase in Recycling Practice would increase manufacturing firm performance. The t-statistic and corresponding p-value led to the conclusion that the null hypothesis is rejected implying that Recycling Practice has a significant influence on firm performance. On the basis of these statistics, the study concluded that there is significant positive relationship between Recycling Practice and firm performance.

As for Reverse Product flow the study findings found that Product Flow Practice was able to explain over fifty percent variations in the firm performance while the rest are explained by the error term. Further study findings indicated that increase in Product Flow Practice causes an increase in manufacturing firm performance. The t-statistic and corresponding p-value results led to the conclusion in which null hypothesis was rejected implying that Reverse Product Flow Practice has a significant influence on firm performance. On the basis of these statistics, the study concluded that there is significant positive relationship between Reverse Product Flow Management Practice and firm performance.

In the case of End-of-Life management, the study finding found that it overs slightly below average variations in the firm performance while the rest are explained by the error term. Further findings indicated that increase in End-of-Life Management

Practice leads to an increase in manufacturing firm performance. The t-statistic and corresponding p-value results led to the conclusion in which null hypothesis was rejected implying that End-of-Life management Practice has a significant influence on firm performance. On the basis of these statistics, the study concluded that there is significant positive relationship between End-of-Life Management Practice and firm performance.

Finally, for the moderator Firm resources, the study findings found that it was able to enhance Reverse Logistic Practices such that it resulted to a high variation in performance of large manufacturing firms in Kenya. The regression model was a good fit as indicated by the significant F-statistic figures. Upon introduction of the interaction term presented as model 2, the model was even more significant inferring that Firm Resources, significantly moderates the relationship between Reverse Logistic Practices and performance of large manufacturing firms in Kenya.

5.4 Recommendations

Manufacturing sector in Kenya plays an important role and it makes a substantial contribution to the country's economic development. It has the potential to generate foreign exchange earnings through exports and diversify the country's economy by raising the GDP. The competitive manufacturing environment is one that is rapidly changing as globalization and technology force organization's to constantly seek ongoing improvement in all areas in terms of their knowledge, flexibility and performance (Muha, 2019). Kenya Vision 2030 had identified the manufacturing sector as one of the key drivers for realizing a sustained annual GDP growth (RoK, 2013). Manufacturing industries have the opportunity to increase their profit margins and minimize losses through implementing reverse logistics practices. Many companies are discovering that they can maximize secondary market opportunities. Based on the research findings, the study recommends the following;

The study findings established that Disposition practice has a positive contribution to manufacturing firm performance. For this to be achieved, it's recommended that firms should implement and make use of remanufacturing as it allows them to recapture value from returned products. Remanufacturing means making use of the returned and in most cases disassembled products or parts to re-produce new products at a lower cost. It's also necessary for firms to utilize refurbishing as it will extend the service life of a product as well as bringing its quality to an acceptable level besides reducing the product acquisition cost. Manufacturing firms can gain extra opportunities to earn a profit by repairing, reusing refurbishing and remanufacturing.

The purpose of recycling is to recover and reuse materials from returned products and parts or components. In reality, not every single part or component can be recycled. Lack of technological recycling solutions can make the recycled materials far from satisfactory. Customers may feel insecure using a product that consists of reused or recycled materials, even though the quality and the performance of the product meet the required standards. However, the study found that recycling procedures exhibit moderate to high levels of importance in Reverse Logistics which have a positive influence to manufacturing firm performance. It's therefore recommended that manufacturing firms should allow recycling procedures such as recalls, trade in's, returnable packages and production recoveries to be implemented as this will boost the performance of the firm.

The study findings also found that proper management of End-of-Life products gives the firm a positive image besides boosting its performance. Hence the study recommended that manufacturing firms should implement legislation laws governing End-of-Life (waste) products. Manufacturers should practice extended producer responsibility in handling all the waste produced.

It is important for the leading manufacturing firms to develop environmentally sustainable products because environmentally unfriendly products would be harmful to firms' reputations and then could cause a substantial loss. Firms should handle materials properly so that most of it can be converted to profitable entities. When properly handled most of the waste material can be recycled to produce different products. It will also make the firm meet the environmental legislation requirements dealing with waste handling and also create a favorable working environment.

Lastly the study findings found firm resources as being a key differentiating function for firm performance. This is because all firm activities depend on availability of resources. It's therefore recommended that the firm should efficiently and effectively make use of all the available resources. These include technology, finance, infrastructure and human resource. In general, it was recommended that manufacturers should be encouraged to implement extended producer responsibility on a product post-consumer stage.

5.5 Suggested areas of further study

As per the responses obtained from the respondents in line with the topic of reverse logistics practices and the performance of large-scale manufacturing firms in Kenya, the following areas were deemed appropriate for future research: Since reverse logistics comes with some costs the current study should therefore be expanded further in future in order to determine cost analysis related to adoption of reverse logistics in manufacturing firms in Kenya in order to affirm its viability. There is also need to undertake similar research in government institutions and public sector organizations in Kenya in order to establish whether the explored factors can be generalized to affect adoption of reverse logistics in manufacturing firms in the public sector.

The study also covered only five reverse logistics practices and selected only large manufacturing firms in Nairobi. This scope can be widened further to consider other practices and cover other firms in different parts of the country. If this study will be used in future research, the authors should focus more on involving more organizations. Other comparative studies between industries as regards reverse logistics would also be interesting for the whole field of reverse logistics processes.

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APPENDICES

Appendix I: Letter of Introduction

TO WHOM IT MAY CONCERN

Dear Sir / Madam,

<u>RE: PERMISSION TO COLLECT DATA</u>

I'm a student at Jomo Kenyatta University Agriculture and Technology (JKUAT) pursuing degree of Doctor of Philosophy in Supply Chain Management. As part of my academic program, I'm supposed to conduct a study on 'reverse logistics practices and the performance of large manufacturing firms in Kenya'.

You have been identified as a potential respondent in this research. Please respond to all questions, using your best estimates. Your participation in answering these questions is very much appreciated. Your responses will be completely confidential. If you have any questions or comments about this survey, you may contact: Felix Ndungu Kamanga Tel: 0720925333; email: kamangafelix60@gmail.com.

Yours faithfully,

Felix Ndungu Kamanga

Appendix 1I: Study Questionnaire

This questionnaire contains questions relating to reverse logistics practices and the performance of large-scale manufacturing firms in Kenya. To achieve this objective, relevant questions have been provided to gather data for analysis. Kindly spare some time to provide the requested information as accurately as possible.

The information provided will be treated with confidentially and will purely be used for academic purpose.

SECTION A: BACKGROUND INFORMATION

PART A: Organizational Data

Please provide the following information regarding your organization.

1. Company name ………………………………………………………

2. Type of manufacturing sector in which your company falls
………………………………………………………………

3. Ownership of company (tick one)

a. Locally [ ]

b. Foreign [ ]

c. Foreign and local [ ]

4. Markets served (tick)

a. Domestic markets only [ ]

b. Foreign markets only [ ]

c. Domestic and foreign [ ]

5. Number of years the organization has been in operation in Kenya

a. Less than 10 years [ ]

b. 11 to 20 years [ ]

c. 21 to 30 years [ ]

d. More than 30 years [ ]

5. Does your company perform its Reverse logistics activities in-house?

a) Yes [ ]

b) No [ ]

6. Approximately what is the annual turnover of your firm?

a) Below Kshs 50 million (small) [ ]

b) Between Kshs 51M and 100M (medium) [ ]

c) Above Kshs 101M (large) [ ]

SECTION B: REVERSE LOGISTICS PRACTICES

1. Disposition Practice

The following statements deal with Disposition Practice in your firm. Please Tick (√) only on one number that best reflects your opinion on the following five-point scale: {1 = Strongly Disagree (SD), 2 = Disagree (D), 3 =Neutral (N), 4 = Agree (A), 5 = Strongly Agree (SA)}

	disposition Practice	SD	D	N	A	SA
D1	Refurbishing offers reduction in unit cost of product					
D2	Refurbishing aims at improving the product's performance,					

D3	Refurbishing extends the service life of product					
D4	Refurbishing brings product quality to an acceptable level					
D5	Remanufacturing brings Reduced product/material acquisition cost					
D6	Remanufacturing aims to make the product's quality standard					
D7	Remanufacturing makes product performance like that of a new one					
D8	Remanufacturing allows the firm to capture value from the returned products					
D9	Repackaging changes the entire look of the products before being presented to the consumer					
D10	Repackaging can occur as a result of complaints from consumers					
D11	Repackaging makes the product more suitable and appealing to their customers					
D12	Repackaging helps firms assess their consumer needs and repackage their products into more convenient way					

Disposition Practice in reverse logistics has some contribution to the overall success of the firm operations.

[ ] Yes [ ] No

Rate your firm's implementation of Disposition Practice as part of reverse logistics by ticking from the scale provided where 1 = Terrible, 2 = Poor, 3 = Fair, 4 = Good and 5 = Excellent

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

2. Recycling Practice

The following statements deal with Recycling practice in your firm. Please Tick (√) only on one number that best reflects your opinion on the following five-point scale: {1 = strongly disagree (SD), 2 = disagree (D), 3 = Neutral (N), 4 = Agree (A), 5 = Strongly Agree (SA)}

	Recycling Practice	SD	D	N	A	SA
R1	Returnable packages provide proper Obsolete equipment/product disposition.					
R2	Returnable packages facilitate the process of recycling to avoid wastage of useful products.					
R3	The Firm allow packages to be returned to the manufacturers for recycling instead of becoming waste.					
R4	Returnable packages have allowed the firm to save on the cost of production by the use of the already available packaging devices.					
R5	The firm recalls products dispatched to customers due to faults detected on the products.					
R6	The Firms recalls products dispatched to customers due to risks posed to consumers in case they use them.					
R7	The firm recalls products to avoid the risk of legal action in case the customers are harmed by the products.					
R8	Our firm has a system of trading in products which the customer would want to dispose					
R9	The process of trade-ins allows the firm to receive discounts on the initial sale.					
R10	Trade-ins increase overall margins and average sale size, and help recycle used merchandise.					
R11	The firm has a trade-in facility on prices of new item in exchange for older item.					
R12	Use of trade-in systems create customer satisfaction and boosts productivity.					
R13	Use of production recoveries improve the lead time of production process.					
R14	Use of production recoveries reduce waste and increases profitability.					
R15	Product recovery aims at recovering the residual value of					

	used products.					
R16	Recovery prevents waste by diverting materials from landfills and conserves natural resources.					

Recycling Practice in reverse logistics has some contribution to the overall success of the firm operations.

[ ] Yes [ ] No

Rate your firm's implementation of Recycling Practice as part of reverse logistics

by ticking from the scale provided where 1=Terrible, 2=Poor, 3 =Fair, 4= Good and 5= Excellent

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

3. **Reverse Product flow Practice**

The following statements deal with Reverse Product flow Practice in your firm. Please Tick (√) only on one number that best reflects your opinion on the following five-point scale: {1 = Strongly Disagree (SD), 2 = Disagree (D), 3 =Neutral (N), 4 = Agree (A), 5 = Strongly Agree (SA)}

	Reverse Product flow Practice	SD	D	N	A	SA
PFM1	The firm returns products found with defects during production phase.					
PFM2	The firm returns final products that fail quality checks.					
PFM3	The production leftovers are returned for recycling purposes.					
PFM4	The by-products and scraps are returned for recycling or proper disposal.					
PFM5	Distributors receive goods for repair which can then be resold to the retailer or customer.					
PFM6	Distribution returns in the reverse supply chain take place between the distributor and the manufacturer.					

PFR7	Distribution returns are initiated by a supply chain actor during distribution, after the product has been made.					
PFM8	The firm returns products found with defects during distribution process.					
PFM9	Retailers accept product returns from the end customers and distribute them back into the reverse supply chain,					
PFM10	The retailers also participate in reselling the repaired or refurbished products.					
PFM11	User returns are those that are initiated by the user of the product as a result of consumption.					
PFM12	The firm returns products found with defects at the retailing level.					

Reverse Product flow Practice in reverse logistics has some contribution to the overall success of the firm operations.

[ ] Yes [ ] No

Rate your firm's implementation of Reverse product flow Practice as part of reverse logistics by ticking from the scale provided where 1 = Terrible, 2 = Poor, 3 = Fair, 4 = Good and 5 = Excellent

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

4. End-of-Life Management Practice

The following statements deal with End-of-Life management Practice in your firm. Please Tick (√) only one number that best reflects your opinion on the following five-point scale: {1 = Strongly Disagree (SD), 2 = Disagree (D), 3 =Neutral (N), 4 = Agree (A), 5 = Strongly Agree (SA)}

	End-of-Life management practice	SD	D	N	A	SA
WM1	Product characteristic should be considered before disposal or return.					
WM2	Products are sorted and categorized during disposal and return process.					
WM3	Material handling involve; collection, transportation and disposal of different kinds of waste.					
WM4	Some of the waste material is recycled to produce different products.					
WM5	Waste from firms includes different waste streams arising from production processes.					
WM6	Our firm has a system of waste material handling through which waste is properly disposed.					
WM7	Adherence to disposal regulations increases the firm corporate image.					
WM8	Waste disposal creates benefits to the environment.					
WM9	Our firm has implemented the environmental legislation requirements dealing with waste handling.					
WM10	Implementing proper waste disposal practice has improved the relationship with stake holders.					
WM11	Implementing proper waste disposal practice has created a conducive working environment.					
WM12	Our firm uses different disposal methods for different waste material.					
WM13	Proper disposal eliminates customer reluctance to handle hazardous substances in product.					

End-of-Life management practice in reverse logistics has some contribution to the overall success of the firm operations.

[ ] Yes [ ] No

Rate your firm's implementation of End-of-Life management Practice as part of reverse logistics by ticking from the scale provided where 1= Terrible, 2 = Poor, 3 = Fair, 4 = Good and 5 = Excellent

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

5. Firm Resources

The following statements deal with Firm Resources in your firm. Please Tick (√) only on one number that best reflects your opinion on the following five-point scale: {1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), 5 = Strongly Agree (SA)}

	Firm Resources	SD	D	N	A	SA
LR1	The firm level of technology influences the extent to which reverse logistics practices are implemented.					
LR2	Technology level improves visibility from initiation of return to ultimate disposition,					
LR3	IT makes transaction of returns flow easier and more transparent than paper-based methods.					
LR4	The firm level of finance influences the extent to which reverse logistics practices are implemented.					
LR5	Product recovery system are challenging due to costs involved in the returns process.					
LR6	The level of finance is a limiting factor in reverse logistics.					
LR7	The firm level of manpower influences the extent to which reverse logistics practices are implemented.					
RL8	The firm has adequate manpower to support RL implementation.					

LR9	HRM practices influences implementation of reverse logistics in the firm.					
LR10	The firm level of infrastructure influences the extent to which reverse logistics practices are implemented.					
LR11	The firm has adequate networking to support RL implementation.					
LR12	The existence of good RL infrastructure provides a firm with the capability to handle returns.					

Firm Resources in reverse logistics has some moderating contribution to the overall success of the firm operations.

[ ] Yes [ ] No

Rate the extent to which Firm Resources contribute to the success of implementing reverse logistics practice by ticking from the scale provided where 1 = Terrible, 2 = Poor, 3 = Fair, 4 = Good and 5 = Excellent

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

SECTION C: MANUFACTURING FIRM PERFORMANCE

Manufacturing firm performance can be measured in terms of cost, customer satisfaction and productivity relative to the industry standards and customer service levels.

Kindly fill in the table below by ticking the appropriate box relating to manufacturing firm performance in each year.

Performance Attribute	Rank	2016	2017	2018	2019	2020
MFP1	(Below 200)					
Productivity in metric tonnes = <u>Total output</u> Total input	(201 – 400)					
	(401 – 600)					
	(601 – 800)					
	(Above 801)					
Performance Attribute	Rank	2016	2017	2018	2019	2020
MFP2.Total Production	(Below 2000)					
	(20001 – 40000)					

Revenue In Ksh x 1000	(40001 – 60000)					
	(60001 – 80000)					
	(Above 80001)					
MFP3.Average Lead time in weeks	(Below 2 weeks)					
	(3 to 4 weeks)					
	(5 to 6 weeks)					
	(7 to 8 weeks)					
	(Above 8 weeks)					
MFP4.Total number of rejected Items per week	(Below 200)					
	(201 – 400)					
	(401 – 600)					
	(601 – 800)					
	(Above 800)					
Performance Attribute	Rank	2016	2017	2018	2019	2020
MFP5.Total number of customer complaints in product performance	(Below 20)					
	(21 – 40)					
	(41 – 60)					
	(61 – 80)					
	(Above 80)					
MFP6.Total number of products returned by customers	(Below 200)					
	(201 – 400)					
	(401 – 600)					
	(601 – 800)					
	(Above 800)					
MFP7. Total number of product failures/rejects	(Below 200)					
	(201 – 400)					
	(401 – 600)					
	(601 – 800)					
	(Above 800)					

Appendix III: List of Large Manufacturing Firms

1	**ELECTICALS & ELECTRONICS**	20	Alloy Steel Castings Ltd
1	Asano International Limited	21	Doshi Enterprises Limited
2	Digitech East Africa Ltd	22	Steelmakers Ltd
3	Aucma Digital Technology Africa Ltd	23	Tarmal Wire Products Ltd
4	East Africa Cables Ltd	24	Greif Kenya Limited
5	IberaAfrica Power (EA) Ltd	25	Elite Tools Ltd
6	Kenwest Cables Ltd	26	Insteel Limited
7	Kenya Power Ltd	27	Standard Rolling Mills Ltd
8	Metlex International Ltd	28	Laminate Tubes Industries
9	Mustek East Africa Limited	29	Steel Structures Limited
10	Nationalwide Electrical Industries Ltd	30	Manufacturers & Suppliers (K) Ltd
		31	Athi River Steel Plant Ltd
2	**METAL AND ALLIED**	32	Napro Industries Limited
1	Tononoka Steel Ltd	33	Booth Extrusions
2	Metal Crowns Limited	34	Warren Enterprises Ltd
3	Heavy Engineering Ltd	35	Brollo Kenya Limited
4	Nampak Kenya Ltd		
5	Kens Metal Industries Ltd		**MOTOR VEHICLE**
6	General Aluminium Fabricators Ltd	1	Auto Ancillaries Ltd Kenya
7	Orbit Engineering Ltd	2	Varsani Brakelining Ltd
8	Apex Steel Ltd - Rolling Mill Division	3	Bhachu Industries Ltd
9	Hobra Manufacturing Ltd	4	Chui Auto Spring Industries Ltd
10	Narcol Aluminium Rolling Mills Ltd	5	Toyota East Africa Ltd Mutsimoto
11	Farm Engineering Industries Ltd	6	Unifilters Kenya Ltd
12	Khetshi Dharamshi & Co. Ltd	7	General Motor East Africa Limited
13	Davis & Shirtliff Ltd	8	Impala Glass Industries Ltd
14	Kenya General Industries Ltd	9	Vehicle Manufacturers Limited
15	Corrugated Sheets Limited	10	Labh Singh Harnam Singh Ltd
16	City Engineering Works Ltd	11	Mann Manufacturing Co. Ltd
17	Devki Steel Mills Ltd	12	Megh Cushion industries Ltd
18	Wire Products Limited	13	Motor Company Ltd
19	Mabati Rolling Mills Limited	14	Pipe Manufacturers Ltd
15	Sohansons Ltd	2	Dawa Limited
16	Theevan Enterprises Ltd	3	Biodeal Laboratories Ltd
17	Kenya Grange Vehicle Industries Ltd	4	Beta Healthcare International Limited

18	Kaluworks Limited	5	Bulks Medical Ltd
19	DT Dobbie Autos	6	Cosmos Limited
20	Autofine Filters & Seals Ltd	7	Laboratory & Allied Limited
		8	Manhar Brothers (K) Ltd
		9	Madivet Products Ltd
4	**PLASTICS & RUBBER**	10	Novelty Manufacturing Ltd
1	Betatrad (K) Ltd	11	Oss. Chemie (K) Pharm
2	Blowplast Ltd	12	Gesto Pharmaceutical Ltd
3	Bobmil Industries Ltd	13	Glaxo Smithkline Kenya Ltd
4	Complast Industries Limited	14	KAM Pharmacy Limited
5	Kenpoly Manufacturers Ltd	15	Pharmaceutical Manufacturing Co
6	Kentainers Ltd		
7	King Plastic Industries Ltd		
8	Kingway Tyres & Automart Ltd	**6**	**FOOD & BEVERAGE**
9	L.G. Harris & Co. Ltd	1	Bio Foods Products Limited
10	ACME Containers Ltd	2	Africa Spirits Ltd Highlands
11	Afro Plastics (K) Ltd	3	Belfast Millers Ltd Insta
12	Alankar Industries Ltd	4	Bidco Oil Refineries Ltd
13	Dune Packaging Ltd	5	Breakfast Cereal Company(K) Ltd
14	Elgitread (Kenya) Ltd	6	Broadway Bakery Ltd
15	Elgon Kenya Ltd	7	Centrofood Industries Ltd
16	Eslon Plastics of Kenya Ltd	8	Coca cola East Africa Ltd
17	Five Star Industries Ltd	9	Confec Industries (E.A) Ltd
18	General Plastics Limited	10	Corn Products Kenya Ltd
19	Haco Industries Kenya Ltd	11	Crown Foods Ltd
20	Laneeb Plastics Industries Ltd	12	Deepa Industries Ltd
21	Metro Plastics Kenya Limited	13	Products (EPZ) Ltd
22	Ombi Rubber Rollers Ltd	14	Homeoil
23	Packaging Industries Ltd	15	Jetlak Foods Ltd
24	Plastics & Rubber Industries Ltd	16	Kenafric Industries Limited
25	Premier Industries Ltd	17	Kenblest Limited
		18	Kenya Breweries Ltd
		19	Nestle Kenya Ltd
5	**PHARMACEUTICAL & MEDICAL EQUIPMENT**	20	Patco Industries Limited
1	Alpha Medical Manufacturers Ltd	21	British American Tobacco Kenya Ltd
22	Pearl Industries Ltd	3	Oasis Limited
23	Pembe Flour Mills Ltd	4	Cooper K-Brands Ltd
24	Premier Flour Mills Ltd	5	Bayer East Africa Ltd
25	Kenya Breweries Ltd	6	Soilex Chemical Ltd
26	Farmers Choice Ltd	7	Crown Gases Ltd
27	Frigoken Ltd	8	Continental Products Ltd
28	Alpha Fine Foods Ltd	9	Cooper Kenya Limited
29	Capwelll Industries Ltd	10	Beiersdorf East Africa Ltd
30	E & A Industries Ltd	11	Blue Ring Products Ltd

31	Trufoods Ltd	12	BOC Kenya Limited
32	Unga Group Ltd	13	Carbacid (CO2) Limited
33	Kevian Kenya Ltd	14	Chemicals and Solvents E.A. Ltd
34	London Distillers (K) Ltd	15	Coil Products (K) Limited
35	Kenya Wine Agency Limited	16	Colgate Palmolive (E.A) Ltd
36	Highlands Canner Ltd	17	Kel Chemicals Limited
37	Nairobi Bottlers Ltd	18	Magadi Soda Company Ltd
38	Rafiki Millers Ltd	19	United Chemical Industries Ltd
39	Softa Bottling Co. Ltd	20	Rumorth East Africa Ltd
40	Wrigley Company (E.A.) Ltd	21	Sadolin Paints (E.A.) Ltd
		22	Super Foam Ltd
7	**BUILDING, MINING & CONSTRUCTION**	23	Procter & Gamble East Africa Ltd
1	Central Glass Industries Ltd	24	Vitafoam Products Limited
2	Manson Hart Kenya Ltd	25	Twiga Chemical Industries Ltd
3	Athi River Mining Ltd	26	Syngenta East Africa Ltd
4	Kenbro Industries Ltd	27	Murphy Chemical E.A Ltd
5	Mareba Enterprises Ltd	28	Unilever Kenya Ltd
6	Flamingo Tiles (Kenya) Limited	29	Soilex Chemical Ltd
7	Bamburi Cement Limited	30	Osho Chemicals Industries Ltd
8	Kenya Builders & Concrete Ltd		
9	Bamburi Special Products Ltd		
10	Central Glass Industries	**9**	**PAPER SECTOR**
11	East Africa Portland Cement	1	Jomo Kenyatta Foundation
12	Flamingo Tiles (Kenya) Limited	2	Interlabels Africa Ltd
13	Glenn Investments Ltd	3	Icons Printers Ltd
14	The Group Ltd Mehta	4	English Press Limited
15	International Energy Technik Ltd	5	Graphics & Allied Ltd
		6	Bag and Envelope Converters Ltd
		7	Brand Printers
8	**CHEMICAL SECTOR**	8	Carton Manufacturers Ltd
1	Basco Product (K) Ltd	9	Chandaria Industries Limited
2	Crown Berger Kenya Ltd	10	Colour Packaging Ltd
11	Colour Print Ltd	3	Shah Timber Mart Ltd
12	Kenya Stationers Ltd	4	Shamco Industries Ltd
13	Paper Converters (Kenya) Ltd	5	Wood Makers Kenya Ltd
14	Printpak Multi Packaging Ltd	6	Woodtex Kenya Ltd
15	Printwell Industries Ltd	7	Newline Limited
16	Dodhia Packaging Limited	8	Transpaper Kenya Ltd
17	Creative Print House	9	Kenya Wood Ltd
18	Prudential Printers Ltd	10	Eldema (Kenya) Limited
19	Paper House of Kenya Ltd		
20	Primex Printers Ltd		
10	**TEXTILE & APPAREL**		
1	YU-UN Kenya EPZ Company Ltd		

2	Kenya Trading (EPZ) Ltd		
3	J.A.R Kenya (EPZ) Ltd		
4	Metro Impex Ltd		
5	Midco Textiles (EA) Ltd		
6	Premier Knitwear Ltd		
7	Protex Kenya (EPZ) Ltd		
8	Rolex Garments (EPZ) Ltd		
9	Riziki Manufacturers Ltd		
10	Image Apparels Ltd		
11	Alpha Knits Limited		
12	Apex Appaels (EPZ) Ltd		
13	Spinners & Spinners Ltd		
14	Straightline Enterprises Ltd		
15	Sunflag Textile & Knitwear		
16	Tarpo Industries Limited		
17	Vaja Manufacturers Limited		
11	**LEATHER & FOOTWEAR**		
1	Bata Shoe Co. (K) Ltd		
2	C & P Shoe Industries Ltd		\
3	Leather Industries of Kenya Limited		
12	**WOOD PRODUCTS**		
1	Fine Wood Works Ltd		
2	Furniture International Ltd		

Source: Kenya Association of Manufacturers (KAM) Directory. June, 2018