

**EFFECT OF SELECTED GREEN SUPPLY CHAIN MANAGEMENT
PRACTICES ON PERFORMANCE OF SUGAR MANUFACTURING FIRMS
IN WESTERN KENYA**

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**A Thesis Submitted in Partial Fulfilment of the Requirements for the Award of
the Degree of Master of Business Administration (Supply Chain Management),
Masinde Muliro University of Science and Technology.**

October, 2025

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DEDICATION

I dedicate this work to my dad CPA Mwalati Kalawanga and my late mum Mrs. Jackline Nekesa Mwalati for their inspiration, financial support, encouragement, understanding and prayers towards the successful completion of this thesis.

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ABSTRACT

The drive to enhance overall sustainability in organization performance has resulted to focus on pollution prevention and minimization of environmental impacts at all stages of the product lifecycle from sourcing of raw materials, through manufacturing, transport, use and disposal, this has not been embraced by all companies in the sugar industry in Kenya while those that have embraced the Green Supply Chain Management Strategies are still under-utilizing them. The general objective of the study was to investigate the effects of selected green supply chain practices on performance of sugar manufacturing firms in western Kenya. The specific objectives were to determine the effect of green manufacturing on performance of sugar manufacturing firms in Western Kenya, to evaluate the effect of green packaging on performance of sugar manufacturing firms in Western Kenya, to establish the effect of reverse logistics on the performance of sugar manufacturing firms in Western Kenya and to examine the effect of green procurement on the performance of sugar manufacturing firms in Western Kenya. It was anchored on two theories of Natural Resource Based View and Transaction Cost Economics theories. The study adopted descriptive and causal research design using both qualitative and quantitative approaches. The study targeted 10 sugar manufacturing firms in Western Kenya with 190 employees from procurement and production departments. Sample size of 129 was selected using simple random sampling technique focusing on designated departments and then stratified sampling was used specifically targeting managers, middle-level managers, and supervisors within the procurement and production sectors. The data was collected using questionnaires within a period of two months. Closed ended questionnaires were used based on a five-point Likert scale. It was then edited and analyzed using Statistical Package for Social Sciences (SPSS) software using descriptive statistics indexes such as mean, percentages and frequency distribution method. Data was presented in form of frequency tables. Data was analyzed using regression analysis using both univariate and bi-variate models. Reliability was tested using Cronbach's Alpha coefficient and validity of the research instruments was tested through content, criterion and construct, hypothesis testing was done basing on the p-values of specific independent variables. Regression coefficient results indicated that green procurement, green manufacturing, green packaging and reverse logistics had a significant effect on performance of sugar manufacturing firms in western Kenya. Findings indicated that green procurement, green manufacturing, green packaging and reverse logistics had a significant effect on performance of sugar manufacturing firms in western Kenya with p-values < 0.05. It was concluded that green supply chain practices affect performance of sugar manufacturing firms in western Kenya. It is advised that the administrators of the sugar manufacturing company should actively advocate for practices that promote sustainability and a green supply chain. The attainment of this objective can be facilitated by implementing training programs, workshops, and internal communication strategies that underscore the significance and advantages of green supply chain management (GSCM). The coefficient of determination (0.560) suggests that around 56% of the variations in sugar manufacturing performance—assessed through operational cost levels, product and service quality, as well as efficiency and effectiveness—can be elucidated by alterations in green supply chain practices. The research complied with ethical standards. The results will prove beneficial to scholars, professionals, and decision-makers.

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ABBREVIATIONS AND ACRONYMS

AGOA	African Growth and Opportunity Act
COMESA	Common Market for Eastern and Southern Africa
EAC	East Africa Community
GDP	Gross Domestic Product
GSCM	Green Supply Chain Management
ISO	International Organization for Standardization
NEMA	National Environmental Management Authority
NRBV	Natural Resource-Based View
OECD	Organization for Economic Cooperation and Development
PPAD	Public Procurement and Asset Disposal
PWC	Price Waterhouse Coopers
RBV	Resource-Based View
SMES	Small and Micro Enterprises
SPSS	Statistical Package for Social Science
VIF	Variance Inflation Factor
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Green Supply Chain Management Practices	The integration of environmentally sustainable activities throughout the whole supply chain, including sourcing, product design and development, production, transportation, packing, storage, retrieval, disposal, and post-sales services, such as end-of-product life management.
Green manufacturing	The practice of producing sugar in a way that reduces harm to the environment, conserves natural resources and promote sustainable operations by using energy-efficient industrial machinery designed to eradicate waste and enhance productivity.
Green packaging	Green packaging encompasses three primary aspects: reducing the use of non-biodegradable materials, employing packaging that requires little energy use, and utilizing ecologically sustainable packaging solutions.
Green procurement	It is choosing to buy goods and services that have lower environmental impact throughout their life cycle.
Reverse logistics	The process of moving products, packaging, or materials backward through the supply chain-from the manufacturer-for the purpose of reuse, recycling, proper disposal, or recovery.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Contemporary industrial advancements lead to heightened competitiveness among industrial sectors. This generates diverse beneficial and bad effects on multiple facets, one of which is the environment. Environmental implications occur throughout the production process, beginning with the acquisition of raw materials, continuing through manufacturing, and culminating in product reuse (Zhang, Wu, Zhang, Zhu, Lin, Zhang, & Smola, 2022). The cultivation and processing of sugarcane have been associated with detrimental impacts on the environment and society, such as habitat destruction, excessive water use, significant pesticide dependence, and air and water pollution (Sugar task force, 2020). Notwithstanding these apprehensions, Kenyan sugar businesses have not undertaken any initiatives to showcase their sustainability policies and environmental effects. The environmental management system was established to offer fundamental rules ensuring that business operations align with environmental sustainability (Affandi, Sarwani, Erlangga, Siagian, Purwanto, Effendy & Juhaeri 2020). Khan, Yu, Belhadi, and Mardani (2020) contended that enterprises ought to prioritize green supply chain management (GSCM) to foster a more sustainable environment.

Green supply chain management represents a contemporary approach for organizations to mitigate environmental degradation and uphold human rights (Kirchoff, Tate, Mollenkopf, & Management, 2016). Tan, Zailani, Tan, and Yeo (2019) and Tseng, Bui, Lim, and Lewi (2021) define supply chain management (SCM) as a network comprising suppliers, manufacturing, assembly, distribution, and logistics facilities that facilitate

the procurement of materials, the transformation of these materials into semi-finished and finished goods, and the subsequent distribution of products to consumers. GSCM involves adding environmental concerns in systems, which include the design of products, the choice of materials and supplier, manufacturability, transportation of finished products to the customer, and the management of products, Novitasari, Alshebami, and Sudrajat (2021).

The enhancement of product design, operations management, and customer relationships are all included in the striving of GSCM to increase the environmental performance. Wenhao et al. (2020) assert that sustainable development can be realized through the practices of GSCM by businesses. These practices would minimize the negative effects on the environment and resources and, nevertheless, maximize economic benefits. Ultimately, green practices are able to improve the performance of a supply chain that will enhance sales and reduce operational expenses (Lee, 2019). Amemba, Nyaboke, Osoro, and Mburu (2013) mention that GSCM is a very broad concept that covers the following activities: green sourcing, production, distribution, packaging, and reverse logistics. Jasneet, Ramneet, Anjali, Satyaveer, and Goyal (2018) identified a list of the green supply chain initiatives. These were green procurement, reverse logistics, customer co-operation on environmental projects, investment recovery and eco-design, internal environmental management, adoption of environmental management systems such as ISO 14001, green manufacturing and packaging, environmental participation, green marketing, energy conservation and supplier and customer cooperation.

According to Aslam, Waseem, and Khurram (2019), as well as Assumpção, Campos, Jabbour, Jabbour, and Vazquez-Brust, (2019), GSCM refers to an inclusion of environmental concerns in supply chain management, which includes the design of

products, raw and auxiliary materials used, manufacturing processes, distribution of the finished products to consumers, and post-consumption disposal of goods. This includes sustainable procurement, integrated supply chain with suppliers, manufacture and consumers, recycling and re-manufacture (Husaini, Pirzada & Saiful, 2020).

Globally, Astawa, Pirzada, Budarma, Widhari, and Suardani (2021) conducted a global study on the impact of GSCM techniques on competitive advantages and organizational performance in five-star hotels in Bali, Indonesia. The study findings indicate that GSCM methods have a favorable and significant impact on the performance and competitive advantage of five-star hotels. Al-Sheyadi, Muyldermans, and Kauppi (2019) examined the complementarity of GSCM strategies and their impact on the environmental performance of Omani manufacturing businesses. Their studies revealed a significant association between collective GSCM proficiency and its environmental impact. Advocating that the integration of GSCM methodologies is more advantageous than relying on isolated best practices.

Gupta, Sharma, Chauhan, Parewa, Rai, and Naik, (2025), using survey data from 389 managers in Indian bag-manufacturing firms and SEM analysis, findings revealed that several GSCM practices (green procurement, green logistics, green product design, regulatory support) positively influence top management performance, which in turn significantly improves low-carbon performance, and that low-carbon performance positively relates to sustainable manufacturing and societal sustainability. Nazir, Zhaolei, Mehmood & Nazir (2024) also while surveying manufacturing firms, their outcome showed that adoption of GSCM practices significantly improves environmental performance, and that the strength of that relationship is moderated by institutional pressure (e.g., regulations, industry norms). Findings stressed that

regulatory/institutional context matters — GSCM pays off more where external pressure or incentives exist.

Organizational performance is improved by operational success. Water shortage, land use, and biodiversity loss are some of the environmental issues that Asia-Pacific countries like India and Thailand face. To address these concerns, green supply chain strategies are being implemented (Winchmann, 2019). Green supply chain techniques improve sugar companies' overall performance, according to the study, which highlights the critical need of government, industry, and civil society working together to promote these practices.

Regionally, a study conducted by Nsowah, Agyenim-Boateng, and Anane (2022) examined the effects of sustainable supply chain management on the performance of manufacturing firms in Ghana. The study found that these firms were more successful in meeting their environmental sustainability goals when they used sustainable materials in product design, standardized their designs to make them more reuse-friendly, manufactured products with a smaller environmental impact, evaluated their current processes to find ways to reduce their environmental impact, and formalized their environmentally friendly practices. Fianko, Amoah, and Dzogbewu (2021) conducted a study to determine the effects of green supply chain practices, internal and external, on the environmental performance of construction businesses. The environmental performance and green purchasing and green construction were also examples of external green practices that directly positively correlated with green design. Oluka, Afito, and Nalukenge (2019) carried out a research that investigated the association between GSCM practices and organizational performance in Uganda. Their results reveal that green supply chain practices are significant in promoting the reputation of the organizations in the country. Consumers and stakeholders are

increasingly becoming aware of the need to go green. Organisations with a veritable commitment to environmental custodianship are bound to gain positive appreciation and create confidence among the stakeholders. In addition, Mukulu and Kikooma (2018) also carried out a study that evaluated the connection between GSCM practices and operational performance. The results of their research show that the application of GSCM has a great positive impact on organizational operational performance and resilience in Uganda. The creation of more resilient supply chains to be disrupted successfully can be achieved by the companies through fostering relationships with sustainable suppliers, reducing environmental effects, and enhancing resource efficiency.

In Kenya, in some of the communities where the sugar companies operate, the practice of green supply chain is of significant importance to the environmental sustainability, social responsibility and economic growth. Mohammed, Lagat, and Ngeno (2019) have discussed the connection between the performance of manufacturing companies in Kenya and their sustainability in supply chain practices. These results suggested that sustainability of the supply chain in terms of environmental considerations was significantly affecting the performance of these companies. In order to improve performance by adopting environmentally sustainable supply chain practices, manufacturing companies should adopt cleaner production that should be part of the core principle that is entrenched in their internal policies.

In one study, Ojijo (2023) investigated how the GSCM Practices can affect the Environmental Performance of Sugar Firms in Western Kenya. As the results showed, the adoption of GSCM practices by these companies has a positive and significant impact on the environmental performance of these companies, which means that an increase in GSCM practices is associated with the performance of the firms in relation

to the environment. In a research carried out in 2018 by Ochieng and Kokwaro, the connection between green procurement and organizational performance was found out where Green procurement and supply chain practices may contribute to the reduction of costs incurred by the organization in Kenya. By means of the tactical improvement of resource exploitation, the minimization of wastes, the optimization of the working processes, organizations can experience the decrease of the total spending, consequently, helping to enhance the financial functioning.

1.1.1 The Green Supply Chain Management

Both different organizations can adopt different GSCM practices according to their operational structures, characteristic traits, as well as the industrial sector in which they are operating. According to the explanation created by Çankaya and Sezen (2019), green manufacturing is a paradigm where companies attempt to make their production systems operate in a way that does not negatively affect the environment. Green manufacturing is aimed at ensuring that the manufacturing process of the company does not cause the contamination of the air, soil and water. Green packaging includes use of re-usable package, recyclable materials, non-hazardous, biodegradable, and adoption of smaller packaging. These practices aim to lower transport costs, optimize shelf space, and diminish carbon footprints. The Sustainable Packaging Coalition (SPC) defines green (sustainable) packaging as that which, throughout its entire life cycle, proves to be beneficial, safe, and healthy for both individuals and society at large. Green packaging offers numerous advantages; it diminishes packaging expenses and solid waste, while also enhancing environmental sustainability through the use of alternative materials and methods.

Reverse logistics, considered an essential principle within the realm of supply chain management, pertains to the strategic utilization of resources aimed at minimizing, recycling, and reusing materials, as well as the elimination of waste. It is also noted to assist in diminishing the volume of waste and facilitates waste recovery (Mesjasz-Lech, 2019). Moreover, reverse logistics encompasses remanufacturing, refurbishment, recycling, disposal, and inventory management. Shao and Ünal (2019) articulate that green procurement involves the integration of environmental considerations into purchasing processes and decision-making, with the objective of generating products and services that are environmentally sustainable, thereby mitigating the detrimental impacts of the supply chain on the environment.

1.1.2 Performance

Zhu, Geng, Fujita, and Hashimoto (2021) articulated the concept of performance as the efficacy of environmental management practices in realizing sustainability objectives, which encompass resource conservation and the mitigation of pollution. The efficacy of GSCM can be articulated as the quantifiable results attained through the adoption of environmentally sustainable methodologies within supply chain operations. This includes multiple facets, including environmental, economic, and social performance indicators, (Sarkis, Zhu, & Lai, 2020).

1.1.3 Sugar Manufacturing firms in Kenya

The manufacturing sector in Kenya accounts for 70 percent of the industrial sector's contribution to GDP (Ker, 2013). Kenya boasts a substantial manufacturing sector that caters to both domestic demands and exports within the East African region. The manufacturing sector in Kenya stands out as a pivotal area earmarked for economic advancement and development, owing to its significant capacity for generating wealth,

creating employment opportunities, and alleviating poverty. The sugar industry plays a significant role in the agricultural sector, which serves as a cornerstone of the economy and sustains the livelihoods of approximately 25% of the Kenyan populace.

The subsector constitutes approximately 15% of the agricultural GDP and serves as the principal employer and source of sustenance for the majority of households in Western Kenya, which includes Nyanza, Rift Valley, and Western Provinces. These firms exhibit enhanced power supply, a greater availability of agricultural products for agro-processing, advantageous tax reforms and incentives, more robust export promotion, and liberal trade incentives designed to capitalize on the broadened market opportunities presented by AGOA, COMESA, and East African Community (EAC) arrangements, leading to sectoral expansion (PWC, 2006).

Compared to other parts of Africa and the world, the Kenya sugar sector has not been performing as expected (AFA 2019), KSD (2018) records indicate that the performance of the sugar manufacturing firms have continued to register declining performance over the last three years, with total sugar produced in Kenya being 638,340 tons in 2015 to 377,126 tons in 2017 representing a decline of 41% in terms of sugar production against an increased local demand of up to 890,000 tons recorded in 2017.

Ojijo, 2023, discovered that the adoption of GSCM practices within sugar manufacturing enterprises in western Kenya encounters a range of obstacles. A significant challenge lies in the insufficient comprehension of GSCM practices among both management and employees, as many organizations continue to adhere to conventional manufacturing methods instead of emphasizing environmental considerations. Moreover, the existing regulatory frameworks impose constraints that necessitate the compulsory implementation of GSCM practices by sugar companies. In western Kenya, one can observe a diverse array of sugar enterprises, including Mumias

Sugar Company Limited, Kabras Sugar Company, Butali Mills Factory, Nzoia Sugar Company Limited, Busia Sugar Industry Limited, Muhoroni, Chemelil, South Nyanza, Kibos, and Transmara.

1.2 Statement of Problem.

Manufacturing firms face significant pressure to innovate and implement environmentally sustainable practices. Consequently, numerous industries are adopting more eco-conscious strategies, including the integration of environmentally considerate design into their products and the adoption of sustainable distribution methods (Murphy, 2012). It is imperative for manufacturers to fully comprehend the stipulations and guarantee that their products adhere to the established regulations. The cultivation and refinement of sugarcane have been associated with detrimental supply chain practices impacting both the environment and society. These practices encompass the degradation of natural habitats, excessive consumption of water resources, a significant dependence on pesticides, and the contamination of air and water (Sugar task force, 2020). The NEMA report from 2015 indicated that despite the gradual adoption of supply chain solutions such as wastewater treatment by sugar mills, the environmental contamination resulting from these operations continues to rise.

The utilization of green supply chain capabilities by manufacturing enterprises to achieve triple-bottom-line performance has received scant attention, notwithstanding the extensive literature surrounding green purchasing practices and sustainability, as noted by Khan and Farooq in 2022. Furthermore, manufacturing firms in Kenya have been encountering a decline in profitability within their production and operations management (KAM, 2019). The mainstream media in 2023 reported on a troubling narrative concerning the contaminated atmosphere surrounding the Transmara sugar factory, where inhabitants faced the peril of potential blindness due to hazardous air quality. The factory's toxic emissions and the lack of regulation in waste disposal have led to a significant contamination of the air with harmful chemicals, thereby presenting considerable health hazards to the local population.

NEMA in 2020 ordered closure of Kibos Sugar Company over violations of environmental management where there was increased air pollution related to high PM10 (particulate matter) emissions (much above limit), and discharging effluent into rivers (Nyamasaria, Kibos) which led to water pollution. The NEMA report of 2021 also indicated that the disposal of bagasse-solid waste by the West Kenya Sugar Company has resulted in a range of detrimental effects. The leachate produced from the bagasse has led to the burning of crops on adjacent farms and has even infiltrated wells and streams, thereby compromising water quality. Ojijo, 2023, while researching on effect of green supply chain management practices on environmental performance of sugar firms in western Kenya found out that sugar firms are still getting complaints from local communities about pollution, despite having environmental management policies.

While a variety of literature indicates the numerous potential advantages of green supply chain practices for firms, empirical studies examining the correlation between these practices and the performance of sugar manufacturing firms remain limited. It is evident that a deficiency in understanding persists, which the present research aims to address. This establishes a foundation for the present study to investigate further the impact of selected GSCM practices on the performance of sugar manufacturing firms in Western Kenya.

1.3. Research Objectives

1.3.1. General Objective.

To determine the effect of selected green supply chain management practices on performance of sugar manufacturing firms in Western Kenya.

1.3.2 Specific Objectives

- i. To establish the effect of green procurement on performance of sugar manufacturing firms in Western Kenya.
- ii. To evaluate the effect of green manufacturing on performance of sugar manufacturing firms in Western Kenya.
- iii. To ascertain the effect of green packaging on the performance of sugar manufacturing firms in Western Kenya.
- iv. To examine the effect of reverse logistics on performance of sugar manufacturing firms in Western Kenya.

1.4 Research Hypothesis

HO₁: Green procurement has no significant effect on performance of sugar manufacturing firms in Western Kenya.

HO₂: Green manufacturing has no significant effect on performance of sugar manufacturing firms in Western Kenya.

HO₃: Green packaging has no significant effect on performance of sugar manufacturing firms in Western Kenya.

HO₄: Reverse logistics has no significant effect on performance of sugar manufacturing firms in Western Kenya.

1.5 Significance of the Study

This research will contribute significantly to the body of knowledge within the realm of supply chain management, thereby providing valuable insights for scholars in the field. This study will enhance the researcher's understanding of GSCM and will also serve as a valuable resource for future scholars in this domain. This study aims to furnish essential insights for policymakers and government agencies; the results will assist them in identifying the pivotal GSCM practices that enhance

supply chain performance and provide valuable evidence for shaping environmental regulations, industry standards and development policies.

This study aims to assist managers and stakeholders, who serve as decision-makers, in refining management practices within the sugar manufacturing sector. It will also elucidate the primary motivations for firms in this sector to adopt a GSCM philosophy as a strategic approach to enhance overall performance. The firms themselves will gain most direct and practical insights which can help sugar manufacturing firms reduce costs, improve production efficiency and strengthen their reputation among consumers and investors.

The study will benefit sugar manufacturing firms' partners; suppliers, transporters, distributors involved in the supply chain by encouraging the adoption of shared sustainability goals, better coordination, and clearer communication. It will foster stronger relationships between them since there's always need for collaboration.

1.6 Scope of the study

This research was conducted on the effect of selected green supply chain management practices on performance of sugar manufacturing firms in Western Kenya. This is a region predominantly housing sugar firms, and where the ramifications of these firms' operations are notably felt. The study was based on green manufacturing practices; green manufacturing, green procurement, green packaging and reverse logistics. The research was undertaken in a period of two months. Western Kenya is home to a variety of sugar companies and study focused on ten of them, including Mumias Sugar Company Limited, Kabras Sugar Company, Butali Mills Factory, Nzoia Sugar Company Limited, Busia Sugar Industry Limited, Muhoroni, Chemelil, South Nyanza, Kibos, and Trans mara.

1.7 Limitations

One significant limitation of this study was the sensitivity surrounding the acquisition of information from the companies. Certain data essential for the research necessitated consent from upper management, which proved challenging to secure. Nevertheless, assurances were made to maintain confidentiality and to ensure that management would provide their support. Concerns regarding the potential disclosure of sensitive information to rival entities. Their apprehensions were alleviated by the assurance that the information provided would be used exclusively for scholarly endeavours. A letter from the University, which authorized the collection of data, provided support for this endeavour.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter examined existing literature concerning practices within green supply chains and their associated performance metrics. This chapter delves deeper into pertinent theories, the conceptual framework, empirical literature, critiques of the current literature, and a comprehensive summary of the existing body of work.

2.2 Theoretical Review

The theoretical framework that informed this study was based on the assumptions that the selected green supply chain practices had effects on the performance of sugar manufacturing companies in Western Kenya. The principles that guided this research were natural resource-based view theory that was the dominant theory and the transaction cost economics theory.

2.2.1 Natural Resource Based View Theory

Resource-based view (RBV) was first theorized by Wernerfelt in the year 1984, who theorized a firm as a wide range of resources, unlike the traditional way of looking at it as being limited to categories such as labor, capital and land. According to Yildiz and Sezen (2019), the theory of resource-based view has been extensively used in explaining how the application of GSCM practices impacts organizational performance. The Resource-Based View (RBV) is recognized as one of the most cited and effective theories in the field of management research that highlights the importance of resources as the main tool of achieving sustainable competitive

advantages to organizations (Namjoo & Keramati 2018). As an example, when green manufacturing and cleaner production approaches are implemented, they often give the enterprises a competitive advantage and enhance the performance of enterprises (Shan and Wang 2019). The Natural Resource-Based View (NRBV) theory as proposed by Hart in 1995 is the extension of the current Resource-Based View; the theory is enriched with the dimension of the natural environment. According to the Resource-Based View, a strategic position and competitive advantage may be created on the basis of capabilities that allow to ensure environmentally friendly economic activities (Hart 1995). According to Hart, a resource would be considered valuable, rare, inimitable, and non-substitutable when it possesses three key attributes it needs to be causally ambiguous, socially complex and firm-specific. The resources can come in different forms, including not only tangible resources (machinery and equipment) but also intangible ones (goodwill, organizational attributes, routines, processes, capabilities, and knowledge), that are part of input, transformation, and output resources (Agyapong and Attram 2019). The theory is a powerful conceptual model that can be used to explore the role of the company resources in the choice of green supply chain practices and the performance of a firm because corporate strategies rely largely on the internal resources it possesses and its ability to sustain these internal competency.

Li, Li, and Xie (2022) defined the Natural Resource-Based View that says that firms can and should deeply integrate environmental concerns into their supply chain strategy. Such integration includes meticulous selection of suppliers who show a strong environmental performance, the design of products with minimal ecological effects, optimization of the transport and logistics system in order to reduce carbon emissions as well as the sustainable disposal of the end-of-life use of products. Zhu,

Geng, Fujita, and Hashimoto (2021) emphasized that the Resource-Based View aids firms in recognizing and utilizing internal resources and capabilities to enhance environmental management practices within their supply chains. This theory underscores the significance of core competencies in propelling sustainability initiatives and improving firm performance. Wu, Subramanian, and Gunasekaran (2021) assert that the Resource-Based View is crucial due to its focus on achieving sustainable competitive advantage via the strategic management of environmental resources and capabilities. The theory holds significance for the study, as NRBV theory frequently elucidates the strategic motivations behind GSCM adoption. It addresses the question of why firms within the same context—be it market or industry—adopt divergent GSCM strategies, even when faced with comparable institutional pressures (Testa & Iraldo 2010). The natural resource-based view (NRBV) incorporates the limitations set by the natural environment to frame the understanding of resources (Hart, 1995). The emphasis was placed on pollution prevention to mitigate environmental harm; product stewardship to incorporate stakeholders' viewpoints and acknowledge the environment's voice in product design and development processes; and clean technology to cultivate new competencies and enhance organizations' competitive edge (Hart, 1995).

Nonetheless, detractors contend that NRBV tends to concentrate primarily on concrete resources, such as raw materials, while neglecting the significance of intangible assets, including knowledge and capabilities that are essential for the effective implementation of green supply chain practices (Jabbour, Jabbour, Hingley, Vilalta-Perdomo, Ramsden, Twigg & Wilhelm, 2020). The NRBV framework may inadequately incorporate the viewpoints of stakeholders, including the interests of communities and environmental NGOs, which are becoming increasingly significant in the development

of green supply chain strategies (Dubey, Gunasekaran, Childe, Papadopoulos, Luo, Wamba, & Roubaud 2019). The theory posits that effective environmental management within the supply chain can confer a competitive advantage to its practitioners. This underscores the entirety of the notion surrounding the adoption of this practice. The According to Lo, Chan, and Lam (2022), Resource-Based View explains the processes with the help of which companies could develop unique environmental capabilities and competencies, thus promoting sustainability initiatives and increasing the overall performance of firms. Resource-based view assumes that organizations may achieve internal competence with the help of organizational core capabilities in terms of pollution prevention, product stewardship, and sustainable development.

2.2.2 The Economies Theory of transaction Costs Economies (TCE)

Transaction cost economics theory was first put forward in 1981 by Williamson and later developed by Sarkis et al. in 2011. The theory explores the level of effort and cost (involved in two parties) investing in an economic exchange/transchange involving a search cost, a bargaining cost, and a control cost. This theory looks at how transactions are systematically organized that occurs whenever a good or service is transferred between a provider and a user, via a technologically different interface. Under the organizational transactions, the costs that may be involved include the control and management of the employees, and the procurement of the required inputs and capital equipment.

The costs involved in acquiring the same good or services by an off-the-balance-sheet supplier can include the cost of source selection, administration of the contract, performance appraisals and dispute resolution. Therefore, transaction costs are greatly influenced by the structure of transaction or the nature of government. Chen, Li and

Zhang (2023) observed that different studies have come up with modified TCE models which combine environmental transaction costs with traditional economic costs and thus provide a more holistic view of decision making in GSCM context.

In their study, Lamming, Caldwell, and Harrison (2022) reviewed the opportunities of using TCE to align incentives of supply chain partners to achieve sustainability goals. This includes the development of contracts and governance systems that are efficient in reducing the transaction costs coupled with encouraging innovative practices and environmental sustainability. On the other hand, Handfield, Linton and Prajoko (2023) stressed the importance of collaborative governance structures in mitigating transaction costs associated with environmental externalities. By developing cross-relationships between different stakeholders of the supply chain, organizations will be able to improve their capacity to manage and reduce the environmental transactions costs, and to further develop sustainable activities.

According to Ahi and Searcy (2020), there have been substantial developments in the development of measures and measurement models that incorporate environmental performance measures in TCE analysis. This will help organizations to be more effective in determining the balance between the economical efficiencies and environmental impacts in their supply chain decision making processes. In their study, Zhu, Sarkis and Lai (2021) explained the dynamic capabilities angle as it correlates to transaction cost economics and how companies can develop capabilities to skillfully negotiate the uncertainties and complexity of the environmental conditions of supply chains. This approach best addresses the criticisms on the orthodox nature of TCE when faced with the dynamic environmental pressures.

However, this theory has been criticized, especially by Morrison, Agndal, and Svensson (2022), who say that the emphasis on minimizing transaction costs through specific

contractual agreements can limit the required flexibility to adapt to changing environmental laws and stakeholder demands. Such rigidity could limit the process of incorporating green innovative practices into supply chains. In addition, De Marchi and Rogers (2020) highlighted in their article that the ideas of Transaction Cost Economics tend to monetary economies of scale in an economic condition that should be minimized in order to create a higher benefit in the long term. Such an approach would likely discourage financial investments into sustainable technologies or practices that, although they may have very high initial costs, would have significant ecological benefits in the long term.

Opponents argue that TCE lacks detailed measures that could be used to determine the environmental performance and performance across the supply chains. Without clear measures, incorporating the environmental aspects into the transaction cost inferences and decision making processes becomes very challenging (Carter and Rogers, 2020). The idea of green supply chain often requires that various stakeholders, including suppliers, customers, and regulators, cooperate with each other. TCE, with its focus on transaction costs in the relationships between principals and agents, might fail to represent the complexity and benefits of collaborative approaches to sustainability (Sarkis, 2021). TCE has in the past focused on minimizing transaction costs in the event of contractual risks and asset specificity without paying much attention to environmental costs and outcomes. Critics argue that TCE does not adequately address broader aspects of sustainability challenges, which are the core of GSCM practices (Huisingh, 2021).

The Model of the Transactions Costs was applicable in the present study because it explained the inefficiencies created by the failure of companies to combine the input of different functional areas into their operations, thus limiting their comprehension and

achievement of the set goals. GSCM strategies aim at reducing costs so that the overall performance is optimized. As a result, the GSCM strategies discussed in this paper give credence to this theory. This theory strengthened the research to provide links between the variables concerning green procurement, green manufacturing, green packaging, and reverse logistics in search of the best organizational performance. This theory was therefore combined with green manufacturing, and with implementing cleaner production processes, which tends to reduce the cost of production, thus, improving the performance of the firms.

2.3 Conceptual Literature Review

2.3.1 Green Supply Chain Management

The globalization period has brought about increased competition, rapid technological changes and increased product complexity thus demanding improvements in the continuous supply chain strategies of companies. Some of the applications that can be used to fulfill this requirement include the GSCM that encompasses the restructuring and improvement of the traditional supply chain management by incorporating environmentally conscious practices in the links of this chain. According to Seuring and Gold (2021), GSCM is the introduction of environmental aspects into the operations of a supply chain to minimize the ecological footprints, and the significance of sustainable sourcing, production methods that are environmentally friendly, and wise waste management practices. The definition of GSCM by Sarkis, Zhu, and Lai (2020) also focuses on sustainable operations throughout the supply chain with the goal of reducing ecological footprints.

Numerous definitions are present within the literature on GSCM (Ahi & Searcy, 2013). Seman, Govindan, Mardani, Zakuan, Saman, Hooker, and Ozkul (2019) articulate that GSCM is characterized by its advantages as practices that possess the capacity to reduce the likelihood of environmental instability during the production of the final

product within manufacturing firms. Despite the multitude of definitions found in the literature, there is a consensus among studies that the concept encompasses the integration of environmental consciousness with proficient supply chain management. The objective of GSCM is to reduce harm to resources and the environment in which businesses function, particularly concerning the supply chain, while simultaneously seeking economic advantages to achieve the sustainable development of societies (Wenhao et al., 2020).

2.3.1.1 Green Manufacturing.

Green manufacturing represents a significant aspect of GSCM. Yildiz and Sezen (2019) articulate that green manufacturing encompasses the strategic planning and execution of activities that prioritize energy efficiency and resource conservation within the production system, aiming to minimize environmental pollution to the greatest extent possible. Eltayeb (2019) identifies four dimensions of green manufacturing: sustainable product design, sustainable process, sustainable supply chain management, and sustainable end-of-life management. Green manufacturing practices serve as crucial elements of GSCM practices, significantly enhancing a firm's sustainability efforts. Consequently, organizations that adopt environmentally friendly manufacturing practices within their production processes are more likely to attain sustainability across multiple performance dimensions, as evidenced by several studies, including those conducted by Srisawat and Srisawat (2020) and Yildiz and Sezen (2019).

The integration of product and process design significantly affects manufacturing, planning, and control, facilitating the identification, quantification, assessment, and management of waste in relation to its environmental impact, while striving to optimize resource efficiency. Maruthia and Rashmi (2015). The practice of water conservation involves safeguarding and maintaining natural resources in their pristine and

unblemished state. The industrial conflict regarding water consumption commences with the meticulous design and redesign of processes to minimize water usage from the outset, all while striving to achieve greater outcomes with reduced resources.

Waste is frequently categorized into seven distinct areas, which include: Overproduction refers to the premature manufacturing of a product prior to its necessity for customers or product development objectives. Waiting denotes the unproductive idling of individuals, machinery, or products at any stage within the production cycle or supply chain. Transportation entails the moving of components or finished products. Actions that go above and beyond what is required by customers or do not offer value are referred to as over processing. Raw materials, components, and completed commodities that are not immediately needed are together referred to as inventory. The term "motion" is used to characterize the needless or too complex transfers of people or data that occur throughout production. Lastly, mistakes that call for product rework or disposal are known as faults. In order to identify sources of waste, manufacturing organizations should conduct thorough process audits.

Capacity utilization serves as a significant operational metric for enterprises and also functions as a crucial economic indicator when considered in the context of overall productive capacity. This metric is commonly utilized as a key performance indicator in the context of assessing overall productive capacity. Numerous sectors employ it as a tactical resource for the formulation of business planning activities. Capacity denotes the caliber of output that can be generated within a specified timeframe, considering the current inventory of capital.

2.3.1.2 Green Packaging

Maziriri (2020) delineates that green packaging encompasses three primary identities: the reduction of hard-to-decompose materials, the adoption of packaging that requires minimal energy consumption, and the utilization of environmentally friendly options. Kadam and Patil (2021) in their research articulated that green packaging encompasses the utilization of materials and processes designed to reduce environmental impact across the entire packaging lifecycle, which includes sourcing, manufacturing, distribution, and disposal. Liu, Lai, and Wang (2021) define green packaging as the creation and utilization of packaging materials designed to minimize environmental pollution, waste, and energy consumption, while fostering sustainable consumption and production practices. The process guarantees the secure transportation of goods to the end user, maintaining their integrity and minimizing expenses, all while striving to reduce delivery costs and enhance sales, thereby increasing profitability. This represents a significant allocation of resources, constituting approximately one-fifth of the household waste stream and between one-tenth and one-twentieth of commercial and industrial waste.

Consequently, the matter of packaging presents significant implications for both consumers and policymakers alike. The fundamental functions of packaging encompass containment, protection, preservation, communication, convenience, and, in certain instances, marketing functions (Jinkarn & Suwannaporn 2015). Packaging serves dual purposes: it ensures the protection of products during transit while simultaneously conveying essential information regarding product attributes to consumers (Arboretti & Bordignon 2016).

The practice of re-utilizing packaging throughout the supply chain presents a significant opportunity to reduce costs, minimize waste, and lower carbon emissions in contrast to the use of single-trip packaging. Numerous opportunities may exist to repurpose packaging directly, requiring little more than a thorough cleaning. These encompass the repurposing by suppliers, within the facility itself, or by various enterprises and community organizations. Utilizing recycled materials for packaging serves to diminish the volume that could potentially contribute to landfill accumulation, while also potentially lessening the carbon footprint associated with a package. A significant number of consumers perceive the utilization of recycled content packaging as a commendable initiative by a brand or retailer. Certain packaging materials possess the capacity to utilize a recycled alternative; for glass, aluminium, steel, paper, and board, this practice has become standard within the industry. A study conducted by Pariatamby and Bhatti (2020) determined that recyclable and biodegradable packaging materials, along with other environmentally friendly products, constitute an integral aspect of green marketing, which further fosters a sustainable competitive advantage for businesses. The employment of biodegradable materials stands to enhance sustainability and mitigate the environmental repercussions linked to the disposal of packaging materials (Song, Murphy, Narayan & Davies 2009). It is imperative that all packages containing hazardous materials are precisely classified, described, packaged, marked, labelled, and maintained in an appropriate condition for transportation in accordance with the relevant regulations. In the contemporary landscape characterized by dynamic economic, social, and regulatory shifts, it is imperative for organizations to embrace a non-hazardous packaging strategy for all their products. This methodology not only fulfils but surpasses anticipated standards and regulatory requirements, simultaneously mitigating carbon emissions and

associated risks. The issue of packaging waste constitutes a substantial component of solid waste, raising considerable environmental concerns and prompting the implementation of stricter regulations designed to mitigate its generation.

2.3.1.3 Reverse Logistics

Green manufacturing is a very important GSCM aspect. Yildiz and Sezen (2019) formulate the fact that green manufacturing is the design and implementation of operations in the production system that are energy-efficient and conserve resources to the maximum in order to reduce environmental pollution as much as possible. According to Eltayeb (2019), green manufacturing has four dimensions, including sustainable product design, sustainable process, sustainable supply chain management, and sustainable end-of-life management. Green manufacturing practices are important components of the practices of GSCM, which play a significant role in making a firm more sustainable. This means that, with an environmentally friendly manufacturing approach, organizations in the production process have greater chances of achieving sustainability in various dimensions of performance as several studies have demonstrated e.g. the work of Srisawat and Srisawat (2020) and Yildiz and Sezen (2019).

Product and process design integration has a great impact on manufacturing, planning and control, as it helps to identify, quantify, evaluate, and manage waste in connection with its impact on the environment, and attempts to optimize resource utilisation.

The reverse logistics system deals with the retrogressive flow of products out of their point of consumption to the point of production, targeting to recover the value and proper disposal (Banihashemi, Fei and Chen, 2019). It is a sort of a downstream to upstream approach of reclaiming value on products used or waste, and recovering value on products or waste directed towards the upstream (Afum et al., 2019). Reverse

logistics entails planning, performance and management of the effective and cost-efficient disposition of raw materials, work-in-progress, finished products, and related data between the consumption location and the source. The process will create value and proper disposal (Sharma et al., 2016).

Reverse logistics can include the refurbishment process. According to Gikonyo, Ngugi, and Nyang'au (2022), reverse logistics is beneficial in optimizing delivery times, customer satisfaction, operational expenses, and delivery quality of goods produced by sugar manufacturing companies in Western Kenya. The fundamental rationale for the implementation of a reverse system within any business process is to reduce expenses and enhance profitability (Grabara, Cehlar, & Dabylova 2019). RL offers both concrete and abstract advantages by reclaiming value from utilized or returned items and prolonging the product life cycle through various activities, including recycling, remanufacturing, and reuse, among others (Banihashemi, Fei, & Chen 2019).

Reverse logistics practices within an organization effectively conserve costs and natural resources associated with the production process, thereby enhancing the firm's profitability through the reutilization of used materials rather than procuring new raw materials from suppliers, which also mitigates the expenditure of manpower and time (Banihashemi et al. 2019). While the disposal aspect is not encompassed within the framework of reverse logistics, it is acknowledged as a terminal point in the reverse logistics flow (Bensalem & Vichara 2019). Conversely, Agrawal and Murtaza (2015) incorporate disposition within the realm of RL activities, which they delineate as comprising product acquisition, gatekeeping, collection, inspection, sorting, and disposition.

The recovery and reuse of products mitigates adverse environmental impacts, primarily

by decreasing waste disposal, minimizing the extraction of raw materials, and reducing emissions associated with transport and distribution. Moreover, companies have the potential to reclaim value from products that have reached the end of their lifecycle by reusing components, recycling materials, or recovering energy through incineration (Mario et al., 2013). Re-manufacturing harnesses value by facilitating the resale and repurposing of previously utilized materials. Reverse logistics initiatives assist organizations in overseeing the lifecycle conclusion of products and the processes associated with recovering investments. The endeavours associated with recovery signify a deployment of strategic resources that necessitate intricate coordination with both upstream and downstream partners within the supply chain (Kirchoff et al, 2016).

2.3.1.4 Green Procurement.

Green procurement refers to a decision-making process wherein buyers aim to obtain items, services, and projects that exhibit a reduced negative environmental impact throughout their life-cycle, in contrast to comparable goods, services, and projects that might otherwise be acquired. (Dinu, 2020). Amemba et al., 2013 Green purchasing may be characterized as the procurement behaviour of an organization shaped by environmental considerations regarding the materials or products acquired. This approach ensures adherence to the environmental safety standards established by the purchasing entity, encompassing the reduction of waste sources, the promotion of recycling, the minimization of resource consumption, and the substitution of materials (Abu Seman, Govindan, Mardani, Zakuan, Mat Saman, Hooker, & Ozkul, 2019). In the realm of procurement, while selecting the appropriate supplier is crucial for attaining a company's environmental goals, it alone does not suffice for enhancing environmental performance. More critically, fostering a strategic and collaborative

relationship with suppliers is deemed essential (Yildiz and Sezen, 2019). As noted by Le (2019), organizations that adopt green purchasing practices are able to judiciously choose products and services from suppliers that pose a reduced threat to the environment.

According to Makori (2017), Green Procurement refers to the acquisition of products or services that exhibit a reduced negative impact on the environment throughout their entire life cycle when compared to standard counterparts. The process involves integrating environmental considerations into purchasing decisions, which are fundamentally based on performance, quality, and price (Coddington, 2013; Gitari and Were, 2014). As noted by Jassim, Al-Mubarak, and Hamdan (2020), engaging in collaboration with suppliers has the potential to reduce environmental impact through the procurement of green and recyclable materials. Collaboration with suppliers on ecological initiatives is essential to the company's success. Having dependable suppliers is crucial for the ongoing delivery of products and services that meet customer expectations in terms of quality, price, environmental impact, and timeliness.

Eco-design refers to the environmental design of products and processes that emphasizes the reduction or prevention of environmental impacts prior to production, distribution, and utilization. The notion of engineering and design for manufacturability and assembly focuses on product simplification strategies aimed at guaranteeing the efficacy of the products. Eco-design proves to be impactful across all stages of the product life cycle, facilitating the processes of raw material extraction, production, packaging, distribution, usage, recovery, recycling, and incineration. All these activities and stages contribute to the influence of eco-design on procurement performance by enhancing efficiency (David and Muthini, 2019). E-procurement refers to the dimension of the procurement function that is facilitated by diverse forms of electronic

communication (Yatundu, Maloba, Wanyonyi, & Mutsotso 2016). The Public Procurement and Asset Disposal Act (PPAD, 2015) established e-procurement as a method within its procurement procedures, specifically through the mechanism of electronic reverse auction. PPAD (2015) characterized electronic reverse auction as a contemporary online purchasing methodology employed by the procuring entity to identify the successful submission. This process entails the presentation of progressively reduced bids by tenderers, suppliers, or contractors during designated intervals, accompanied by the automatic assessment of these bids. This process seeks to minimize delays in tendering while simultaneously promoting transparency and accountability. In light of the necessity for organizations to amalgamate essential functions like procurement while optimizing processes and improving transparency in management, they have embraced the strategy of implementing e-procurement (Mambo, 2015).

2.3.2 Performance.

Marendi and Sarhaye (2017), Performance encompasses the capacity to meet obligations, achieve established objectives, satisfy requirements, and realize commitments as anticipated or promised. Performance reflects the capacity of an organization to achieve its objectives through the judicious and efficient utilization of resources. Organizational performance encompasses the systematic activities undertaken by government entities or their agencies, which include planning, implementing, reviewing, evaluating, and reporting on the efficacy of their policies, programs, and projects. Goldratt (2012) posits that efficiency is a metric that assesses the extent to which resources are effectively employed to attain specified outcomes.

This entails optimizing output while reducing inputs, including time, labour, energy, or materials.

Performance metrics related to efficiency might encompass production cycle durations, throughput rates, equipment utilization, and inventory turnover ratios. As articulated by Chopra and Meindl (2019), cost serves as a measure of the efficiency with which resources are employed in the production of goods or the provision of services. This entails the reduction of costs throughout the supply chain, all the while ensuring that the requisite standards of quality are upheld. Cost performance metrics can encompass total production expenses, material expenditures, labour costs, and overhead allocations. As noted by Oarkland (2014), quality is centred on fulfilling or surpassing customer expectations in relation to the characteristics of a product or service. This encompasses elements such as reliability, durability, functionality, and adherence to specifications. Performance metrics of high caliber may encompass defect rates, customer satisfaction indices, product reliability assessments, and warranty claim statistics.

2.4 Empirical Literature Review

2.4.1 Green Procurement and Performance of sugar manufacturing firms in Western Kenya.

Ivanova (2020) carried out a study on the topic of green procurement management in small and medium-sized companies in the developing world, but in this case, the researcher focused on companies in the City of Kyiv and its environs. The measures used in the survey were subjected to structural equation modelling and factor analysis, in order to determine the hypotheses. As a result, the conclusion was made that green procurement has a positive impact on the well-being of the society, the ecological health

and the economic condition of small and medium-sized enterprises. This report advised the SMEs of the developing countries to focus on using green supply techniques because this would improve their performance.

The focus of a research project conducted by Blomea, Hollosby, and Paulrajac (2013) was to determine how the green procurement and green supplier development can impact the performance of Western European companies operating in the manufacturing and service industries in terms of their supply chain. The research targeted a workable group made up of top management of supply chain consulting companies in Europe. The gathering of data was performed by the use of questionnaires. The findings of the study identified that development of the green suppliers has a direct impact on the performance of the supply chain.

Shiyuka and Senelwa (2022) have performed a study to investigate how green procurement has impacted the manufacturing sector. The results showed that there is a positive relationship between green procurement practices and overall performance. Green procurement practices are relevant to the elimination of pollution, quality products, user satisfaction, product costs optimization, and efficient product inventory management.

The article by Marendi and Sarhaye (2017) is a study that investigates the role of green procurement on the organizational performance of the Coca-Cola Company. The results of this research show that there is a positive correlation between the reverse logistics and the organizational performance of the Coca-Cola Company. The study also concluded that the process of acquiring commodities is undertaken with careful attention to the quality of supplies and the organization is undertaking award winning environmental programs on regular basis. The supplier assessment analysis indicated

that there was a strong positive relation with organizational performance of the Coca-Cola Company. The study also established that the suppliers are considered based on their ability to control the pollution.

Thiga, Chege, and Arani (2023) have carried out a study about green procurement and how it affects the performance of food and beverage manufacturing companies in Kenya. Their results show that green procurement practices have a positive correlation with the performance of such companies in the Kenyan market. On the other hand, Wanja and Achuora (2020) carried out an investigation on sustainable procurement practice and its impact on the procurement performance of the food and beverage production companies in Kenya. The results revealed that sustainable procurement had a significant positive effect on procurement performance that eventually resulted in a positive effect on the overall firm performance.

Pembere (2016) aimed to explain the impact of environmentally conscious purchasing decisions on the supply chain efficiency of the listed companies on Nairobi Securities Exchange. The investigation used a descriptive design methodology. All of the mentioned companies' procurement managers were the primary subjects of the research. The study relied on first-hand accounts. The results show that the supply chain works better when eco-friendly purchasing policies are put in place.

Ivanova (2020); Pembere (2016); Marendi and Sarhaye (2017); Shiyuka and Senelwa (2022); Wanja and Achuora (2020); Thiga, Chege, and Arani (2023), all of them demonstrated that there is a positive correlation between green procurement and performance and this study aimed to assess the impact of green procurement, a facet of green supply chain practices, on the performance of sugar manufacturing firms in Western Kenya, utilizing metrics of e-procurement, supplier collaboration, and eco-

design, all of which demonstrated a positive correlation between green procurement and organizational performance.

2.4.2 Reverse Logistics and Performance of sugar manufacturing firms in Western Kenya.

A study by Gikonyo, Ngugi, and Nyang'au (2022) aimed to determine how reverse logistics affected the performance of Kenyan building and construction manufacturing firms. The researchers found that reverse logistics significantly impacted the performance of these firms. Lumba and Mwanza (2023) conducted a study to assess the impact of the reverse logistics system on a company's economic performance and found a positive and significant correlation between reverse logistics practices and the company's economic benefits, identifying the advantages of implementing such practices.

Kiogora, Chege, and Arani (2023) observed that the implementation of reverse logistics enhances the performance of food and beverage manufacturing firms in Kenya by enabling companies to identify opportunities for reusing, reselling, or recycling materials that would otherwise be disposed of in landfills, thereby improving their reputation.

Kaberger and Richu (2015) found that product recovery and product reuse positively influence the operational performance of sisal processing enterprises in Nakuru County, Kenya, in their study on the impact of reverse logistics. The study advised that the management of processing enterprises should consider reverse logistics as a strategic approach to get competitive advantage and manage it with the same rigor as other critical management domains.

Previous studies demonstrated that reverse logistics significantly impacts the performance of various organizations. This study, utilizing the metrics of

remanufacturing, recycling, disposal, and inventory management, aimed to investigate how reverse logistics influences the performance of sugar manufacturing firms in Western Kenya.

2.4.3 Green Packaging and Performance of sugar manufacturing firms in Western Kenya.

Maziriri (2020) claims that green packaging has three primary identities: reducing the usage of difficult-to-decompose packaging; utilizing a packaging with low energy consumption; and employing the ecologically friendly packaging. The green packaging problem is often used to show the company's commitment to environmental sustainability and to promote the brand's acceptance (Kolk, 2016). A survey by Maziriri (2020) also shown that utilizing green packaging is more and more becoming a must for businesses to compete and the businesses who do so claim a more favourable brand image and reputation, cost savings and better environmental footprints among other advantages.

According to Ayandibu and Akbar (2021), eco-packaging or green packaging enables companies to be far ahead of the rivals. Pariatamby and Bhatti's (2020) research found that recyclable and biodegradable packaging materials as well as other environmentally friendly products are all components of green marketing, which also drives sustainable competitive advantage of companies.

Agarwal and Kumar (2020) conducted another experiment that shown green packaging aids business enterprises in achieving competitive advantage. Jaggernath and Khan (2015) discovered that, in addition to the environmental advantages of using sustainable packaging, eco-friendly packaging can enhance sales, decrease packaging expenses, and elevate a company's brand image, coinciding with the growing awareness of

environmental effect. The research identified a direct association between a company's use of sustainable packaging and enhanced sustainable green logistics management.

Jepchumba, Ngugi, Shale, and Odhiambo (2022) looked at how packaging affected the efficiency of Kenyan food and drink factories. The findings showed that food and beverage processing companies' performance was greatly affected by product packaging. The research showed that Kenyan food and beverage manufacturing enterprises might greatly benefit from better product packaging if they wanted to boost their performance.

Nthiwa, Muli, and Kitheka (2024) demonstrate a substantial positive link between green packaging and overall firm performance. These approaches contribute to environmental sustainability and increase operational success within the industry. Adopting and enhancing these green packaging strategies is essential for achieving a sustainable equilibrium between environmental stewardship and the ongoing development and prosperity of food and beverage manufacturing companies in Kenya. Previous research has demonstrated that green packaging provides a competitive advantage and enhances the performance of most organizations. This study investigated the impact of green packaging on the performance of sugar manufacturing firms in western Kenya by utilizing reusable, recyclable, and biodegradable packaging.

2.4.4 Green Manufacturing and Performance of sugar manufacturing firms in Western Kenya.

A study by Yildiz and Sezen (2019) demonstrated that green manufacturing exerts a considerable positive influence on the three key indicators of sustainability performance: environmental, economic, and social performance. A further investigation conducted by Srisawat and Srisawat (2020) revealed a noteworthy positive influence of green manufacturing on the sustainability of firms. The

implementation of Green Manufacturing is associated with a decrease in material waste and energy usage. Moreover, it reduces production costs while simultaneously improving product quality, (Cory & Carolina 2016).

Eltayeb (2019) also looked at certified companies in Malaysia that were involved in green manufacturing activities, with an emphasis on sustainability. According to the research, an organization's operational success and environmental sustainability are greatly affected by how green manufacturing and GSCM (GSCM) interact with one another. According to Dheeraj and Vishal (2012), green manufacturing improves an organization's product quality over time by increasing productivity and reducing environmental impact. This, in turn, contributes to overall socio-economic development. In addition, they state that green manufacturing is the process of reducing the environmental impact of a company's operations, goods, and services while increasing profits and gaining a competitive edge through the integrated application of acceptable productivity with environmental monitoring and evaluation tools.

Afum, Agyabeng-Mensah, and Owusu (2020) set out to determine how green supply chain integration (GSCI) mediates the connection between green manufacturing practices (GMPs) and business sustainability in the Ghanaian setting. Green manufacturing processes have a favorable and significant impact on sustainability performance, according to the study. Their study also showed that green supply chains are more likely to be integrated when ecologically sustainable manufacturing practices are used.

A study conducted by Fore and Mbohwa (2015) reveals that the majority of cement manufacturers in South Africa employed outdated techniques. Industries must engage in investments aimed at enhancing process optimization and innovations in process control to effectively minimize waste and mitigate the environmental repercussions

associated with lime production. The manufacturing sectors that embraced eco-friendly practices, such as bucket transport, effectively minimized spillage, resulting in a decrease in raw material waste and a reduction in environmental emissions. It was proposed that effective housekeeping practices, including the maintenance of optimal inventories, contribute to a decrease in production costs.

Based on their research, Musau and Rucha (2021) found that green manufacturing helps manufacturing enterprises in Mombasa County improve their operational performance. Product quality has been improved by the implementation of green manufacturing, which has reduced production costs significantly, minimized market failures, and ensured that products correspond to standards. Product delivery, time to market, and responsiveness to changing customer preferences have all seen significant improvements.

Kithure, 2022), the practice of green manufacturing enhances the operational efficacy of manufacturing enterprises. Consequently, it is essential for companies to utilize inputs that exhibit comparatively minimal environmental repercussions. He underscored the importance of creating products that are recyclable and produce minimal pollution. Moreover, it is imperative for manufacturing firms to prioritize the minimization of effluent waste generation. Bor (2021) conducted a study examining the practices of GSCM and their impact on the performance of the Food and Beverage Processing Sector in Kenya. The findings indicated that enhanced performance was linked to various green manufacturing practices, including production processes aimed at minimizing waste and conserving water, maximizing capacity utilization, reducing hazardous waste during production, implementing eco-design in products, and employing cleaner production techniques. In summary, it is imperative for manufacturing firms to embrace environmentally sustainable manufacturing practices.

This research assessed the impact of environmentally sustainable manufacturing practices on the performance of sugar manufacturing companies in western Kenya. It operationalized these practices through water conservation, waste reduction and treatment, capacity utilization, and product and process design, drawing comparisons to prior studies that indicated a positive correlation between sustainable manufacturing and corporate performance.

2.4.5 Green Supply Chain Practices and Performance of sugar manufacturing firms in Western Kenya.

In a study conducted by Le (2020), the focus was on Vietnamese building materials manufacturing enterprises and how GSCM strategies correlated with sustained performance. In order to collect source data, a survey was carried out in Vietnam comprising 218 building material firms. According to the study's findings, green procurement improved societal and economic outcomes without changing environmental outcomes. The opposite was true for green design and production, which produced substantial benefits in every one of the three outcome areas. Sustainable distribution and environmental sustainability were also found to have a notable and meaningful relationship, according to the findings.

Tran, Phan, Ha, and Hoang (2020) conducted an assessment of the influence of supply chain quality integration on financial performance, environmental performance, and GSCM. Data from 568 businesses in Vietnam's tourist industry were analysed in the study. GSCM and financial performance were both positively affected by quality integration throughout the supply chain, according to the findings. Environmental performance and economical outcomes were both positively affected by the deployment of GSCM. When it came to the relationship between financial performance, supply chain quality integration, and GSCM, the middleman was vital. Environmental

and financial success were both positively correlated with GSCM, regardless of the dimensions or institutional impacts.

In a similar vein, Zhang, Zhang, Ang, and Ma (2020) explored the interconnections among institutional pressures, GSCM practices, and business performance. The researchers utilized a quantitative research design to gather questionnaire data from 255 firms within the automobile sector in China, resulting in 224 valid responses. The researchers employed an institutional theory in their study to elucidate the manner in which institutional pressures may affect firms in their adoption of GSCM practices. Their research demonstrated that institutional pressures exert a considerable positive influence on GSCM practices and overall business performance. Furthermore, the implementation of GSCM practices has been observed to exert a considerable positive influence on environmental, operational, and economic outcomes. Furthermore, the scale of the firm and the timing of GSCM implementation both serve to positively influence the relationship between GSCM practices and firm performance. Their study advises managers to integrate GSCM practices within the organization and to acknowledge that pollution signifies inadequate utilization, which should be regarded as an issue requiring prompt resolution. It is essential for the government to develop and enforce policies pertaining to environmental protection to effectively regulate corporate activities.

A study conducted by Nsowah, Agyenim-Boateng, and Anane (2022) examined the effects of sustainable supply chain management on the performance of manufacturing firms in Ghana. The study found that these firms were more successful in meeting their environmental sustainability goals when they used sustainable materials in product design, standardized their designs to make them more reuse-friendly, manufactured products with a smaller environmental impact, evaluated their current processes to find

ways to reduce their environmental impact, and formalized their environmentally friendly practices. A study was carried out by Fianko, Amoah, and Dzogbewu (2021) to assess the impact of green supply chain practices, both internal and external, on the environmental performance of construction enterprises. There was a direct positive association between environmental performance and green purchasing and green construction, two examples of external green practices that were found to be positively impacted by green design.

Oluka, Afito, and Nalukenge (2019) conducted a study examining the relationship between GSCM practices and organizational performance in Uganda. Their findings indicate that the adoption of green supply chain practices significantly enhances the reputation of organizations within the country. There is a growing appreciation among consumers and stakeholders for sustainability, and organizations that exhibit a dedication to environmental stewardship are poised to garner favourable recognition and cultivate trust with their stakeholders. Furthermore, Mukulu and Kikooma (2018) conducted a study examining the interplay between GSCM practices and operational performance. Their findings indicate that the implementation of GSCM significantly enhances the operational performance and resilience of organizations in Uganda. By fostering relationships with sustainable suppliers, minimizing environmental impacts, and improving resource efficiency, companies are able to establish more resilient supply chains that can effectively endure disruptions.

Ojijo (2023) conducted a study examining the impact of GSCM practices on the environmental performance of sugar firms in Western Kenya. The findings revealed that the implementation of GSCM practices by these firms positively and significantly influences their environmental performance, indicating that an enhancement in the adoption of such practices correlates with an improvement in environmental outcomes

at a similar magnitude. Mugabe (2013) conducted an investigation to ascertain the correlation between green supply chain practices and the performance of the supply chain within pharmaceutical companies located in Nairobi, Kenya. All of the target companies in the study population were included in the census, and the methodology used was descriptive in nature. Despite the fact that some pharmaceutical businesses have adopted reverse logistics tactics and others are using biodegradable eco-packaging, the research showed that many of these organizations are not participating in green supply chain practices. The limitations of the study encompassed a restricted examination of the pharmaceutical companies located in Nairobi, alongside an oversight of various green supply chain practices.

Bor (2021) undertook a study examining the practices of GSCM and their impact on the performance of the food and beverage processing sector in Kenya. His findings indicate that the effective implementation of GSCM practices—namely green procurement, green packaging, reverse logistics, and green packaging—results in enhanced financial performance, improved product quality, reduced costs, and greater environmental preservation.

Table 2.1 Summary of Literature Review

AUTHOR/Y EAR	TITLE	METHODO LOGY	FINDINGS	GAPS	HOW TO ADDRESS GAPS
Jermsittiparse r, Namdej, Somjai, (2019)	Green Supply Chain Practices and Sustainable Performance: Moderating Role of Total Quality Management Practices in Electronic Industry of Thailand	Descriptive design	The results showed that there is positive significant relationship between green purchasing and sustainable performance, green logistics and legislation also found to be significant and positive relationship with sustainable performance, also TQM practices doesn't moderate statistically significant between the relationship of Green purchasing and sustainable performance at electronic industry of Thailand	The study was based in Electronic industry and used a moderator.	This current study will be focused in sugar manufacturing industry
Ojijo, (2023)	Effect of Green Supply Chain Management Practices on Environmental Performance of Sugar Firms in Western Kenya.	Explanatory design	The study established that green supply chain management practices used by sugar firms in Western Kenya have a positive and significant effect on their environmental performance	The study only focused on environmental performance.	The current study will focus on the general performance of the sugar manufacturing firms.

AUTHOR/Y EAR	TITLE	METHODO LOGY	FINDINGS	GAPS	HOW TO ADDRESS GAPS
Bor, (2021)	Green supply chain management Practices and performance of food and Beverage processing sector in Kenya	Explanatory research design	Green supply chain management practices: green procurement, green packaging, reverse logistics and green packaging; when properly implemented lead to higher financial performance, superior quality of products, reduced costs and better environmental preservation. Legislations have a positive significant moderating effect on green supply chain management practices	The study focused on food and beverage processing sector in Kenya.	The current study will focus on sugar manufacturing sector in Western Kenya.
Afum,Agyabeng-Mensah, and Owusu, (2020)	Impact of green organizational culture in mediating the connection between environmental management practices (EMPs) and environmental performance of Ghanaian manufacturing SMEs	Descriptive design	Green organizational culture and EMPs (green manufacturing and green procurement) had a significant impact on environmental performance. It was also observed that EMPs had a positive effect on green organizational culture, thus providing evidence that EMPs and environmental performance could be mediated by green corporate culture	The data as collected from SMEs within the Ghanaian context	The current study will focus on sugar manufacturing firms in Western Kenya.

AUTHOR/Y EAR	TITLE	METHODO LOGY	FINDINGS	GAPS	HOW TO ADDRESS GAPS
Kithure, (2022)	Moderating effect of collaborative Capability on the relationship between Green supply chain management Practices and performance of Manufacturing firms in Kenya	Descriptive survey design	Green supply chain management practices have a significant and positive effect on performance of manufacturing firms in Kenya. Collaborative capability moderates the relationship between green supply chain practices and firm performance	The study focused on the entire manufacturing sector in Kenya.	The study will focus on sugar manufacturing firms in Western Kenya.
Hejazi, Al Batati, and Bahurmuz, (2023)	The Influence of Green Supply Chain Management Practices on Corporate Sustainability Performance	Descriptive survey design	Green supply chain management techniques greatly impact economic, environmental, and social performance; adopting green practices improved firms' sustainability performance in terms of their economic, environmental, and social sustainability	The study relied on a survey of Saudi Arabian manufacturing companies to determine the level of adoption of green supply chain management methods and their effects on corporate performance.	This study will adopt a descriptive and causal research design in sugar manufacturing firms in Western Kenya

AUTHOR/Y EAR	TITLE	METHODO LOGY	FINDINGS	GAPS	HOW TO ADDRESS GAPS
Fianko, Amoah, Afrifa, Dzogbewu, (2021)	Green Supply Chain Management and Environmental Performance: The moderating role of Firm Size	Quantitative survey design	The study found that firm size does not moderate the direct relationship between internal green supply chain and environmental performance. Rather, firm size moderates the relationship between internal green supply chain practices through external green supply chain practices in order to enhance environmental performance among Ghanaian construction firm.	The study was focused on Ghanaian construction firm.	This study will be focused on sugar manufacturing firms in Western Kenya.

2.5 Conceptual Framework

The conceptual framework presented by Mugenda and Mugenda (2003) elucidates the interplay among the study variables, serving to clarify the connections and relationships between the dependent and independent variables. This conceptual framework illustrates the interconnections among various practices of green supply chain management, including green manufacturing, green packaging, reverse logistics, and green procurement, and their impact on the performance of sugar manufacturing firms in Western Kenya, operationalized through metrics of efficiency and effectiveness, quality, and cost.

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Independent variables

Green supply chain management practices

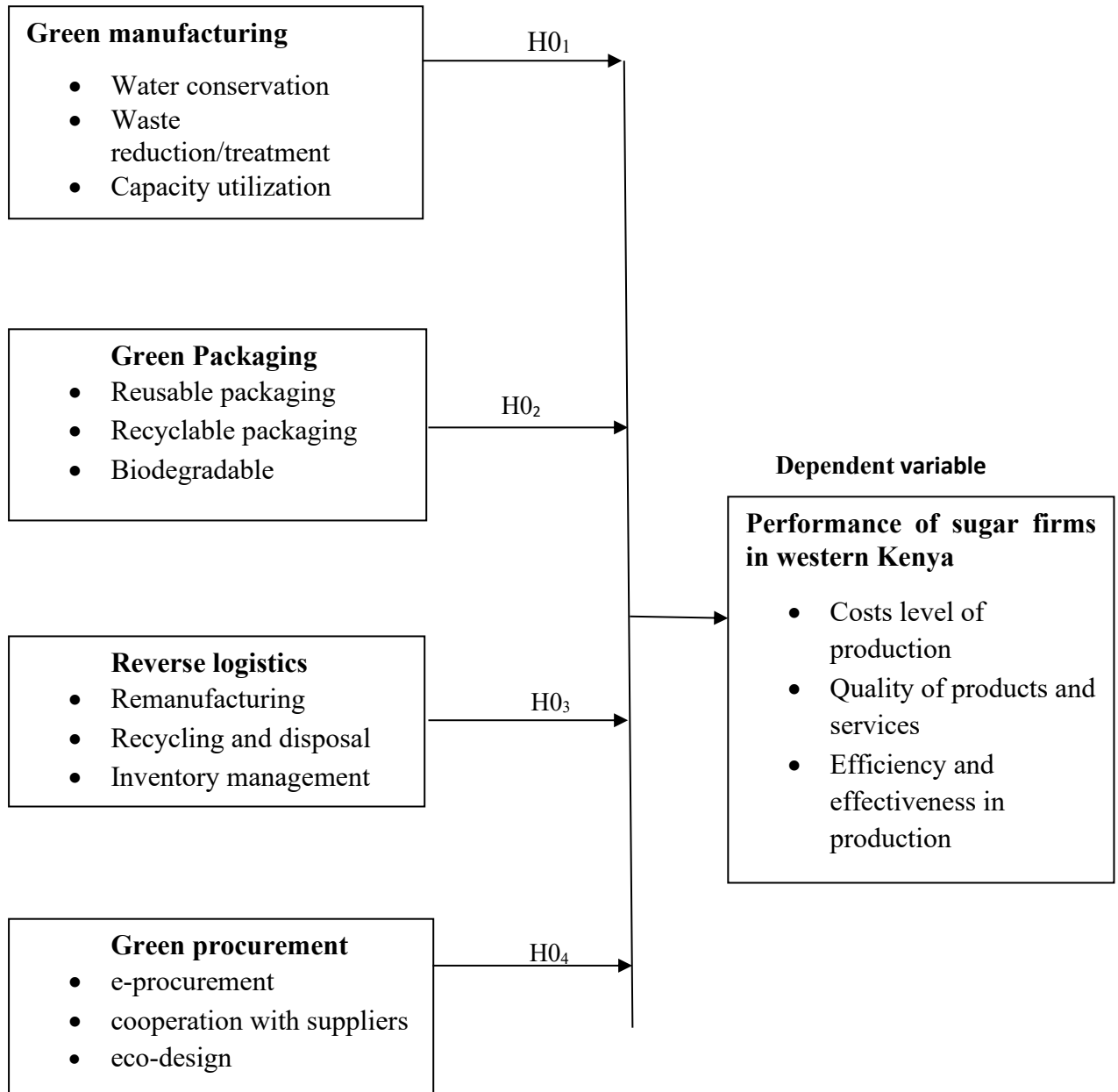


Figure 2.6 Conceptual Framework

Source: Adapted from; Ojijo (2023); Bor, (2021); Senelwa and Shiyuka, (2022)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter delineates the methodology that will be utilized to assess the impact of GSCM practices on the performance of sugar manufacturing firms in western Kenya. The study encompassed several critical components: the research design, the sampling design of the population, the area of investigation, and the sampling technique employed, the methods of data collection, the analysis of the data, and the ethical considerations involved.

3.2 Research Design

The research employed a descriptive and causal design to investigate the impact of selected green supply chain practices on the performance of sugar manufacturing firms in western Kenya, utilizing both quantitative and qualitative methodologies. Descriptive studies may investigate inquiries pertaining to "what." (Baskerville & Pries-Heje, 2010). The process is undertaken to discern and record the interrelations among diverse elements of the phenomenon being examined, (Rahi, 2017). Githara (2018), conducted a study on large-scale food and beverage manufacturing firms in Nairobi and incorporated the descriptive research design to seek factual, detailed accounts on how the independent factors were, and to describe their relationship with the dependent variable. Causal research design aims to elucidate the relationships of cause and effect that exist between variables. El Baz, Evangelista, Iddik, Jebli, Derrouiche and Akenroye, (2022) in their research on how green innovation actions cause outcomes on GSCM, adopted the causal research design to explain the underlying

processes (situational, action-formation and transformational) that connects green innovation initiatives with measurable results. The quantitative approach prioritizes measurement, with data analysed numerically to provide a precise description. In contrast, qualitative research systematically examines information to yield valuable conclusions and recommendations regarding social contexts and the individuals who embody those traits.

3.3 Study Area

The investigation was conducted in Western Kenya, the region that hosts the majority of sugar mills. This is a region where the ramifications of these firms' operations are notably felt. The study encompassed the participation of Chemelil Sugar Company, Kabras Sugar Company, Mumias Sugar Company, Muhoroni Sugar Company, Nzoia Sugar Company, South Nyanza Sugar Company, Kibos Sugar and Allied Industries, Butali Sugar Mills Limited, Transmara Company, and Busia Sugar Company. The assessed sugar mills are those actively engaged in milling operations and possessing an established environmental management program. A total of ten sugar companies were surveyed.

3.4 Target Population.

A population encompasses the entirety of elements regarding which the study aims to draw inferences (Blumberg, Cooper & Schindler, 2014). Other scholars, including Barnat (2015), characterized population as the complete set of individuals, events, or objects sharing a common observable characteristic. Ott and Longnecker (2015) contend that a target population is defined as a compilation of elements or individual members of the broader population from which a sample is extracted. This study focused on a target population consisting of 10 sugar companies located in western

Kenya. The research encompassed individuals occupying leadership positions, including managers, middle managers, and supervisors, from the procurement and production departments of the chosen sugar factories. Participants were purposively selected based on their engagement with selected green supply chain practices. The Sugar Directorate of the Agriculture and Food Authority reports that the designated departments collectively employ around 190 individuals across all sugar factories.

Table 3.1 List of sugar manufacturing firms

Sugar Factories	Managers	Middle managers	Supervisors	Total Number of Respondents
Kabras	5	9	10	24
Butali mills	5	6	7	18
Chemilil	5	6	7	18
Muhoroni	3	5	6	14
Nzoia	2	3	5	10
Mumias	8	8	14	30
South nyanza	6	8	10	24
Kibos	3	5	6	14
Transmara	3	4	7	14
Busia	6	8	10	24
TOTAL	46	62	82	190

Source: Sugar Directorate of the Agriculture and Food Authority

3.5 Sample and Sample Technique

A sampling technique refers to a method employed to derive a smaller subset from a larger target population, which is presumed to embody the traits of the overall population (Wilson, 2014). The significance of sampling in research lies in its capacity to reduce costs, as it involves only a segment of the population. Sampling refers to the methodology employed by a researcher to collect individuals, locations, or objects for examination (Nachiamis & Nachamis, 2012). The procedure involves the careful selection of a subset of individuals or objects from a larger population, ensuring that this chosen group embodies the diverse characteristics present within the entirety of the population. The sample was selected from each company using a simple random sampling technique, focusing on the designated departments of procurement and production. Stratified sampling was then used specifically targeting managers, middle-level managers, and supervisors within the procurement and production sectors which are directly involved with selected green supply chain management practices. The research employed the methodology proposed by Yamane (1967) to determine the sample size. The study comprised a sample size of 129 respondents, determined through the application of the Yamane formula, utilizing a confidence level of 95% and a precision level of 0.05 (5%).

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

Where n is the sample size required

N is the population size

e is the precision level

$$190 / 1 + 190(0.05^2)$$

$$= 129 \text{ respondents}$$

Table 3.2 Number of sample size in each firm

Sugar companies	Target population	Formula	Sample size
Kabras sugar company	24	$24/190*129$	21
Butali mills factory	18	$18/190*129$	19
Chemilil sugar company	18	$18/190*129$	19
Muhoroni sugar company	14	$34/190*129$	16
Nzoia sugar company	10	$10/190*129$	13
Mumias sugar company	30	$30/190*129$	24
South nyanza sugar company	24	$24/190*129$	21
Kibos company	14	$14/190*129$	16
Transmara	14	$14/190*129$	16
Busia sugar company	24	$24/190*129$	21
TOTAL	190		129

Source: Researcher, field data, 2025.

Table 3.3: Specific sample size in each department in specific firms.

Sugar companies	Target population	Managers	Middle managers	Supervisors	Total sample size
Kabras sugar	24	$5/24*16=3$	$9/24*16=6$	$10/24*16=7$	16
Butali mills factory	18	$5/18*12=3$	$6/18*12=4$	$7/18*12=5$	12
Chemilil sugar	18	$5/18*12=3$	$6/18*12=4$	$7/18*12=5$	12
Muhoroni sugar	14	$3/14*10=2$	$5/14*10=4$	$6/14*10=4$	10
Nzoia sugar	10	$2/10*7=1$	$3/10*7=2$	$5/10*7=4$	7
Mumias sugar	30	$8/30*20=5$	$8/30*20=5$	$14/20*=10$	20
South nyanza	24	$6/24*16=4$	$8/24*16=5$	$10/24*16=7$	16
Kibos company	14	$3/14*10=2$	$5/14*10=4$	$6/14*10=4$	10
Transmara	14	$3/14*10=2$	$4/14*10=3$	$7/14*10=5$	10
Busia sugar	24	$6/24*16=4$	$8/24*16=5$	$10/24*16=7$	16
TOTAL	190	29	42	58	129

Source: Researcher, field data, 2025.

3.6 Research Instruments

The research utilized a self-administered questionnaire featuring both structured and semi-structured inquiries aligned with the study objectives, serving as a principal tool for the collection of primary and secondary data. The questionnaire was divided into three parts; general information, information on independent variables and information on the dependent variable, and used a Likert scale ((Key: 1=strongly disagree (SD), 2=disagree (D), 3=fairly agree (FA), 4=agree (A), 5=strongly agree (SA)). The use of questionnaires was deemed suitable for this study as they facilitated the collection of standardized data, which simplifies analysis and allows for engagement with a larger pool of respondents (Zikmund, 2010). This approach was particularly suitable for the study, as it allowed the researcher to gather primary and secondary data within a condensed timeframe. A questionnaire constitutes a thoroughly crafted collection of inquiries designed for respondents to document their responses, typically within a framework of narrowly defined options (Sekaran et al., 2011). Secondary data was used to measure cost level of production, quality of products and services, and efficiency and effectiveness in production, which were measures of the dependent variable of performance of sugar firms in western Kenya.

3.7 Reliability

Reliability refers to the degree to which a questionnaire, observation, or any measurement procedure yields consistent results across repeated trials (Lalit & Shyamkumar 2019). Adejimi, Oyediran, and Ogunsanmi (2010) define reliability as the consistency of measurement, which is often evaluated through the test–retest reliability method. An analysis of internal consistency will be conducted to assess the reliability of the items associated with each critical factor through the application of Cronbach’s

alpha. This method proves to be both useful and adaptable, serving as a means to examine the reliability of test results, particularly when test items are evaluated in a dichotomous manner (Toke & Kalpande, 2018). Cronbach's alpha serves to assess the extent of systematic or consistent variance present within a collection of test scores. The range extends from 0.0, indicating a complete absence of consistent variance, to 1.00, which signifies total consistency in variance. All values within this spectrum, from 0.0 to 1.00, are also feasible. For instance, should the Cronbach alpha for a collection of scores be determined to be 0.90, one could interpret this as indicating that the test possesses a reliability of 90%, thereby suggesting a corresponding unreliability of 10%. The threshold for Cronbach's alpha is considered acceptable when it exceeds 0.6 (Soo & Quazi 2005; Kalpande, Gupta & Dandekar, 2013; Toke & Kalpande 2019). Ritter (2010) established a measuring scale indicating that an acceptable alpha is 0.60 and above. They assert that a value exceeding 0.70 serves as a benchmark for indicating strong internal reliability.

3.8 Validity

The validity of an instrument refers to its capacity to accurately measure the concept it is designed to assess (Al-Shboul, Al-Saideh & Al-Labadi 2017). The degree to which an instrument accurately assesses what it is intended to assess and operates according to its intended design (Cheng 2014). This is employed to ascertain if the research instrument effectively gauges what it was intended to measure (Naga & Bouazza 2014). The major aim of validity analysis is to provide the research instrument that allows researchers to attain the study's objectives. This study evaluated the criteria, content, and construct validity of the research instrument.

3.8.1 Content Validity

To ascertain content validity, the questionnaire underwent rigorous testing to confirm the absence of both typographical and structural errors, drawing upon the insights of experts in the field. The content validity of the survey was established through a comprehensive literature review, discussions with practitioners, academic experts, and assigned supervisors in the field, as well as a pretest of the survey involving interviews, as suggested by Lee (2015).

3.8.2 Criterion Validity

To guarantee criterion or face validity, the researcher thoroughly scrutinized each question in relation to the study objectives and the responses anticipated from the operation managers, subsequently implementing the requisite modifications. The instruments created for analogous studies were likewise employed for comparative analysis. Brace (2013) posits that the constructs of a study may be developed from existing research to improve criterion validity.

3.8.3. Construct Validity

Construct validity pertains to the formulation of suitable operational measures for the concepts under investigation (Parotti, Canziani, Marchesi, & Butelli 2012). Construct validity can be examined by determining whether the independent variables behave in line with theoretical expectations when tested against an outcome variable. In regression analysis, this involves entering the constructs of interest as predictors and assessing their relationship with a dependent variable that they are expected to influence. If the regression model is statistically significant and the coefficients of the predictors align with theoretical assumptions, it indicates that the constructs measure what they are intended to measure. Additionally, the use of collinearity diagnostics such

as tolerance and variance inflation factor (VIF) helps to confirm that the predictors represent distinct concepts, further supporting the discriminant aspect of construct validity.

3.9 Data Processing and Analysis

The quantitative data obtained from the questionnaires underwent thorough verification for completeness and accuracy, followed by coding for analytical purposes utilizing the Statistical Package for Social Science (SPSS) using descriptive statistics indexes such as mean, percentages and frequency distribution method. Data was presented in form of frequency tables. The quantitative analysis was conducted by calculating the frequencies and means. The use of standard deviations serves as an appropriate statistical tool, effectively illustrating the distribution associated with each variable under examination. Inferential statistics employing correlation and regression analysis were conducted to elucidate the nature of the relationship that exists between variables. The research employed both simple and multiple regression analyses to elucidate the relationship between the independent and dependent variables. The data was carefully organized into frequency tables, having been collected over a span of two months.

3.9.1 Simple Regression Model

The model enables the analysis of the direct link between the dependent variable and the independent factors. The regression analysis about the influence of selected green supply chain practices on the performance metrics of sugar manufacturing enterprises in Western Kenya was executed utilizing the following models:

Simple Regression Model

$$Y = a + \beta X + e$$

Where Y= Firm performance

a = the constant/Y-intercept

X= Independent variables

β = coefficient for the independent variables

e= error term

3.9.2 Multiple Regression Model

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e$$

Where Y = Firm performance.

X_1 =Green Procurement.

X_2 =Green Manufacturing.

X_3 = Green Packaging.

X_{4a} = Reverse Logistics.

β = the coefficients for the independent variables

a = the constant/Y-intercept

e = Error term

3.10 Assumptions of Regression Analysis

3.10.1 Linearity Test

The efficacy of standard multiple regression in estimating the relationship between dependent and independent variables is contingent upon the linearity of those relationships. Should the association between independent variables and the dependent

variable deviate from linearity, the outcomes of the regression analysis will fail to accurately reflect the genuine relationship. This underestimation presents two significant risks: an elevated likelihood of a Type II error for the independent variable in question, and, in the context of multiple regression, a heightened risk of Type I errors (overestimation) for other independent variables that share variance with the aforementioned variable. The analysis employed the ANOVA test, utilizing a statistical package for social sciences to examine linearity.

3.10.2 Normality Test

Regression posits that the variables exhibit normal distributions. The premise relies on the configuration of the normal distribution curve, providing the researcher with insights into the anticipated values (Keith, 2006). Variables that do not follow a normal distribution can obscure relationships and impact the validity of significance tests. Outliers may be discerned through the visual examination of histograms or frequency distributions, or by transforming data into z-scores. The assessment of normality was conducted utilizing the Shapiro-Wilk test. The null hypothesis is rejected when the p values for the chi square joint test are less than 0.05.

3.10.3 Homoscedasticity

Homoscedasticity signifies that the dependent variable demonstrates uniform variability across all values of the independent variables (Garson, 2012). A homoscedasticity test is performed to evaluate the variance of residuals in the utilized regression model. Homoscedasticity in the error term allows us to deduce a normal distribution. The lack of consistent variability among the values of the independent variables is termed heteroscedasticity. The Levine test was utilized to evaluate homogeneity.

3.10.4 Multi-Collinearity Test

This phenomenon arises when multiple independent variables exhibit strong correlations with each other, or when one independent variable closely resembles a linear combination of other independent variables (Keith, 2006). Multi-collinearity may lead to deceptive and atypical outcomes, increased standard errors, and diminished efficacy of the regression coefficients, necessitating larger sample sizes (Keith, 2006). To evaluate multi-collinearity, the Variance Inflation Factor (VIF) was employed, serving as a metric for assessing multi-collinearity within the regression model. It is commonly accepted that a VIF exceeding 4 necessitates additional scrutiny. Furthermore, if two or more variables exhibit a VIF of 5 or higher, it is imperative to eliminate one of these variables from the regression model (Bryman & Cramer, 2012).

3.11 Ethical Considerations

Researchers are individuals who possess a sincere commitment to enhancing the quality of life for others; they ought to embody integrity, eschewing pursuits driven by personal gain or inquiries that may cause harm to others (Mugenda & Mugenda 1999). Ethical considerations were precisely adhered to by obtaining consent from the companies to secure authorization for the study. Approval was obtained from the managing directors and all participants prior to the commencement of the study. The confidentiality and anonymity of respondents were carefully preserved, employing numerical identifiers in lieu of names where appropriate. The objective of the study was conveyed to the respondents through either verbal communication or written instructions. To circumvent plagiarism, the study duly recognized the sources of data and information derived from others. NACOSTI was established to guarantee the adherence to ethical standards in research endeavors. The study upheld a consistent standard of integrity

throughout its duration. No participant was compelled or obligated to provide answers to inquiries they were not inclined to address (Kombo & Tromp, 2006).

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION.

4.1 Introduction

This chapter elucidates the findings and engages in a discourse regarding the analysis, aligning with the objectives of the study.

4.2 Reliability

The data presented in Table 4.1 reveals that Cronbach's Alpha for the study variables was 0.7966, surpassing the 70% threshold, thereby demonstrating the reliability of the instruments employed.

Table 4.1 Reliability test

Green supply chain practices	Cronbach's Alpha	Items	Results
Green Procurement	0.777	6	Reliable
Green Manufacturing	0.830	5	Reliable
Green Packaging	0.704	4	Reliable
Reverse Logistics	0.834	5	Reliable
Performance	0.838	8	Reliable

Source: Researcher, field data, 2025.

4.3 Validity test

The validity of the measurement model was assessed through regression analysis, where selected green supply chain practices were tested as predictors of firm performance. The overall regression model was statistically significant, $F(4,90) =$

28.594, $p < .001$, with an R^2 of 0.560. This indicates that 56% of the variation in performance among sugar manufacturing firms in Western Kenya can be explained by the four practices considered: green procurement, green manufacturing, green packaging, and reverse logistics. The significance of the model demonstrates that the constructs used in this study have predictive power, thereby supporting criterion-related validity.

Further examination of the coefficients showed that green procurement ($\beta = .476$, $p < .001$) and reverse logistics ($\beta = .365$, $p = .001$) exerted significant positive effects on firm performance, while green manufacturing and green packaging did not display statistically significant contributions. The collinearity statistics revealed variance inflation factor (VIF) values below 3 for all predictors, confirming that each construct measured distinct aspects of green supply chain management. These results strengthen both the discriminant and construct validity of the instrument, indicating that the questionnaire items captured unique dimensions of green practices while also demonstrating meaningful predictive relationships with performance outcomes.

Tables include;

Table 4.2 Model Summary

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.748 ^a	.560	.540	.41211

Predictors: (Constant), GP, GM, GPG, RL.

Source: Researcher, field data, 2025.

Table 4.3 ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	19.425	4	4.856	28.594	.000 ^b
	Residual	15.285	90	.170		
	Total	34.710	94			

a. Predictors: (Constant), GP, GM, GPG, RL

Source: Researcher, field data, 2025.

Table 4.4 Regression coefficient

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	T	
1	(Constant)	1.289	.261		4.946	.000
	Green procurement	.433	.104	.476	4.176	.000
	Green manufacturing	-.025	.094	-.031	-.270	.788
	Green packaging	.040	.071	.057	.568	.572
	Reverse logistics	.254	.074	.365	3.411	.001

a. Dependent Variable: performance

Source: Researcher, field data.

4.4 Response Rate

A total of 129 questionnaires were disseminated to the participants utilizing a drop and pick method. Of the 129 individuals initially targeted, 95 completed and submitted the questionnaires. Consequently, the response rate was determined to be 73.6%, as illustrated in Table 4.5. Kothari (2014) posits that a response rate of 70% or higher is commendable and advisable for the generalization of study findings to a broader population.

Table 4.5 Response Rate

Response	Frequency	Percent (%)
Responsive	95	73.6
Unresponsive	34	26.4
Target	129	100.0

Source: Researcher, field data, 2025.

4.5 Company's ownership

Table 4.6 delineates the ownership structure of sugar manufacturing firms, categorizing them as either privately held or state-owned entities. Among the 95 questionnaires collected, 50 respondents, representing 52.6%, were affiliated with privately owned sugar firms, while 45 respondents, accounting for 47.4%, were associated with state-owned sugar firms.

Table 4.6 company ownership

Ownership	Frequency	Percent (%)
Private	50	52.6
State-owned	45	47.4
Total	95	100

Source: Researcher, field data, 2025.

4.6 Highest level of education

Table 4.7 delineates the results pertaining to the highest level of education attained. Among the 95 respondents, 53 (55.8%) reported possessing diplomas, 37 (38.9%) confirmed holding bachelor's degrees, and 5 (5.3%) indicated that they are postgraduates.

Consequently, a significant proportion of the participants indicated that they possess a diploma (55.8%). The findings suggest that the sugar manufacturing firms in western Kenya employ individuals with extensive and profound academic qualifications, thereby demonstrating familiarity with selected green supply chain practices.

Table 4.7 Level of education

Level of education	Frequency	Percent (%)
Diploma	53	55.8
Bachelor's Degree	37	38.9
Post graduate	5	5.3
Total	95	100.0

Source: Researcher, field data, 2025.

4.7 Period of time the sugar firm has been operational.

Table 4.8 delineates the results pertaining to the duration of the sugar firm's operational activities. Among the 95 respondents, 62 (65.3%) reported that the sugar firm has been in operation for a duration of 10 to 20 years, 26 (27.4%) confirmed that it has been operational for over 20 years, and 7 (7.4%) indicated that it has been functioning for a period of 0 to 10 years. The findings suggest that the sugar manufacturing firms in western Kenya have been integrating selected green supply chain practices throughout their operational history.

Table 4.8 Period of time the company has been operational.

Time (years)	Frequency	Percent (%)
Above 20yrs	26	27.4
10-20yrs	62	65.3
0-10yrs	7	7.4
Total	95	100

Source: Researcher, field data, 2025.

4.8 Appreciating the role of selected green supply chain practices.

Table 4.9 elucidates the findings regarding the extent to which sugar manufacturing firms in western Kenya recognize the significance of green supply chain practices. Among the 95 respondents, all 95 (100%) expressed their appreciation for green supply chain practices.

The findings suggest that sugar manufacturing firms in western Kenya recognize the significance of green supply chain practices, which consequently result in enhanced financial performance, improved product quality, decreased costs, and greater environmental preservation. The results align with a study conducted by Bor in 2021,

which demonstrated that the implementation of green supply chain practices resulted in enhanced efficiency and effectiveness. Tran, Phan, Ha, and Hoang (2020) undertook a comprehensive assessment, revealing that GSCM positively influences both environmental performance and financial performance.

Table 4.9 appreciating the role of green supply chain management practices

Response	Frequency	Percent (%)
Yes	95	100
No	0	0
Total	95	100

Source: Researcher, field data, 2025.

4.9 Descriptive Statistics.

This section elucidates the descriptive statistics pertaining to Green Procurement, Green Manufacturing, green packaging, reverse logistics, and performance. The responses varied from 1—strongly disagree, 2—disagree, 3—fairly agree, 4—agree, to 5—strongly agree.

4.9.1 Effects of Green Procurement on performance of sugar manufacturing firms

Table 4.10 presents statistics on the effect of green procurement on performance of sugar manufacturing firms.

Table 4.10 Effects of Green Procurement on performance of sugar manufacturing firms

Green procurement practices	SD	D	FA	A	SA
We evaluate suppliers on specific environmental criteria.	1 (1.1%)	7 (7.4%)	19 (20.0%)	45 (47.4%)	23 (24.2%)
Our firm uses eco labeling practices	1 (1.1%)	3 (3.2%)	24 (25.3%)	41 (43.2%)	26 (27.4%)
Company uses paperless methods to order materials	1 (1.1%)	6 (6.3%)	26 (27.4%)	37 (38.9%)	25 (26.3%)
Company Procures products that are made using recycled packages.	7 (7.4%)	22 (23.2%)	13 (13.7%)	24 (25.3%)	29 (30.5%)
We Require suppliers to have ISO 14001 certificates during their evaluation for environmental risks mitigation.	1 (1.1%)	4 (4.2%)	24 (25.3%)	33 (34.7%)	33 (34.7%)
We Ensure reduced tendering delays as well accountability and transparency.	0 (0%)	2 (2.1%)	11 (11.6%)	42 (44.2%)	40 (42.1%)

Source: Researcher, field data, 2025.

The findings presented in table 4.10 reveal that 71.6% of respondents concurred with the notion of assessing suppliers based on particular environmental criteria, while an additional 20.0% expressed a moderate agreement on this matter. Concerning the adoption of eco-labeling practices by firms, a notable 70.6% (43) of respondents affirmed that their organizations engage in such practices, while a mere 4.3% expressed disagreement regarding their firms' utilization of eco-labeling. Concerning the adoption of paperless methods for material ordering within companies, a notable 65.2% of respondents expressed agreement, whereas a mere 7.4% voiced disagreement regarding

their company's utilization of such methods. Upon assessing the extent to which company's source products manufactured from recycled materials, 55.8% of respondents expressed agreement, whereas 13.7% indicated a moderate level of agreement, and 30.6% disagreed with the notion that companies procure products derived from recycled packaging. A significant 69.4% of participants concurred with the assertion that suppliers must possess ISO 14001 certification, while 25.3% expressed moderate agreement. Conversely, 5.3% of respondents disagreed with the necessity for suppliers to hold ISO 14001. The participants were queried regarding their perspectives on the extent to which their organizations guarantee diminished tendering delays, alongside accountability and transparency. The findings revealed that 86.3% expressed agreement, whereas 2.1% voiced disagreement.

The findings align with the conclusions drawn by Yildiz and Sezen (2019), which emphasize the importance of selecting the appropriate supplier in fulfilling a company's environmental goals. Additionally, David and Muthini (2019) underscored that eco-design plays a crucial role throughout the various stages of the product life cycle, facilitating processes such as raw material extraction, production, packaging, distribution, usage, recovery, recycling, and incineration.

Pariatamby and Bhatti (2020) concluded that recyclable packaging materials and other environmentally friendly products are integral to green marketing, which also fosters a sustainable competitive advantage for firms. This stands in contrast to the findings of Naeem et al. (2022), who examined the textile, automobile, and tobacco sectors in Pakistan. Their research indicated that although green procurement seeks to enhance environmental performance, its effectiveness may be constrained by factors such as

insufficient supplier commitment and elevated costs, which could undermine the anticipated performance advantages.

4.9.2 Effects of Green Manufacturing on performance of sugar manufacturing firms

Table 4.11 presents statistics on effects of green manufacturing on performance of sugar manufacturing firms.

Table 4.11 Effects of Green Manufacturing on performance of sugar manufacturing firms

Green manufacturing practices	SD	D	FA	A	SA
Company generates low or no waste or pollution	3 (3.2%)	4 (4.2%)	24 (25.3%)	39 (41.1%)	25 (26.3%)
Company incurs lower raw material costs	3 (3.2%)	7 (7.4%)	18 (18.9%)	37 (38.9%)	30 (31.6%)
Our firm uses eco-friendly product and process design.	0 (0%)	5 (5.3%)	30 (31.6%)	37 (38.9%)	23 (24.2%)
Company ensures capacity utilization through quality production.	2 (2.1%)	18 (18.9%)	20 (21.1%)	33 (34.7%)	22 (23.2%)
We treat our wastes products before disposal	1 (1.1%)	1 (1.1%)	30 (31.6%)	35 (36.8%)	28 (29.5%)

Source: Researcher, field data, 2025.

The results presented in table 4.11 reveal that 67.4% of respondents concurred with the assertion that the company produces minimal or no waste or pollution, whereas 7.4% expressed disagreement with this claim. A significant portion of the respondents, 70.5%, concurred that their firms experience reduced raw material costs. Meanwhile, 18.9% of the respondents moderately agreed with this assertion, while 10.6% expressed disagreement regarding the notion that their company incurs lower raw material costs.

Upon assessing the extent to which firms engage in eco-friendly product and process design, it was found that 63.1% of respondents expressed agreement, while 5.3% voiced disagreement on the matter. A significant portion of the respondents, 57.9%, concurred that their organizations effectively guarantee capacity utilization via quality production, while 21.1% expressed moderate agreement with this assertion. A significant proportion of respondents, 66.3%, affirmed that their companies engage in the treatment of waste products prior to disposal. Meanwhile, 31.6% expressed a moderate agreement with this practice, while a minority of 2.2% voiced their disagreement. This outcome aligns with the research conducted by Yildiz and Sezen (2019), who characterize green manufacturing as the strategic planning and execution of energy-efficient activities that minimize resource consumption within the production framework, thereby generating minimal environmental pollution. Additionally, the findings of Fianko, Amoah, and Dzogbewu (2021) indicate that green design positively influences external green practices, including green purchasing and green construction, which, in turn, demonstrate a direct positive relationship with environmental performance. The findings stand in contrast to those of Naeem, Shaukat, Mustafa, and Jameel (2022), who concluded that green manufacturing practices did not consistently lead to notable enhancements in overall sustainable supply chain performance in their investigation of GSCM in Pakistan.

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4.9.3 Effects of Green Packaging on performance of sugar manufacturing firms
Table 4.12 presents effects green packaging on performance of sugar manufacturing firms

Table 4.12 Effects of Green Packaging on performance of sugar manufacturing firms

	SD	D	FA	A	SA
Green packaging practices	1	2	3	4	5
The company uses re-usable packaging material	2 (2.1%)	5 (5.3%)	22 (23.2%)	38 (40.0%)	28 (29.5%)
The company uses biodegradable packaging material	11 (11.6%)	11 (11.6%)	26 (27.4%)	35 (36.8%)	12 (12.6%)
Our Firm uses non-hazardous packaging material	10 (10.5%)	16 (16.8%)	24 (25.3%)	25 (26.3%)	20 (21.1%)
Our Firm uses low density packaging material.	16 (16.8%)	11 (11.6%)	26 (27.4%)	30 (31.6%)	12 (12.6%)

Source: Researcher, field data, 2025.

The respondents provided their perspectives on the utilization of re-usable packaging materials by their firms, with 69.5% expressing agreement, 23.2% indicating a moderate level of agreement, and 7.4% dissenting from this view. A survey regarding the utilization of biodegradable packaging materials revealed that 49.4% of participants affirmed their firms' adoption of such practices, while 27.4% expressed moderate agreement. Conversely, 23.2% of respondents indicated their disagreement with this approach. Participants were solicited for their views regarding their organization's utilization of non-hazardous packaging materials, with 47.4% (34) expressing agreement, while 25.3% indicated a moderate level of agreement. Respondents expressed a moderate consensus, with 27.4% indicating that their firms utilize low-density packaging materials, while a majority of 44.2% concurred with the assertion that their firms employ such materials.

The findings align with the research conducted by Pariatamby and Bhatti (2020), which determined that recyclable packaging materials and other environmentally friendly products constitute green marketing, thereby fostering a sustainable competitive advantage for companies. The findings align with those of Maziriri (2020), who elucidated that green packaging encompasses three primary facets: reducing the reliance on non-biodegradable materials, employing packaging that requires minimal energy consumption, and utilizing environmentally sustainable options. In their 2009 work, Song, Murphy, Narayan, and Davies emphasized that employing biodegradable materials plays a significant role in promoting sustainability and mitigating the environmental consequences linked to the disposal of packaging materials. Liu, Lai, and Wang (2021) articulated the concept of green packaging as the advancement and application of packaging materials designed to mitigate environmental pollution, minimize waste, and decrease energy consumption, all while fostering sustainable consumption and production practices.

Nevertheless, JohnsByrne (2023), in his article, explored the intricacies involved in the implementation of green packaging solutions, highlighting that a fragmented approach may fail to yield the anticipated enhancements in supply chain performance. Khan, Ahmed, & Zafar (2022), in their investigation into the impact of green purchasing and green packaging on sustainability and operational performance, concluded that green packaging did not have a significant effect on the operational performance of the e-commerce sector.

4.9.4 Effects of Reverse Logistics on performance of sugar manufacturing firms

Table 4.13 presents statistics on effects of reverse logistics on performance of sugar manufacturing firms.

Table 4.13 Effects of Reverse Logistics on performance of sugar manufacturing firms

Reverse Logistics Practices	SD 1	D 2	FA 3	A 4	SA 5
Our firm designs products that can be remanufactured	8 (8.4%)	9 (9.5%)	9 (9.5%)	30 (31.6%)	39 (41.1%)
We encourage suppliers to use Returnable packaging materials.	10 (10.5%)	9 (9.5%)	24 (25.3%)	31 (32.6%)	21 (22.1%)
Our supply chain framework provides for product Returns	10 (10.5%)	14 (14.7%)	25 (26.3%)	32 (33.7%)	14 (14.7%)
The company's solid wastes are recycled and the company has organization policies on disposal methods	4 (4.2%)	4 (4.2%)	16 (16.8%)	47 (49.5%)	24 (25.3%)
Our firm ensures proper inventory management to avoid a lot of wastages.	0 (0%)	9 (9.5%)	20 (21.1%)	45 (47.4%)	21 (22.1%)

Source: Researcher, field data, 2025.

A significant portion of the respondents, 72.7%, concurred that their firms engage in the design of products amenable to remanufacturing, while 17.9% (5) expressed disagreement with this assertion. A total of 54.7% of respondents expressed their agreement with the notion of encouraging suppliers to utilize returnable packaging materials, while 25.3% indicated a moderate level of agreement, and 20% voiced their disagreement.

Concerning the supply chain framework's provision for product returns, 48.4% expressed agreement, while 26.3% indicated a moderate level of agreement.

Concerning the recycling of the company's solid wastes and the existence of

organizational policies on disposal methods, a significant majority of 74.8% expressed agreement, while 8.4% voiced disagreement. A notable 69.5% of respondents concurred that their firm effectively implements inventory management practices to mitigate excessive waste, while 21.1% expressed a moderate level of agreement on the matter.

This aligns with the findings of Kirchoff et al., 2016, who demonstrated that re-manufacturing generates value by facilitating the resale and reuse of utilized materials. Reverse logistics initiatives assist organizations in overseeing the lifecycle conclusion of products and the processes associated with investment recuperation. Recovery initiatives embody strategic assets that necessitate intricate coordination with both upstream and downstream supply chain collaborators. The findings are consistent with the assertions made by Banihashemi, Fei, & Chen in 2019, who articulated that reverse logistics can yield both tangible and intangible advantages by reclaiming value from utilized or returned items and prolonging the product life cycle through processes such as recycling, remanufacturing, and reuse.

The findings align with those of Mario et al. (2013), who emphasized that the recovery and reuse of products mitigates adverse environmental impacts, particularly by decreasing waste disposal, the extraction of raw materials, and emissions associated with transport and distribution. Moreover, companies have the potential to reclaim value from products that have reached the end of their lifecycle by reusing components, recycling materials, or harnessing energy through incineration. The findings align with the work of Sharma et al. (2016), who elucidate that reverse logistics involves the strategic planning, execution, and oversight of the efficient and economical movement of raw materials, work-in-progress inventory, finished products, and associated information from the consumption point back to the origin, aimed at generating value

and ensuring appropriate disposal. The findings align with the work of Grabara, Cehlar, & Dabylova (2019), who articulate that the fundamental rationale for adopting a reverse system within any business process is to curtail expenses and enhance profitability, thereby diminishing waste. Nevertheless, these findings stand in opposition to the conclusions drawn by Khan and Qianli (2024) regarding the relationship between reverse logistics capabilities and supply chain performance in a developing nation: The pharmaceutical sector indicated that reverse logistics did not uniformly improve supply chain performance, as the findings suggested a mixed impact. Haidara (2022) conducted an analysis of the influence of reverse logistics on supply chain performance, concluding that without proper implementation and integration, reverse logistics may not produce substantial enhancements.

4.9.5 Performance

Table 4.14 presents statistics on performance

Table 4.14 Performance.

Performance	SD	D	FA	A	SA
	1	2	3	4	5
Product quality has increased after introduction of selected green supply chain practices.	3 (3.2%)	10 (10.5%)	24 (25.3%)	36 (37.9%)	22 (23.2%)
There is increased use of green packaging after the introduction of selected green supply chain practices.	4 (4.2%)	16 (16.8%)	27 (28.4%)	29 (30.5%)	19 (20.0%)
Our waste water and solid has been reduced after the introduction of selected green supply chain practices.	3 (3.2%)	3 (3.2%)	21 (22.1%)	47 (49.5%)	21 (22.1%)
There is increased efficiency and effectiveness in our operations after introduction of selected green supply chain practices	1 (1.1%)	1 (1.1%)	18 (18.9%)	42 (44.2%)	33 (34.7%)
Our energy consumption has been reduced after the introduction of selected green supply chain practices.	0 (0%)	5 (5.3%)	17 (17.9%)	45 (47.4%)	28 (29.5%)
Capacity utilization has improved after introduction of selected green supply chain practices.	0 (0%)	1 (1.1%)	18 (18.9%)	47 (49.5%)	29 (30.5%)
There is increased supplier cooperation with our firm to ensure green production.	2 (2.1%)	1 (1.1%)	16 (16.8%)	47 (49.5%)	29 (30.5%)
There is increased production of eco-friendly production after introduction of selected green supply chain practices.	0 (0%)	1 (1.1%)	11 (11.6%)	39 (41.1%)	44 (46.3%)

Source: Researcher, field data, 2025.

Concerning the impact of selected green supply chain practices on product quality, a significant majority of respondents, 61.1%, affirmed this assertion, while 13.7% expressed disagreement. The evaluation indicated that there was a notable increase in the utilization of green packaging following the implementation of selected green supply chain practices. Specifically, 50.5% of respondents affirmed this increase, while 28.4% expressed moderate agreement. A significant proportion of respondents, 71.6%, concurred that the implementation of selected green supply chain practices has led to a reduction in both their wastewater and solid waste, while 22.1% expressed moderate agreement as well. The participants were queried regarding their views on the enhancement of efficiency and effectiveness in our operations following the implementation of selected green supply chain practices. A significant majority, 78.9%, expressed agreement, while a mere 2.2% voiced disagreement. A significant 76.4% of respondents concurred that energy consumption has diminished following the implementation of selected green supply chain practices, while a further 17.9% expressed moderate agreement. Concerning this evaluation, 80% of the respondents concurred that capacity utilization has enhanced following the implementation of selected green supply chain practices, while 18.9% (23) expressed moderate agreement with this assertion. A significant majority of the respondents, 80.0%, concurred that there has been an enhancement in supplier cooperation with our firm to facilitate green production, while 16.8% expressed moderate agreement as well. Concerning the assessment of whether the implementation of selected green supply chain practices has led to an increase in eco-friendly production, a significant majority of respondents, 87.4%, expressed agreement, while 11.6% indicated a moderate level of agreement.

This aligns with the findings of Musau and Rucha (2021), who emphasized that the adoption of green manufacturing led to a significant reduction in production costs, enhanced product quality by ensuring conformity to specifications and market viability, improved delivery efficiency, and decreased time to market as well as responsiveness to shifts in consumer preferences. Agarwal and Kumar (2020) also revealed that green packaging aids business organizations in achieving a competitive advantage. A study conducted by Bor (2021) revealed that enhanced performance can be linked to green manufacturing practices, which include production processes aimed at minimizing waste and ensuring water conservation, optimizing capacity utilization, decreasing hazardous waste during production, implementing eco-design in products, and adopting cleaner production techniques. The findings align with the assertions made by Cory & Carolina in 2016, which indicated that the adoption of Green Manufacturing is associated with a decrease in material waste and energy consumption. Moreover, it reduces production expenses while simultaneously improving the quality of the product. Dheeraj and Vishal (2012) articulated that green manufacturing represents the integrated utilization of productivity standards alongside environmental assessment tools and methodologies that mitigate the ecological footprint of an organization's operations, products, and services, while simultaneously augmenting profitability and competitive edge, thereby corroborating these findings.

4.10 Inferential Statistics

4.10.1 Diagnostic Tests

A series of diagnostic tests were performed prior to estimating the model to confirm that the assumptions of the linear regression model were not violated. This contributed to the mitigation of risks associated with acquiring biased, inefficient, and inconsistent parameter estimates.

4.10.1.1 Linearity Test

Green procurement and performance

An ANOVA test was performed to investigate the linear correlation between green procurement and the performance of sugar manufacturing enterprises. The p-value for divergence from linearity was 0.115, beyond the 0.05 criterion, indicating a linear connection.

Table 4.15 Green procurement.

		Sum of Squares	Df	Mean Square	F	Sig.
Between groups	(Combined)	20.024	17	1.178	6.176	.000
	Linearity	15.391	1	15.391	80.695	.000
	Deviation from linearity	4.633	16	.290	1.518	.115
Within groups		14.686	77	.191		
Total		34.710	94			

Source: Researcher, field data, 2025.

Green manufacturing and Performance

An ANOVA test was conducted to examine the linear relationship between green manufacturing practices and the performance of sugar manufacturing firms. The p-value for deviation from linearity was found to be 0.109, exceeding the threshold of 0.05, thereby suggesting the presence of a linear relationship.

Table 4.16 Green Manufacturing.

		Sum of Squares	Df	Mean Square	F	Sig.
Between groups	(Combined)	16.558	16	1.035	4.447	.000
	Linearity	11.158	1	11.158	47.947	.000
	Deviation from linearity	5.400	15	.360	1.547	.109
Within groups		18.152	78	.233		
Total		34.710	94			

Source: Researcher, field data, 2025.

Green packaging and Performance

An ANOVA test was performed to investigate the linear correlation between green packaging and the performance of sugar producing companies. The p-value for divergence from linearity was 0.175, beyond the 0.05 criterion, indicating a linear connection.

Table 4.17 Green Packaging

		Sum Squares	of Df	Mean Square	F	Sig.
Between groups	(Combined)	14.559	15	.971	3.805	.000
	Linearity	9.572	1	9.572	37.527	.000
	Deviation from linearity	4.987	14	.356	1.396	.175
Within groups		20.151	79	.255		
Total		34.710	94			

Source: Researcher, field data, 2025.

Reverse logistics and Performance

An ANOVA test was performed to investigate the linear correlation between reverse logistics and the performance of sugar producing companies. The p-value for deviation from linearity was 0.952, beyond the 0.05 threshold, indicating a linear connection.

Table 4.18 Reverse Logistics

		Sum Squares	of Df	Mean Square	F	Sig.
Between groups	(Combined)	15.740	17	.926	3.758	.000
	Linearity	13.866	1	13.866	56.284	.000
	Deviation from linearity	1.874	16	.117	.475	.952
Within groups		18.970	77	.246		
Total		34.710	94			

Source: Researcher, field data, 2025.

4.10.1.2 Test for Multicollinearity

Variance inflation factors (VIFs) and their reciprocals were computed for each independent variable to evaluate multicollinearity, specifically through the analysis of tolerances. It is generally accepted that the VIFs ought not to surpass the value of ten. All of the VIFs are below 10, indicating that none of the independent variables in question contravene the assumption.

Table 4.19 Test for Multicollinearity

		Collinearity Statistics	
Model		Tolerance	VIF
1	GP	.776	2.656
	GM	.862	2.765
	GPG	.884	2.067
	RL	.928	2.335

Source: Researcher, field data, 2025.

4.10.1.3 Normality Test

The study tested the normality using the Shapiro-Wilk test. For data sets small than 2000 elements, we use the Shapiro-Wilk test; otherwise, the Kolmogorov-Smirnov test is used. For data to be normal, the p-value must be > 0.05 at a 95% confidence level. If that is the case, then we conclude that the data is normally distributed. Table 4.20 shows that the data is normally distributed as the respective p values for all variables more than 0.05. Thus, it is concluded the data is normally distributed.

Table 4.20 Normality Test

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Green Procurement	.229	95	.543	.775	95	.507
Green Manufacturing	.179	95	.234	.926	95	.298
Reverse logistics	.153	95	.312	.952	95	.349
Green Packaging	.211	95	.125	.899	95	.109

a. Lilliefors Significance Correction

Source: Researcher, field data, 2025.

4.10.1.4 Homoscedasticity

The Levin test was employed to assess the homogeneity of variance. The probability value for green procurement was determined to be 0.000, which is below the threshold of 0.05, suggesting a lack of homogeneity. The probability value for green manufacturing was recorded at 0.125, exceeding the threshold of 0.05, thereby suggesting a state of homogeneity. The probability value for green packaging was 0.011, exceeding the threshold of 0.05, thereby suggesting a state of homogeneity. Ultimately, the analysis of reverse logistics yielded a probability value of 0.000, which is significantly below the threshold of 0.05, suggesting a lack of homogeneity.

Table 4.21 Test of Homogeneity of Variances

		Levin			
		Statistic	df1	df2	Sig.
Green procurement	Based on Mean	4.331	15	77	.000
Green manufacturing	Based on Mean	1.532	13	78	.125
Green Packaging	Based on Mean	2.325	13	79	.011
Reverse logistics	Based on Mean	3.613	14	77	.000

Source: Researcher, field data, 2025.

4.11 Simple regression analysis

4.11.1 Green procurement and performance

According to table 4.22, at a 95% confidence level, green procurement accounts for 66.6% of the variation in the performance of sugar manufacturing firms. The R^2 value of 0.666 serves as an indication of this phenomenon.

Table 4.22 Model summary

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.666 ^a	.443	.437	.45577

Predictors: (Constant), green procurement

Source: Researcher, field data, 2025.

ANOVA^a

Table 4.23 indicates that the P value for green procurement is 0.000, which is below the 0.05 threshold at a 95% significance level. This signifies that the model is suitable for examining the correlation between green procurement and the performance of sugar manufacturing enterprises. Consequently, H_0 is rejected due to the existence of a positive and significant correlation between green procurement and the performance of sugar production enterprises.

Table 4.23 Anova

Model		Sum Squares	of Df	Mean Square	F	Sig.
1	Regression	15.391	1	15.391	74.091	.000 ^b
	Residual	19.319	93	.208		
	Total	34.710	94			

a. Dependent Variable: performance.

b. Predictors: (Constant), green procurement.

Source: Researcher, field data, 2025.

Regression coefficient

$$Y=1.586+0.606X_1$$

If all components remain constant at zero, a unit change in the p-value will be 1.586, while a single unit rise in green procurement will yield a 0.606 increase in the performance of sugar manufacturing firms. This aligns with a research by Shiyuka and Senelwa (2022), which examined the effects of green procurement on performance in the industrial sector and determined that a positive correlation exists between green procurement and performance. Wanja and Achuora (2020) study on sustainable procurement practices and their influence on procurement performance within food and beverage manufacturing firms in Kenya aligned with these findings where their findings indicated that sustainable procurement markedly enhances procurement performance, ultimately leading to a favourable impact on overall firm performance.

Table 4.24 Regression coefficient.

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	T	
1	(Constant)	1.586	.278		5.703	.000
	Green Procurement	.606	.070	.666	8.608	.000

Dependent Variable: performance

Source: Researcher, field data, 2025.

4.11.2 Green manufacturing and performance

From table 4.25 at 95% confidence level green manufacturing account for 56.7% of variation in performance of sugar manufacturing firms. This is indicated by an R² value of 0.567.

Table 4.25 Model summary

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.567 ^a	.321	.314	.50323

Predictors: (Constant), green manufacturing

Source: Researcher, field data, 2025.

ANOVA^a

Table 4.26 indicates that the P value for green manufacturing is 0.000, which is below the 0.05 threshold at a 95% significance level. This signifies that the model is suitable for examining the correlation between green manufacturing and the performance of sugar producing enterprises. Consequently, HO1 is rejected due to the existence of a

favourable and significant correlation between green manufacturing and the performance of sugar producing enterprises.

Table 4.26 ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	11.158	1	11.158	44.060	.000 ^b
	Residual	23.552	93	.253		
	Total	34.710	94			

a. Dependent Variable: performance

b. Predictors: (Constant), green manufacturing

Source: Researcher, field data, 2025.

Regression coefficient

$$Y=2.199+0.458X_1$$

If all factors held constant at 0, the unit change in the p value will be 2.199 a single unit increase in green manufacturing will result in 0.458 increase in performance of sugar manufacturing firms. This is in line with a study by Srisawat and Srisawat (2020) found a significant positive effect of green manufacturing on firm’s sustainability, and also by Musau and Rucha (2021) who found out that green manufacturing helps manufacturing enterprises in Mombasa County improve their operational performance.

Table 4.27 Regression coefficient

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	2.199	.268		8.206	.000
	Green manufacturing.	.458	.069	.567	6.638	.000

Dependent Variable: performance

Source: Researcher, field data, 2025.

4.11.3 Green packaging and performance

From table 4.28 at 95% confidence level green packaging account for 52.5% of variation in performance of sugar manufacturing firms. This is indicated by an R² value of 0.525.

Table 4.28 Model summary

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.525 ^a	.276	.268	.51990

Predictors: (Constant), Green Packaging

Source: Researcher, field data, 2025.

ANOVA^a

Table 4.29 indicates that the P value for green packaging is 0.000, which is below the 0.05 threshold at a 95% significance level. This signifies that the model is suitable for examining the correlation between green packaging and the performance of sugar production companies. Consequently, HO1 is dismissed due to the favourable and

strong correlation between green packaging and the success of sugar production enterprises.

Table 4.29 ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	9.572	1	9.572	35.413	.000 ^b
	Residual	25.138	93	.270		
	Total	34.710	94			

a. Dependent Variable: performance

b. Predictors: (Constant), green packaging

Source: Researcher, field data, 2025.

Regression coefficient

$$Y=2.680+0.372X_1$$

If all factors held constant at 0, the unit change in the p value will be 2.680 a single unit increase in green packaging will result in 0.372 increase in performance of sugar manufacturing firms. This is in line with a study by Nthiwa, Muli and Kitheka, (2024) that revealed there is significant and positive correlation between green packaging with overall company performance, also a study by Agarwal and Kumar (2020) that showed green packaging aids business enterprises in achieving competitive advantage.

Table 4.30 Regression Coefficient

Model		Unstandardized Coefficients		Standardize	T	Sig.
		B	Std. Error	d		
1	(Constant)	2.680	.219		12.230	.000
	Green packaging	.372	.063	.525	5.951	.000

Dependent Variable: performance

Source: Researcher, field data, 2025.

4.11.4 Reverse Logistics and Performance

From table 4.31 at 95% confidence level reverse logistics account for 63.2% of variation in performance of sugar manufacturing firms. This is indicated by an R² value of 0.632.

Table 4.31 Model summary

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.632 ^a	.399	.393	.47342

Predictors: (Constant), Reverse Logistics

Source: Researcher, field data, 2025.

ANOVA^a

Table 4.32 demonstrates that the P value for reverse logistics is 0.000, which is below the 0.05 criterion at a 95% confidence level. This indicates that the model is appropriate for analysing the relationship between reverse logistics and the performance of sugar production companies. Therefore, HO1 is rejected based on the robust and favourable link between reverse logistics and the performance of sugar manufacturing firms.

Table 4.32 ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	13.866	1	13.866	61.868	.000 ^b
	Residual	20.844	93	.224		
	Total	34.710	94			

a. Dependent Variable: performance

b. Predictors: (Constant), reverse logistics

Source: Researcher, field data, 2025.

Regression coefficient

$$Y=2.335+0.440X1$$

Assuming other components remain constant at zero, a unit change in the p-value will be 2.335, whereas a single unit rise in reverse logistics will result in a 0.440 improvement in the performance of sugar-producing firms. A study conducted by Gikonyo, Ngugi, and Nyang'au (2022) evaluated the influence of reverse logistics on the performance of building and construction manufacturing enterprises in Kenya,

determining that reverse logistics had a considerable impact on their performance. Similar study by Lumba and Mwanza (2023) conducted to assess the impact of the reverse logistics system on a company's economic performance found a positive and significant correlation between reverse logistics practices and the company's economic benefits, identifying the advantages of implementing such practices.

Table 4.33 Regression Coefficients

Model		Unstandardized		Standardized		
		Coefficients		Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.335	.210		11.106	.000
	Reverse logistics	.440	.056	.632	7.866	.000

a. Dependent Variable: performance

4.12 Multiple regression analysis

An R2 of 0.560 signifies that almost 56% of the variability in the performance of sugar manufacturing enterprises, as assessed by operational cost levels, is elucidated by fluctuations in selected green supply chain practices. Forty-one percent of the variances in selected green supply chain practices can be ascribed to issues outside the purview of this study.

Table 4.34 Model summary.

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.748 ^a	.560	.540	.41211

Predictors: (Constant), GP, GM, GPG, RL.

Source: Researcher, field data, 2025.

4.13 ANOVA

The ANOVA results in table 4.35 indicate that selected green supply chain practices significantly affect the performance of sugar manufacturing firms at a 95% confidence level, as reflected by a p-value of 0.000, which is below 0.05. The F value from the ANOVA signifies a significant link between selected green supply chain practices and the performance of sugar-producing firms. An F value of 28.594 surpasses the critical value of 2.35 at 4 degrees of freedom. The selected green supply chain practices significantly influenced the performance variance of sugar producing firms at a 5% significance level, as evidenced by ANOVA table 4.31 with a p-value of 0.000, which is below 0.05.

Table 4.35 ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	19.425	4	4.856	28.594	.000 ^b
	Residual	15.285	90	.170		
	Total	34.710	94			

a. Predictors: (Constant), GP, GM, GPG, RL

b. Dependent Variable: performance (operation Cost level, quality of products).

Source: Researcher, field data.

Multiple Regression coefficient.

From table 4.36, the regression equation will be;

$$Y = 1.289 + 0.433X_1 - 0.025X_2 + 0.040X_3 + 0.254X_4$$

If all components remain constant at 0, the unit change in the p-value will be 1.289. An increment of one unit in green procurement will yield a 0.433 enhancement in the performance of sugar manufacturing enterprises. A one-unit rise in green manufacturing will lead to a 0.025 decrease in the performance of sugar manufacturing firms. A one-unit increase in green packaging will lead to a 0.040 enhancement in the performance of sugar producing firms, while a one-unit increase in reverse logistics would yield a 0.254 improvement in their performance.

Table 4.36 Regression coefficient

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	T	
1	(Constant)	1.289	.261		4.946	.000
	Green procurement	.433	.104	.476	4.176	.000
	Green manufacturing	-.025	.094	-.031	-.270	.788
	Green packaging	.040	.071	.057	.568	.572
	Reverse logistics	.254	.074	.365	3.411	.001

b. Dependent Variable: performance

Source: Researcher, field data.

4.14 Summary of Hypotheses Testing

Table 4.37 presents a summary of the hypotheses evaluated in relation to the study objectives. The simple regression results indicated that green procurement, green manufacturing, green packing, and reverse logistics had p-values below 0.05, signifying a significant impact on the performance of sugar manufacturing enterprises.

Table 4.37 Hypotheses

No.	Hypothesis	P-value	Results
Ho ₁	Green procurement has no significant effect on performance of sugar manufacturing firms in Western Kenya.	0.000 < 0.05	Rejected
Ho ₂	Green manufacturing has no significant effect on performance of sugar manufacturing firms in Western Kenya.	0.000 < 0.05	Rejected
Ho ₃	Green packaging has no significant effect on performance of sugar manufacturing firms in Western Kenya.	0.000 < 0.05	Rejected
Ho ₄	Reverse logistics has no significant effect on performance of sugar manufacturing firms in Western Kenya.	0.000 < 0.05	Rejected

Source: Researcher, field data.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the study's findings in light of the specific study objectives. In addition, it provides recommendations for policymakers, summary of the findings and areas for further studies.

5.2 Summary of the findings

The objective for this study was to evaluate the effects of selected green supply chain practices on performance of sugar manufacturing firms in western Kenya. Both descriptive and inferential data analysis techniques were employed. According to the findings majority of the response was from the private owned firms with a rate of (52.6%). Majority of respondents from the sugar manufacturing firms had a diploma at a response rate of (55.8%) of implying that most of them are well versed with selected green supply chain practices and hence practiced them. The findings also revealed that sugar manufacturing firms in western Kenya has been operational from 10 to 20 Years at a response rate of 62 (65.3%) indicating that selected green supply chain practices have been operational. All the respondents were in agreement that they appreciated selected green supply chain practices by a response rate of (100%).

5.2.1 Green Procurement

The first hypothesis posited that green procurement has no significant effect on the performance of sugar manufacturing firms in Western Kenya. However, the findings revealed that green procurement positively and significantly impacts performance

($\beta_1=0.433$, $p<0.05$), leading to the rejection of H01 and concluding that green procurement significantly influences performance.

5.2.2 Green Manufacturing

The second hypothesis suggested that green manufacturing has no significant effect on the performance of sugar manufacturing firms in Western Kenya. However, the findings showed that green manufacturing has a significant impact on performance ($\beta_2=-0.025$, $p<0.05$), leading to the rejection of H02 and concluding that green manufacturing significantly influences performance.

5.2.3 Green Packaging

The third hypothesis posited that green packaging has no significant effect on the performance of sugar manufacturing firms in Western Kenya. However, the findings revealed that green packaging has a positive and significant impact on performance ($\beta_3=0.040$, $p<0.05$), leading to the rejection of H03 and concluding that green packaging significantly influences performance.

5.2.4 Reverse Logistics

The fourth hypothesis stated that reverse logistics has no significant effect on the performance of sugar manufacturing firms in Western Kenya. However, the findings indicated a positive and significant impact of green distribution on performance ($\beta_4=0.254$, $p<0.05$), leading to the rejection of H04 and concluding that reverse logistics significantly influences performance.

5.3 Conclusions

Based on the findings, it is concluded that green procurement practices and performance are positively and significantly related. Implementing green procurement practices

results in cost savings, environmental protection, improved market position, customer loyalty, and competitive advantage while fostering employee satisfaction and engagement.

The study further concludes that green manufacturing and performance are positively and insignificantly related. Green manufacturing practices result in substantial cost savings, improved product quality and innovation, enhanced brand image and customer loyalty. Additionally, they foster employee engagement and their safety and ensure compliance with environmental regulations, thereby enhancing profitability and competitive advantage which results to long-term sustainability and resilience.

Similarly, green packaging and performance was found to be positively and insignificantly related. Green packaging results in environmental benefits by reducing waste and pollution, lowering carbon footprint and conservation of resources, helps in improving brand image and creation of customer loyalty, cost savings to businesses through incentives and tax breaks and production efficiency. Additionally green packaging ensures compliance with regulations, health benefits and encourages innovation.

The study concludes that reverse logistics and performance is positively and significantly related. This demonstrates that adopting reverse logistics practices can result in substantial performance gains which are cost savings, environmental sustainability, customer satisfaction and loyalty, risk and compliance management, corporate responsibility and competitive advantage.

5.4 Recommendations

The following recommendations were established from the research findings.

Sugar manufacturing firm's managers should actively promote practices that supports sustainability and green supply chain. This can be achieved through training programs, workshops, and internal communication strategies that emphasize the importance and benefits of green supply chain management (GSCM).

Specifically, managers should integrate green procurement practices by partnering with suppliers who prioritize environmental sustainability to ensure provision of desirable products to customers. They should introduce e-procurement to achieve transparency and accountability. Managers should introduce eco-design production process that are friendly to their workers and the environment around them before production, distribution and use.

Additionally, investing in green manufacturing technologies and processes can significantly enhance operational efficiency, ensure capacity utilization and reduce environmental impact. It is utmost necessary for the firms to use inputs with relatively low environmental impacts. They should ensure waste treatment and its reduction before disposal to protect the environment and ensure water conservation by avoiding disposal of untreated effluents into water sources.

Managers should also prioritize green packaging principles to reduce waste and promote product recyclability. The green packaging principles reduces energy consumption at the same time promoting sustainable consumption and production patterns. Firms should introduce packaging materials that can be recycled and reused to cut costs and avoid a lot of wastes. They should implement use of bio-degradable packaging which will contribute to sustainability and reduction of environmental associated impacts.

Implementing reverse logistics methods, such as remanufacturing, inventory management and recycling can improve performance and create competitive advantage. Generally, it is crucial for managers to regularly evaluate and adapt their green supply chain practices in response to changing environmental regulations and market conditions. Policymakers should develop and enforce regulations that encourage and, where feasible, mandate the adoption of green supply chain practices. It is also crucial for regulatory bodies to facilitate continuous learning and development programs that help organizations stay updated with the latest green supply chain practices and technologies.

5.5 Implications of the study

Theoretical implications

The idea of transaction cost economics posits that minimizing transaction costs is crucial for enhancing organizational efficiency and effectiveness. It advises organizations to optimize their supply chain operations by forming enduring partnerships with suppliers and investing in information solutions that improve transparency and collaboration. By reducing transaction costs related to negotiating, monitoring, and enforcing contracts, organizations can attain more efficient green procurement and distribution methods. This hypothesis substantiates the research by correlating the variables with the roles of green procurement, green manufacturing, green packaging, and reverse logistics in attaining optimal organizational performance. Consequently, this theory can be integrated with green manufacturing, as adopting cleaner production typically lowers production costs, thereby enhancing enterprises' performance.

According to NRBV theory, environmental management inside the supply chain can confer a competitive advantage to its practitioners. It underscores the entire premise of embracing this discipline. The Resource-Based View (RBV) elucidates how organizations can cultivate distinctive environmental capabilities and competences to propel sustainability activities and improve organizational performance. The resource-based view (RBV) posits that organizations can attain internal competence through their fundamental capabilities, including pollution prevention, product stewardship, and sustainable development, by implementing and fully integrating green supply chain practices such as green procurement, green manufacturing, green packaging, and reverse logistics.

Policy implications

The study will assist policymakers in sugar producing companies in identifying areas for the integration of green supply chain strategies. The findings establish a basis for developing and executing policies regarding green procurement, green manufacturing, reverse logistics, and green packaging to enhance product and service quality, increase production process effectiveness and efficiency, and optimize service costs throughout the supply chain network.

Practice implications

The research examined the integration of green supply chain techniques by sugar manufacturing companies to enhance their performance. The response came from employees in leadership positions, allowing them to thoroughly understand the impact of green supply practices on the performance of sugar manufacturing firms in western Kenya. This understanding facilitated the identification of methods to enhance existing production and reinforced regulations for monitoring production within the supply

chain, aiming to minimize acquisition costs, improve product and service quality, reduce pollution, and enhance production efficiency and effectiveness.

5.6 Areas of further studies

Future studies could expand the geographical scope beyond Western Kenya to include other regions or counties, providing a comparative analysis that could highlight regional differences in the effectiveness of green supply chain practices. Researchers can further studies by specifically focusing on either private or state-owned companies and asses how green supply chain practices have been implemented in these firms. There is also a need to examine the influence of external factors, such as government policies, market conditions, and technological advancements, on the effectiveness of green supply chain practices.

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APPENDICES

APPENDIX I: INTRODUCTORY LETTER TO RESEARCH RESPONDENTS

Date: _____

Dear Participant:

My name is Mwalati Mercy .I am an MBA student at the School of Business, Masinde Muliro University. I'm currently undertaking my research project entitled Effects of Selected Green supply chain practices on performance of sugar manufacturing firms in Western Kenya. The attached questionnaire is for gathering data, which will be useful in the mentioned research.

You have been selected as one of the respondents in this study. I therefore request you to kindly facilitate the collection of the required data by answering the questions herein. Please note that the information sought is purely for academic purposes and will be treated with utmost confidentiality. I promise that a copy of the final report will be available to you on demand.

Your cooperation will be highly appreciated

Yours faithfully,

Mwalati Mercy

Phone number :(0797234467)

Email: mwalatimercy@gmail.com

APPENDIX II: RESEARCH QUESTIONNAIRE

The questionnaire will serve the purpose of collecting information on the effect of selected green supply chain practices on performance of sugar manufacturing firms in western Kenya.

Please fill the options of your choice in the boxes and space provided.

PART ONE: GENERAL INFORMATION

1. Is company private or state owned?

Private State-owned

2. Highest level of education of employees?

Diploma Bachelor Degree

Post-graduate

3. How long has the company been in operation?

Above 20 years 10 –20 years

0 - 10 years

4. As an individual, do you appreciate the role of Green Supply Chain Management practices? Yes No

PART TWO: GREEN SUPPLY CHAIN PRACTICES

Below is a list of practices of Green Supply Chain Practices. Please tick appropriately the extent to which each of them is practiced in your company. (Key: 1=strongly disagree (SD), 2=disagree (D), 3=fairly agree (FA), 4=agree (A), 5=strongly agree (SA))

GREEN PROCUREMENT PRACTICES	SD	D	FA	A	SA
	1	2	3	4	5
We evaluate suppliers on specific environmental criteria					
Our firm uses eco labeling practices					
Company uses paperless methods to order materials					
Company Procures products that are made using recycled packages.					
We Require suppliers to have ISO 14001 certificates during their evaluation for environmental risks mitigation.					
We Ensure reduced tendering delays as well accountability and transparency.					
GREEN MANUFACTURING PRACTICES	SD	D	FA	A	SA
	1	2	3	4	5
Company generates low or no waste or pollution					
Company incurs lower raw material costs					
Our firm uses eco-friendly product and process design.					
Company ensures capacity utilization through quality production.					
We treat our wastes products before disposal					
GREEN PACKAGING	SD	D	FA	A	SA

	1	2	3	4	5
The company uses re-usable packaging material					
The company uses biodegradable packaging material					
Our Firm uses non-hazardous packaging material					
Our Firm uses low density packaging material.					
	SD	D	FA	A	SA
	1	2	3	4	5
REVERSE LOGISTICS					
Our firm designs products that can be remanufactured					
We encourage suppliers to use Returnable packaging materials.					
Our supply chain framework provides for product Returns					
The company's solid wastes are recycled and the company has organization policies on disposal methods					
Our firm ensures proper inventory management to avoid a lot of wastages.					

PART THREE: PERFORMANCE

PERFORMANCE	SD	D	FA	A	SA
	1	2	3	4	5
Product quality has increased after introduction of selected green supply chain practices.					
There is increased use of green packaging after the introduction of selected green supply chain practices.					
Our waste water and solid has been reduced after the introduction of selected green supply chain practices.					
There is increased efficiency and effectiveness in our operations after introduction of selected green supply chain practices					
Our energy consumption has been reduced after the introduction of selected green supply chain practices.					
Capacity utilization has improved after introduction of selected green supply chain practices.					
There is increased supplier cooperation with our firm to ensure green production.					
There is increased production of eco-friendly production after introduction of selected green supply chain practices.					

APPENDIX III: LIST OF SUGAR COMPANIES IN WESTERN KENYA

1. Kabras Sugar Company
2. Butali mills factory
3. Chemilil Sugar Company
4. Muhoroni Sugar Company
5. Nzoia Sugar Company
6. South nyanza Sugar Company
7. Kibos sugar company
8. Transmara Company
9. Sukari industries limited
10. Mumias sugar Company
11. Busia Sugar Company .

Source: Sugar Directorate of the Agriculture and Food Authority

APPENDIX IV: RESEARCH LICENCE



REPUBLIC OF KENYA



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Date of Issue: **13/August/2024**

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