GREEN LOGISTICS PRACTICES AND PERFORMANCE OF FOOD AND BEVERAGE MANUFACTURING FIRMS IN KENYA

CHARLES MAMU NTHIWA

DOCTOR OF PHILOSOPHY IN SUPPLY CHAIN MANAGEMENT

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

Green Logistics Practices and Performance of Food and Beverage Manufacturing Firms in Kenya

Charles Mamu Nthiwa

A Thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy in Supply Chain Management of the Jomo Kenyatta University of Agriculture and Technology

2026

DECLARATION

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

Signed…… Date……

Charles Mamu Nthiwa

This thesis has been submitted for examination with our approval as University Supervisors.

Signed……..... Date…….....

Dr. Samuel Muli, PhD

JKUAT, Kenya

Signed……..... Date……

Dr. Samson Kitheka, PhD

TUM, Kenya

DEDICATION

I dedicate this thesis to my wife and children for their sincere love and patience as I was pursuing this course. They gave me support even when I felt like giving up.

ACKNOWLEDGEMENT

First and foremost, I would like to express my sincere acknowledgement to the Almighty God.

I extend my earnest acknowledgements to my supervisors, Dr. Samuel Muli and Dr. Samson Kitheka for their consistent advice, guidance, incisive criticism and mentorship which have culminated in the completion of this thesis.

I would like to express my heartfelt gratitude to my family for their unwavering support throughout the period of writing this thesis. Their encouragement, and understanding have been my pillars of strength. Their sacrifices and belief in my abilities have been the driving force behind the completion of this thesis.

I am immensely thankful to my friends for their constant motivation which has been a valuable source of inspiration.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

AC	Absorptive Capacity
ANOVA	Analysis of Variance
BOD	Board of Directors
CVI	Content Validity Index
EBIT	Earnings Before Interest and Taxes
EMT	Ecological Modernization Theory
EPP	Environmentally Preferable Purchasing
EU	European Union
FBMF	Food Beverage and Manufacturing Firms
GDP	Gross Domestic Product
GSCM	Green Supply Chain Management
GWP	Green Warehouse Practices
ICT	Information Communication Technology
IT	Institutional Theory
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KAM	Kenya Association of Manufacturers
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KNBS	Kenya National Bureau of Statistics
MDG	Millennium Development Goals
NEMA	National Environmental Management Authority
NRBV	Natural Resource Based View
NRBV	Natural Resource Based View
PCAP	Potential Application of Absorptive Capacity
RBV	Resource Based View
RDT	Resource Dependence Theory
ROA	Return on Assets
ROHS	Restriction of Hazardous Substance
ROS	Return on Sales
SCM	Supply Chain Management

SCRM	Supply Chain Relationship management
TCA	Transaction Cost Analysis
TSA	Transaction Specific Assets
USA	United States of America

DEFINITION OF OPERATIONAL TERMS

Absorptive Capacity	The firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends (Mata *et al.*, 2023).
Firm Performance	The ability of a business to efficiently utilize the accessible resources to achieve targets in line with the set plans of the company, keeping in mind their relevance to the users (Boiko, 2022).
Green Distribution	The use of low pollution vehicles that minimize environmental harm during the process of dispensing goods so as to limit the release of air pollutants in the communities (Ricardianto, *et al.*, 2022).
Green Logistics	The environmentally friendly logistics that aims to minimize the damage caused by logistics processes to the environment (Adıgüzel, 2024).
Green Packaging	The use of materials to wrap, pack and ship products that are reusable, biodegradable and recyclable in manufacturing techniques to diminish energy use and reduce the harmful impacts of packaging on the environment (Chang, 2023).

Green Warehousing	The organizational solutions designed for the efficiency of warehouse processes by maintaining the highest social standards and minimizing the effect on nature in terms of financial efficiency (Modica *et al.,* 2021).
Reverse Logistics	The process where previously shipped products are accepted by the manufacturer from the consumption point likely for re-manufacturing and re-processing (Kamanga, 2024).

ABSTRACT

Despite contributing significantly to the economy of the country, the food and beverage manufacturing firms face challenges in optimizing performance. The purpose of this study was to examine the influence of green logistics practices on the performance of food and beverage manufacturing firms in Kenya. Specifically, the study examined the influence of reverse logistics, green warehousing, green packaging and green distribution on the performance of food and beverage manufacturing firms in Kenya. The study examined the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. Theoretical framework was guided by the complexity theory, ecological modernization theory, resource dependence theory and natural resource-based view theory. The research utilized the positivism research philosophy. A correlational cross-sectional survey research design was employed to test non-causal relationships among study variables without controlling any of the variables. The proportionate stratified random sampling technique was used to select a sample size of 141 food and beverage manufacturing firms from a target population of 217 food and beverage manufacturing firms in Kenya. A pilot study was conducted to determine the validity and reliability of the constructed survey questionnaire. A cross-sectional survey approach was used for the collection of primary data. Data processing was conducted prior to the data analysis. Data analysis utilized the descriptive and inferential statistics. The correlation results indicated that reverse logistics, green warehousing, green packaging and green distribution had positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that reverse logistics, green warehousing, green packaging and green distribution had positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that absorptive capacity had a positive and significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The study recommends that managers and practitioners should consider a holistic reassessment and implementation of the green logistics to foster the performance of the food and beverage manufacturing firms. The policymakers should consider initiating a review of the existing policies to motivate the managers and practitioners to consider a holistic reassessment and implementation of the green logistics to foster the performance of the food and beverage manufacturing firms. Future research should examine the influence of green logistics on firm performance with absorptive capacity as a moderator in other sectors or contexts.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The food and beverage sub-sector contribute significantly to the economy of the country. However, the food and beverage sub-sector faces challenges in optimizing performance (Widjaja, 2024). Previous studies have shown that the sub-sector has a high industrial concentration and price-cost margin (Sulistyowati, 2024). At the macro level, strong economic growth increases people's purchasing power, encouraging consumption of food and beverage products, while high inflation can increase raw material production and distribution costs, which, if not managed well, can reduce the company's profit margin (Rizki, Syahputra, Masri, & Rinaldi, 2024). The manufacturing sector's contribution to the GDP has been consistently falling across the last few years (Sinha, Mishra, Manogna, & Prabhudesai, 2023; Thuita, Miriti, & Mwirigi, 2023).

The food and beverage subsector serves as a cornerstone of the global economy, supporting millions of jobs and generating substantial revenue annually (Corigliano & Algieri, 2024). However, changes in gross domestic product (GDP) or other macroeconomic indicators, such as employment, investment, and demand can affect market structure and industry performance through different phases of business cycle, including growth, expansion, or recession (Hurriyah, Indiastuti, Septiani, & Kharisma, 2024). While the food and beverage players must concentrate on their business performance, the post-pandemic economic challenges are particularly severe for small and medium-sized businesses, even with the numerous government initiatives that have been put into place over the last two years (Dewi, Muhaimin, Setiawan, & Maulidah, 2024). Despite being a vital contributor to Kenya's economy, the food and beverage subsector faces challenges in optimizing performance. The food and beverage manufacturing subsector has been experiencing performance challenges (Adhiambo & Osoro, 2024; Thuita *et al.*, 2023). The food and beverage subsector has

been experiencing a lot of turbulence in the recent past including a drop in the GDP, an increasing imbalance of trade, and the exiting of large multinationals (Mbugua, Ngugi, Thogori, & Mwangi, 2024). The food and beverage manufacturing subsector has been experiencing fluctuations in profitability (Abade, Noor, Namusonge, & Wachiuri, 2024; Nzomo & Wachiuri, 2023). In Kenya, the food and beverage manufacturing subsector recorded a significant drop in growth from 4.7% to 1.6% and 2.7% to 0.2%, respectively (Ngenoh & Noor, 2024). The manufacturing sector's contribution to the GDP has been consistently falling across the last few years, giving rise to fears of a premature deindustrialization phenomenon (Datche, Kising'u, & Kalimbo, 2023; Mungai & Ndiritu, 2023).

Green logistics has emerged as a critical approach to minimize the environmental impact of transportation, reverse logistics, packaging, warehousing, and distribution systems while maintaining operational efficiency (Nagy & Szentesi, 2024). The concept of green logistics has gained prominence due to the growing awareness of environmental issues and the need for businesses to adopt sustainable practices (Kamewor, Kwateng, & Mensah, 2024). Green logistics is the execution of logistics activities in an environmentally friendly manner, taking into account the green agreement (Adıgüzel, 2024). Green logistics, also known as sustainable or environmental logistics, is a concept that focuses on integrating environmentally responsible practices into the supply chain and production management processes (Musau, 2024). Green logistics optimizes supply chains to reduce environmental impact through reverse logistics, green warehousing, green packaging and green distribution, reducing carbon footprints while balancing ecological responsibility with economic efficiency (Arroyo, Barreto, Vasquez, & Nicola, 2023).

The value chains in the food and beverage sub sector are crucial for food systems transformation and economic development (Paul Jr, Nana, Zimmermann, & Jafari, 2024). However, it accounts for about 30% of the global energy consumption and emissions (Corigliano & Algieri, 2024). The growing focus on sustainable practices has brought attention to the importance of green logistics which plays a crucial role in promoting awareness of environmental issues and encouraging stakeholders to

consider the impact of their actions (Zhou, Siddik, Zheng, & Masukujjaman, 2023). Therefore, green logistics aims to reduce the emission of greenhouse gases, the use of fossil energy sources and the return of materials after their end-of-life (De Souza, Kerber, Bouzon, & Rodriguez, 2022).

The primary goal of green logistics is to minimize the environmental impact of logistics activities, including transportation, warehousing, and distribution, while optimizing efficiency and reducing resource consumption (Musau, 2024). In the context of environmentally responsible supply chain and production management, green logistics plays a crucial role in addressing environmental challenges and meeting sustainability goals (Jayarathna, Agdas, & Dawes, 2024). Green logistics, on one hand, optimizes transportation, storage, and distribution processes, leading to decreased energy resource (Ju, Liu, Xu, & Zhang, 2023).

The concept of green logistics practices has gained prominent attention in research, because of its numerous benefits including sustainable transportation, distribution, monitoring etc. (Sharma, Luthra, Joshi, Kumar, & Jain, 2023). Nevertheless, a dearth of literature exists on how the green logistics affects a firm's sustainability performance (Kamewor *et al.*, 2024; Nikseresht, Golmohammadi, & Zandieh, 2024; Zhou *et al.*, 2023). Previous research on green logistics focusing on packaging issues is scarce despite its importance and impact on the environment (De Souza*et al.*, 2022). A lack of theoretical foundation has been cited as a potential reason for the contradictory findings (Verma, 2024).

Despite increasing scholarly attention to this concept, there remains considerable ambiguity surrounding its antecedents, practices, and performance outcomes (Kamewor *et al.*, 2024). While some research has found a negligible correlation, others have revealed a significant relationship between green logistics and sustainable development (Verma, 2024) firm performance (Sharma *et al.*, 2023). In spite of the wide use of quantitative assessment to identify the relationship between green logistics practices and the sustainability performance of firms, results of these studies are inconsistent (Jayarathna *et al.*, 2024). The extant literature presents conflicting and incomplete frameworks for investigating these dynamics and their resultant effects,

often leading to fragmented perspectives, conceptual confusion, and paradoxical understandings (Zhou *et al.*, 2023). This study aims to address critical gaps in existing logistics and supply chain management literature, offering insights into the influence of green logistics practices on firm performance of food and beverage manufacturing companies in the Kenyan context.

1.1.1 Global Perspective of Green Logistics Practices and Firm Performance

Verma (2024) examined the effect of green logistics practices on the sustainability performance of manufacturing enterprises in Oman. The findings indicated that green logistics management had positive and significant effect on sustainability performance of manufacturing enterprises. The results indicated that supply chain trackability does not significantly moderate the relationship between green logistics and sustainability performance of manufacturing enterprises.

Visamitanan and Assarut (2021) examined the impact of green supply chain management practices on employee engagement and organizational commitment with mediating role of firm performance in Thailand. The findings indicated that green marketing, environmental education, green warehousing and green distribution had positive and significant effect on employee engagement and organizational commitment, while green manufacturing had a negative effect on firm performance. The results showed that social and operating performance mediated the relationship between green marketing, environmental education, green warehousing and employee engagement and organizational commitment.

Kuwornu, Khaipetch, Gunawan, Bannor, and Ho (2023) examined the effect of adopting sustainable supply chain management practices on performance and quality assurance of food companies in Bangkok, Thailand. The findings indicated that sustainable supply chain management practices had positive and significant effect on performance and quality assurance of food companies. The results indicated that sustainable supply chain management practices had positive and significant effect on performance and quality assurance of food companies.

Xu *et al.* (2022) examined the impact of green supply chain management on operational performance of manufacturing firms in China. The findings indicated that a company's quality and environmental responsibility significantly impacts its green supply chain management practices, which further improve its operational performance in quality, cost, flexibility, and delivery. The results indicated that supplier and customer relational capital strengthens the influence of environmental responsibility on green supply chain management. The findings indicated that while supplier relational capital reinforces the impact of green supplier management on flexibility and delivery performance, customer relational capital only strengthens the influence of green customer management on flexibility performance.

Nureen *et al.* (2023) examined the influence of green supply chain management on firm performance in the manufacturing sector in China. The findings showed that green supply chain management positively influences firm performance. The results also showed that green training mediates the relationship between green supply chain management and firm performance. The findings further showed that green organizational culture positively moderates the relationship between green training and firm performance.

Le (2023) conducted research on the moderating role of circular economy thinking in the relationship between big data-driven supply chain management, sustainable supply chain management and corporate performance in Vietnam. The results indicated that big data-driven supply chain management positively, directly and indirectly, impacted sustainable corporate performance. The findings showed that sustainable supply chain management partially mediated the correlation between big data sustainable supply chain management and sustainable corporate performance. Additionally, the findings indicated that circular economy thinking application moderated the relationship between big data-driven supply chain management and sustainable supply chain management. The results indicated that circular economy thinking application had a direct and positive effect on sustainable supply chain management.

Jayarathna *et al.* (2024) examined the perceived relationship between green logistics practices and sustainability performance in Australia. The findings showed that there existed nonlinear relationship between green logistics practices and sustainability performance. The study revealed that despite the wide use of quantitative assessment to identify the relationship between green logistics practices and the sustainability performance of firms, results of these studies are inconsistent.

1.1.2 Regional Perspective of Green Logistics Practices and Firm Performance

Mungazu (2023) examined the influence of green supply chain management practices on performance of manufacturing firms in Northern Uganda. The results indicated that reverse logistics, green procurement and green packaging practices had positive and significant relationship with the performance of manufacturing firms. The findings indicated that reverse logistics, green procurement and green packaging practices had positive and significant effect the performance of manufacturing firms.

Asamoah *et al.* (2024) examined the relationship between green supply chain management practices and firm performance in manufacturing firms in Ghana. The results indicated that green purchasing, customer cooperation and investment recovery had a direct positive and significant effect on firm performance. The findings showed that the paths from green purchasing and customer cooperation to firm performance were positively mediated by green absorptive capacity.

Owusu and Odartey (2021) examined the influence of green supply chain management on firm performance in the Ghana's food production and processing industry. The results indicated that green supply chain management practices had positive and significant relationship with firm performance. The findings indicated that green supply chain management practices had positive and significant effect firm performance.

Akpevwe and Kaine (2023) examined the effect of green supply chain management on marketing performance of Unilever Nigeria PLC. The results indicated that reverse logistics, product eco-design and green purchasing practices had positive and

significant relationship with marketing performance. The findings indicated that reverse logistics, product eco-design and green purchasing practices had positive and significant effect marketing performance.

Aziz (2023) examined the impact of green supply chain management practices on organizational performance of manufacturing firms in Ghana. The results indicated that green design, green production, green procurement and green logistics had positive and significant relationship with the performance of manufacturing firms. The findings indicated that green design, green production, green procurement and green logistics had positive and significant effect the performance of manufacturing firms.

1.1.3 Kenyan Perspective of Green Logistics Practices and Firm Performance

Gikonyo (2023) examined the influence of green logistics on performance of building and construction manufacturing firms in Kenya. The findings indicated that green packaging, logistics innovation and green distribution had positive and significant relationship with the performance of building and construction manufacturing firms. The results indicated that green packaging, logistics innovation and green distribution had positive and significant influence on the performance of building and construction manufacturing firms.

Kamanga (2024) examined the influence of sustainable supply chain management practices on the performance of horticultural firms in Kenya. The results indicated that reverse logistics, green packaging, green purchasing and green distribution had a positive and significant relationship with the performance of horticultural firms. The findings indicated that reverse logistics, green packaging, green purchasing and green distribution had positive and significant influence on the performance of horticultural firms. The results showed that value addition had significant moderating influence on the relationship between reverse logistics, green packaging, green purchasing and green distribution and the performance of horticultural firms.Kenei and Wachiuri (2024) examined the influence of green supply chain practices on the performance of the food and beverage firms in Nairobi City County, Kenya. The findings indicated that reverse logistics and green purchasing had positive and significant relationship

with the performance of the food and beverage firms. The results indicated that reverse logistics and green purchasing had positive and significant influence on the performance of the food and beverage firms.

Panya, Ochiri, Achuora, and Gakure (2021) examined the effect of sustainable supply chain management on the performance of sugar sub-sector in Kenya. The results indicated that green manufacturing and green procurement had a positive and significant relationship with the performance of sugar sub-sector. The findings indicated that green manufacturing and green procurement had a positive and significant influence on the performance of sugar sub-sector.

Bor (2021) examined the effect of green supply chain management practices and performance of food and beverage processing sector in Kenya. The results indicated that reverse logistics, green procurement, green manufacturing and green packaging had a positive and significant relationship with the performance of food and beverage processing firms. The findings indicated that reverse logistics, green procurement, green manufacturing and green packaging had a positive and significant effect the performance of food and beverage processing firms. The results showed that legislations had a significant moderating effect on the relationship between green supply chain management practices and the performance of food and beverage processing firms.

Auko (2023) examined the influence of green supply chain management practices on organizational competitiveness of commercial state corporations in Kenya. The results indicated that green packaging and green distribution had positive and significant relationship with the organizational competitiveness of commercial state corporations. The findings indicated that green packaging and green distribution had a positive and significant effect the organizational competitiveness of commercial state corporations.

Ngatia, Osoro, and Nyang'au (2024) examined the influence of green supply chain management and performance of food and beverages manufacturing firms in Kenya. The results indicated that green supply chain management had a positive and significant relationship with the performance of food and beverages manufacturing

firms. The findings indicated that green supply chain management had a positive and significant effect the performance of food and beverages manufacturing firms.

Thiro, Kiumbe, and Kagure (2023) examined the relationship between green supply chain practices and sustainability of tea factories in Nyeri County, Kenya. The results indicated that reverse logistics and green procurement practices had a positive and significant relationship with the sustainability of tea factories. The findings indicated that reverse logistics and green procurement practices had a positive and significant effect the sustainability of tea factories.

Dido, and Shale (2023) examined the influence of green supply chain management practices and performance of state corporations in the energy sector in Kenya. The results indicated that green material sourcing and green marketing practices had a positive and significant relationship with the performance of state corporations in the energy sector. The findings indicated that green material sourcing and green marketing practices had a positive and significant effect the performance of state corporations in the energy sector.

1.1.4 The Context of Food and Beverage Manufacturing Firms in Kenya

The food and beverage manufacturing sub sector encompasses seven distinct sub-sectors. The sub sectors include the dairy products, bakers and millers, alcoholic beverages and spirits, cocoa, chocolate and sugar confectionery, juices/water/carbonated soft drinks, meat slaughter, preparation and preservation, as well as tobacco and edible oils (Mogaka, 2023). The food and beverage manufacturing sub sector is one of the instrumental contributors to the country's economic growth and development (Mohamed & Nderui, 2024). In Kenya, the food processing industry remains the largest component of the food and beverage manufacturing sub sector in terms of structure, its economic contributions and the increased performance within the manufacturing sector (Bor, 2021; Jepchumba, 2024; Osman, 2023).The food and beverage manufacturing sub sector has a great potential for promoting economic growth and competitiveness in Kenya. However, the food and beverage manufacturing sub sector has been experiencing performance challenges (Adhiambo & Osoro, 2024).

Despite the importance of the food and beverage manufacturing sub sector, it has been experiencing a lot of turbulence in the recent past including a drop in the GDP, an increasing imbalance of trade, and the exiting of large multinationals (Mbugua *et al.*, 2024).

1.2 Statement of the Problem

The manufacturing industry plays a pivotal role in global economic development, yet its operations often come at a significant environmental cost, primarily due to carbon emissions (Shamsul Bahrin, Mokhtar, Muhamed, & Kaliani Sundram, 2024). With increasing awareness of climate change and its detrimental effects, there's a growing urgency for industries to adopt sustainable practices, particularly in their supply chains (Cheng, Masukujjaman, Sobhani, Hamayun, & Alam, 2023). However, in spite of the wide use of quantitative assessment to identify the relationship between green logistics practices and the sustainability performance of firms, results of these studies are inconsistent (Jayarathna *et al.*, 2024). While some research revealed that green logistics practices negatively influence business performance (Agyabeng-Mensah *et al.*, 2021), others found a significant relationship between green logistics and firm performance (Gikonyo, 2023; Jayarathna *et al.*, 2024), creating a need for clearer theoretical foundations.

Despite being a vital contributor to Kenya's economy, the food and beverage sub-sector faces challenges in optimizing performance. The food and beverage manufacturing sub sector has been experiencing performance challenges (Adhiambo & Osoro, 2024) and fluctuations in profitability (Abade *et al.*, 2024; Nzomo & Wachiuri, 2023). In Kenya, the food and beverage manufacturing sub sector recorded a significant drop in growth from 4.7% to 1.6% and 2.7% to 0.2%, respectively (Ngenoh & Noor, 2024). The food and beverage subsector has been experiencing a lot of turbulence in the recent past including a drop in the GDP, an increasing imbalance of trade, and the exiting of large multinationals (Mbugua *et al.*, 2024). Its contribution to the GDP has been consistently falling across the last few years, giving rise to fears of a premature deindustrialization phenomenon (Datche *et al.*, 2023; Mungai & Ndiritu, 2023).

A lack of theoretical foundation has been cited as a potential reason for the contradictory findings (Verma, 2024). The extant literature presents conflicting and incomplete frameworks for investigating these dynamics and their resultant effects, often leading to fragmented perspectives, conceptual confusion, and paradoxical understandings (Kamewor *et al.*, 2024; Zhou *et al.*, 2023). While prior studies have addressed the influence of overall green supply chain management practices on firm performance (Kamanga, 2024; Kenei & Wachiuri, 2024; Ngatia *et al.*, 2024), limited empirical work has isolated how specific green logistics practices such as green packaging, green transportation, and reverse logistics influence firm performance (Kamewor *et al.*, 2024) in the food and beverage context.

The role of absorptive capacity as a moderating variable on the relationship between green logistics practices and firm performance remains underexplored (Asamoah, Acquah, Nuertey, Agyei-Owusu, & Kumi, 2024). There is a need to ground the influence of green logistics practices on performance of food and beverage manufacturing firms using established frameworks, such as the natural resource-based theory, stakeholder theory (Benjamin, Shee, & de Vass, 2023; Tembo-Mwanaumo, Mutono-Mwanza, & Siaminwe, 2023), and contingency theory, resolving the existing inconsistencies in the literature. A specific knowledge gap remains regarding how absorptive capacity moderates the relationship between green logistics practices and performance of food and beverage manufacturing firms in the Kenyan context. The general business problem is that limited empirical clarity exists on how green logistics practices such as green packaging, green transportation, and reverse logistics influence performance of food and beverage manufacturing firms in Kenya. The specific business problem is that some supply chain managers need deeper, actionable knowledge on how specific green logistics practices influence the performance of food and beverage manufacturing firms in Kenya. Therefore, the study sought to bridge this gap by investigating the influence of specific green logistics practices on performance of food and beverage manufacturing firms, and the moderating influence of absorptive capacity, especially in the Kenyan context.

1.3 Research Objectives

The study was guided by a general objective and five research objectives.

1.3.1 General Objective

The general objective of the study was to examine the influence of green logistics practices on performance of food and beverage manufacturing firms in Kenya.

1.3.2 Specific Objectives

1. To determine the influence of reverse logistics on performance of food and beverage manufacturing firms in Kenya.
2. To analyze the influence of green warehousing on performance of food and beverage manufacturing firms in Kenya.
3. To establish the influence of green packaging on performance of food and beverage manufacturing firms in Kenya.
4. To examine the influence of green distribution on performance of food and beverage manufacturing firms in Kenya.
5. To assess the moderating influence of absorptive capacity on the relationship between green logistics practices and performance of food and beverage manufacturing firms in Kenya.

1.4 Research Hypotheses

The study tested 5 null hypotheses.

$H_0$1: Reverse logistics has no significant influence on performance of food and beverage manufacturing firms in Kenya.

$H_0$2: Green warehousing has no significant influence on performance of food and beverage manufacturing firms in Kenya.

$H_0$3: Green packaging has no significant influence on performance of food and beverage manufacturing firms in Kenya.

$H_0$4: Green distribution has no significant influence on performance of food and beverage manufacturing firms in Kenya.

$H_0$5: Absorptive capacity has no significant moderating influence on the relationship between green logistics practices and performance of food and beverage manufacturing firms in Kenya.

1.5 Significance of the Study

The study is of significance to managers and practitioners, government and policy makers, scholars, academicians and future researchers.

1.5.1 Managers and Practitioners

The research provides managers and practitioners with crucial insights regarding the influence of green logistics practices on performance of food and beverage manufacturing firms in Kenya. The findings will help managers in identifying various green logistics practices which improve the performance of food and beverage manufacturing firms. They can also ascertain the weak and strong green logistics practices and how they can be practiced to increase performance. The findings would help management to greatly improve on supply chain management where suggested policy initiatives would address the strategic direction in the supply chain of food and beverage manufacturing firms and other organizations in Kenya.

1.5.2 Government and other Stakeholders

The study benefits employees in government institutions since they were able to use effective green logistics practices mentioned in this study in their day-to-day procurement activities. The research would be useful to supply chain management Boards of Directors (BODs), Kenya Association of Manufacturers, shareholders and other stakeholders. The BODs are the policy makers who put in place policies that are geared towards ensuring that shareholders get value for their money that is invested while the other stakeholders would be interested in the results of their investments and efficient service delivery.

1.5.3 Policy Makers

The research provides policy makers with crucial insights regarding the influence of green logistics practices on performance of food and beverage manufacturing firms. The findings can be used by the policy makers to formulate viable policy documents that boost firm performance and environmental compliance within the food and beverage manufacturing subsector. Policy makers within the food and beverage manufacturing subsector can use the study findings to diversify their knowledge on green logistics practices, hence making effective policies on logistics capabilities in public institutions.

1.5.4 Scholars, Academicians and Future Researchers

The study is significant to scholars, academicians and future researchers. The research provides scholars, academicians and future researchers with crucial insights that help refine or challenge established theories. The study contributes new knowledge, bridges gaps in existing literature, and provides a foundation for future exploration. The findings, methodology, and limitations of the study offer clear directions for future inquiry.

1.6 Scope of the Study

The scope of the study was delimited on the influence of green logistics practices on firm performance with absorptive capacity as a moderator in food and beverage manufacturing firms in Kenya. The scope of the study was delimited on only four green logistics practices, namely reverse logistics, green warehousing, green packaging and green distribution. The scope of the study was delimited on the food and beverage manufacturing firms in Kenya. The target population of the study was 217 food and beverage manufacturing firms in Kenya, as per the Kenya Association of Manufacturers (KAM, 2023) as at 31st December, 2023. The study focused on food and beverage manufacturing firms because there has been an increase in production and consumption of goods using non-replenishable resources and environmentally detrimental manufacturing practices over the past few years. This has increased the

scale of negative human impact on earth. The food and beverage manufacturing sub sector provides mankind with goods to fulfill his needs, but at the same time generates serious problems of resource depletion and environmental degradation.

1.7 Limitations of the Study

The study has some limitations that should be considered in future research. First, as the study utilized a cross-sectional survey approach for data collection, it was impossible to examine the influence of green logistics practices on firm performance over a period in other contexts. Therefore, future researchers should consider utilizing a longitudinal survey approach for data collection in order to examine the influence of green logistics practices on firm performance over a period to time to detect trends and changes. Second, as the study employed a correlation research design, no inferences about the causality of relationships could be made. Therefore, future researchers should consider employing quasi-experimental design to make causal inferences.

Third, the study focused on the influence of green logistics practices on firm performance and the moderating influence of absorptive capacity in that relationship in the context of the food and beverage manufacturing firms in Kenya. Therefore, caution should be taken when attempting to generalize the results beyond the food and beverage manufacturing firms in Kenya. Therefore, future researchers should consider examining the influence of green logistics practices on firm performance and the moderating influence of absorptive capacity in that relationship in other sub sectors, sectors or contexts. Fourth, as the study utilized a structured survey questionnaire for data collection, no inferences about the complex issues and opinions can be made. Therefore, future researchers should consider utilizing a semi-structured survey questionnaire to make inferences about the complex issues and opinions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review. It presents theoretical framework, conceptual framework, review of the literature on study variables, empirical review and the critique of the existing literature relevant to the study, research gaps and summary of the chapter.

2.2 Theoretical Framework

Theoretical framework describes the broader lens through which the researcher views the topic and guides their overall understanding and approach. A theoretical framework is the foundational structure of a research study, providing a lens made of existing theories, concepts, and definitions to guide the research, explain the problem, and interpret findings (Chakabwata & McKay, 2026). A theory is a set of principles and accounts created to a phenomenon or a group of facts particularly one that has recurrently been widely accepted, tested and can be used to make extrapolations about a natural phenomenon (van Trigt *et al.*, 2026). A theoretical framework is a foundational review of existing theories that serves as a roadmap for developing the arguments used in research study (Luft, Jeong, Idsardi, & Gardner, 2022). Theoretical framework was guided by the complexity theory, ecological modernization theory, resource dependence theory and natural resource-based view theory.

2.2.1 Complexity Theory

The complexity theory describes the workings of complex systems (Mason, 2024). From its origins in the natural sciences last century, complexity theory (von Beralanffy, 1950) has lately been recognized as beneficial for the social sciences (Hager & Beckett, 2024). The idea of organized complexity is core to complexity theory (Ortega, Pedreira, & Piattini, 2024). The complexity theory suggests that many familiar intricate or complicated systems are actually simple rather than complex

(Jalonen, 2024). The complexity theory proposes that as complexity increases, firms find it more difficult to plan and predict their organizational actions like in the case of green logistics implementation (Gružauskas & Burinskienė, 2022). Therefore, the complexity theory provides a relevant underpinning theoretical framework to explain the influence of green logistics practices on performance of food and beverage manufacturing firms in Kenya.

The complexity theory suggests that complex systems, from ecosystems to economies, feature many interconnected parts whose non-linear interactions create unpredictable, emergent patterns and behaviors not obvious from the parts alone (Ortega *et al*, 2024). Drawing substantially on the power of compounding (which is itself redolent of the claim made by complexity theory that relations and emergence are crucial concepts), complexity theory offers unique insights into how and why things change - and also into how and why things remain largely the same or inexorably grind towards failure (Mason, 2024). The crucial feature of complex systems, that underlies this vital difference from simple, or even complicated, systems, is that their complexity arises from the relations between entities, rather than from the entities themselves (Gibson & Ifenthaler, 2024; Uher, 2024). The complexity theory refers to a collection of concepts and heuristics that can be used to study the developments emerging from interactions between phenomena, actors, and events (Jalonen, 2024).

The complexity theory suggests that unlike simple or complicated systems, complex systems involve multiple non-linear relations between the entities within the system (Wu, 2024). The complexity theory proposes that it is interactions between these non-linear relations that can 'give rise to novel structures or qualities (Hager & Beckett, 2024). The complexity theory advocates that though constrained by the original relations of the system, these novel structures or qualities are not wholly predictable from them, nor are they reducible to them (Ortega *et al.*, 2024). The complexity theory posits that this phenomenon, known as emergence, is a defining feature of complex systems (Jalonen, 2024). The complexity theory is a framework explaining how complex systems change and adapt over time (Klocek, Premus, & Řiháček, 2024). The complexity theory suggests that the performance outcome of green logistics activities

cannot be accurately predicted without knowing the actual contributions by other involved parties in the system, due to the bounded rationality of individual parties (Yaftiyan, Amoozad Mahdiraji, Hosseinzadeh, & Vrontis, 2025). Therefore, the complexity theory provides a relevant underpinning theoretical framework to explain the influence of reverse logistics on performance of food and beverage manufacturing firms in Kenya.

2.2.2 Ecological Modernization Theory

The ecological modernization theory (Giddens, 1990; Mol, 1996; Spaargaren, 1997) suggests that economic growth and environmental protection are not contradictory, but can be achieved together through technological innovation, market forces, and institutional reform, allowing modern societies to "green" capitalism by integrating ecological concerns into production and consumption without radical systemic shifts (Viera-Romero, Selfa, Luzadis, & Diemont, 2026). The ecological modernization theory (Mol, 2010; Spaargaren, 2000) emerged in the 1990s as an alternative means of thinking about environmental reform that was centred around “de-growth” and “small is beautiful” environmental activism (Stroparo & Floriani, 2025). The ecological modernization theory posits a "win-win" scenario where environmental protection and economic growth can be reconciled through technological innovation and institutional reform, which directly applies to green warehousing practices (Dadsena, Rathore, Mathiyazhagan, Jayaraman, & Saha, 2026). Therefore, the ecological modernization theory provides a relevant theoretical framework to explain the influence of green warehousing on performance of food and beverage manufacturing firms in Kenya.

The ecological modernization theory suggests a dialogical approach where local communities actively participate in the development and implementation of new technologies instead of imposing standardized technological models (Sun & Zhang, 2026). The ecological modernization theory posits that environmental problems can be solved by harnessing capitalist dynamics, like competition, to drive eco-innovation and cleaner processes, moving beyond simple "end-of-pipe" solutions to fundamentally restructure economies for sustainability (Dadsena *et al.*, 2026). The ecological modernization theory suggests that corporate achievement of the industrial

development and protection of the environment can be attained through technological development, state planning, preventive innovation and coordination including innovations in management, technologies, products and processes (Viera-Romero *et al.*, 2026). The ecological modernization theory states that modern green technology and innovations, also called green warehousing, has increased environmental performance thus decreasing effects on environmental sustainability (Raßmann, 2026).

The ecological modernization theory argues that modern societies can address and resolve the environmental crisis by extending the principles of modernity, such as technological progress, economic growth, and instrumental rationality, rather than abandoning them (Stroparo & Floriani, 2025). The ecological modernization theory rejects the idea that environmental protection is a constraint on economic growth, positing instead that the two can be compatible and mutually reinforcing (Raßmann, 2026). The ecological modernization theory is a higher-level theory that needs to be incorporated with micro-level theories so as to explain more on green warehousing practices (Viera-Romero *et al.*, 2026). The ecological modernization theory moves beyond viewing environmental action as a mere cost or regulatory burden, instead framing green warehousing as an innovative strategy that actively contributes to the sustained success of food and beverage manufacturing firms (Dadsena *et al.*, 2026). Therefore, the ecological modernization theory provides a relevant theoretical framework to explain the influence of green warehousing on performance of food and beverage manufacturing firms in Kenya.

2.2.3 Resource Dependence Theory

The resource dependence theory suggests (Pfeffer, 1972; Pfeffer, 1987; Pfeffer & Salancik, 1974) is a cornerstone of organizational theory that focuses on how external resources affect the behavior and strategies of organizations (Coşkun & Öztürk, 2024). The resource dependence theory (Heide, 1994; Pfeffer & Nowak, 1976; Nienhüser, 2008; Pfeffer & Salancik, 1978) is premised on the concept that all organizations critically depend on other organizations for the provision of vital resources, and that this dependence is often reciprocal (Alkhuzaim, Kouhizadeh, & Sarkis, 2022). The

resource dependence theory suggests that no organization is entirely self-sufficient; all organizations require resources from the environment, and this dependency influences their behavior and decision-making processes (Alharasis, Alshdaifat, & Ab Aziz, 2026; Ozturk, 2021). The resource dependence theory (Ulrich & Barney, 1984) advocates that the control over critical and scarce resources gives power to the controlling entity over the organization that needs them (Xu & Ding, 2026). The resource dependence theory proposes that in the supply chain, member firms should be dependent and collaborate to seek higher performance gains in the long-run instead of pursuing short-term benefits at the expense of others (Yuan, Abidin, & Zulhumadi, 2026). Therefore, the resource dependence theory provides a relevant theoretical framework to explain the influence of green packaging on performance of food and beverage manufacturing firms in Kenya.

The resource dependence theory suggests that firms are dependent on resources provided by others in order to sustain growth, as well as other organizations that may be dependent on them (Alkhuzaim *et al.*, 2022). The resource dependence theory assumes that that firms cannot be fully self-sufficient with regards to strategically critical resources for survival (Coşkun & Öztürk, 2024). The resource dependence theory argues that firms need to depend on resources from outside parties to compete and carefully manage this dependency with other firms to strive for sustainable development (Xu & Ding, 2026). The resource dependence theory is based on the idea that to acquire resources, an organization must interact with other organizations and individuals in its environment (Ozturk, 2021; Yuan *et al.*, 2026). The resource dependence theory suggests that firms that have the ability in the supply chain can develop the course of distributing sustainable supply chain management practices in between supply chain members (Silva, Pereira, & Sehnem, 2025). The resource dependence theory proposes that firms need to control or access critical resources such as standards, procedures, enabling technologies, materials sources, and distribution channels, to implement green supply chain management practices and fully realize the potential gains (Zhou, Xu, Zhai, & Kong, 2026). Therefore, the resource dependence theory provides a relevant theoretical framework to explain the influence of green packaging on performance of food and beverage manufacturing firms in Kenya.

2.2.4 Natural Resource-Based Theory

The natural resource-based theory (NRBT) of the firm (Hart, 1995) is a prominent theory in academia, emerging with particular significance in sustainable operations literature (Engelke, Pearse, Correa, & Skae, 2024). The NRBT of the firm (Chicksand, Watson, Walker, Radnor & Johnston, 2012) extends the resource-based theory (Barney, 1991; Penrose, 1959) and focuses on integrating both internal and external natural resources to protect the firm against competition (Agyabeng-Mensah *et al.*, 2021). The NRBT (Sodhi, Son, & Tang, 2012) of the firm suggests that the adoption of the green logistics may serve as competitive advantage for a firm to advance its performance (AL-Shboul, 2024). Drawing from theoretical underpinnings of the natural-resource-based view theory, Asamoah *et al.* (2024) examined the relationship between green supply chain management practices and the performance of manufacturing firms in Ghana. Therefore, the NRBT of the firm provides a relevant theoretical framework to explain the influence of green distribution on performance of food and beverage manufacturing firms in Kenya.

The NRBT of the firm suggests that an organization's interaction with the environment is critical for developing capabilities that can lead to competitive advantage (Sarpong, Adu-Aboagye, & Oppong, 2024). Therefore, the NRBT of the firm provides a relevant theory to explain moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. Drawing from theoretical underpinnings of the natural-resource-based view theory, Asamoah *et al.* (2024) examined the role of green absorptive capacity in the relationship between green supply chain management practices and the performance of manufacturing firms in Ghana. The NRBT of the firm, a significant extension of the RBV, builds on the principle that a firm's competitiveness depends on its interactions with the natural environment and considers the ecological impact of firm resources derived from this resource base (Roy & Mohanty, 2024). The NRBT of the firm (Marshall, McCarthy, Heavey & McGrath, 2015) is grounded on three inter-related environmental strategies, which comprises, pollution prevention, product stewardship and sustainable development (Manzoor &

Jahangir, 2024). The NRBT of the firm suggests that the pollution prevention strategy focuses on reducing environmental degradation and damage through the reduction of emissions and waste (Engelke *et al.*, 2024).

The NRBT of the firm proposes that through reduced emission and waste, pollution prevention strategy reduces cost of raw materials and disposal, saves compliance liability cost, and improves efficiency and productivity leading to high cash inflow and profitability (Agyabeng-Mensah *et al.*, 2021; Ramanathan, Ramanathan, Pelc, & Hermens, 2024). The NRBT of the firm (Allenby, 1991) advocates that the product stewardship strategy focuses on integrating the voice of the external stakeholders into the development of products and processes (Ramanathan *et al.*, 2024). The NRBT of the firm suggests that the product stewardship strategy helps firms to reduce the life cycle cost of their products through redesigning of existing product systems, exiting environmentally toxic business and developing new products (Engelke *et al.*, 2024).

The NRBT of the firm proposes that product stewardship strategy helps firms to create competitive advantage through access to preferred inputs and improved green product reputation (Manzoor & Jahangir, 2024). The NRBT of the firm recommends that the sustainable development strategy focuses on the minimization of the environmental burden of firms on the natural environment (Agyabeng-Mensah & Tang, 2021). The NRBT of the firm holds that the adoption of the green distribution may serve as competitive advantage for a firm to advance its performance (Ramanathan *et al.*, 2024; Sarpong *et al.*, 2024). Therefore, the NRBT of the firm provides a relevant theoretical framework to explain the influence of green distribution on performance of food and beverage manufacturing firms in Kenya.

2.2.5 Stakeholder Theory

The stakeholder theory (Freeman, 1984a; Freeman, 1984b; Freeman, 1984c) suggests that a company's sole responsibility is to make money for its shareholders (Valentinov & Roth, 2024). The stakeholder theory (Freeman & Phillips, 2002; Freeman, 2010) provides a relevant theoretical framework that explains the influence of green logistics practices on the performance of food and beverage manufacturing firms in Kenya. The

stakeholder theory provides a framework for understanding how organizations respond to pressures from various stakeholders and how these responses can have implications for their environmental sustainability practices, reputation, and financial performance (Sarpong *et al*, 2024). Using the stakeholder theory, Asante-Darko and Osei (2024) examined the connection between sustainable supply chain management and the performance of firms operating in different industries in Ghana. Therefore, the stakeholder theory provides a relevant theoretical framework to explain the moderating influence of absorptive capacity on the relationship between green logistics practices and performance of food and beverage manufacturing firms in Kenya.

The stakeholder theory suggests that organizational and regulatory stakeholder pressures play a crucial role in shaping green logistics practices and financial performance of organizations (Sarpong *et al*, 2024). The stakeholder theory provides a relevant theoretical framework that explains the influence of reverse logistics on the performance of food and beverage manufacturing firms in Kenya. Drawing on insights from stakeholder theory, Kalubanga and Mbekeka (2024) examined how reverse logistics practices relate with firm environmental performance in food and beverages manufacturing firms in Uganda. The stakeholder theory can be used to explain some interesting behavior of food businesses engaging in the reduction of food waste in their supply chains (Ramanathan *et al.*, 2024).

The stakeholder theory posits that organizations have a responsibility to consider the interests of all their stakeholders, including internal stakeholders and external stakeholders (Asante-Darko & Osei, 2024). A stakeholder is defined as an individual or group of people who have the power to influence or to be influenced by an organization's objectives achievement (Nthiwa *et al.*, 2024). The stakeholder theory suggests that organizations have a responsibility to consider the interests of all their internal stakeholders, including the employees and management as well as the external stakeholders including the customers, suppliers, regulators, and community members (Sarpong *et al*, 2024).

Stakeholder theory is widely known for promoting a relational view of business. The stakeholder theory suggests that many stakeholders are affected by externalities created by companies, and they also affect the firm internally and externally (Asante-Darko & Osei, 2024). The stakeholder theory proposes that the externalities tend to make stakeholders intensify the pressure put on companies for them to reduce the negative impacts and increase the positive effects (Valentinov & Roth, 2024). The stakeholder theory suggests that corporations have no real social responsibility, but it is up to the shareholders to be socially responsible, not the company itself (Kalubanga & Mbekeka, 2024). The stakeholder theory suggests that stakeholder pressures can influence organizational decision making and behaviour (Sarpong *et al*, 2024). Therefore, the stakeholder theory provides a relevant theoretical framework to explain the moderating influence of absorptive capacity on the relationship between green logistics practices and performance of food and beverage manufacturing firms in Kenya.

2.3 Conceptual Framework

The conceptual framework depicts that the performance of food and beverage manufacturing firms is conceptualized as the dependent variable. Reverse logistics, green warehousing, green packaging and green distribution are conceptualized as the independent variables. However, absorptive capacity is conceptualized as the moderating variable. Figure 2.1 presents the conceptual framework.

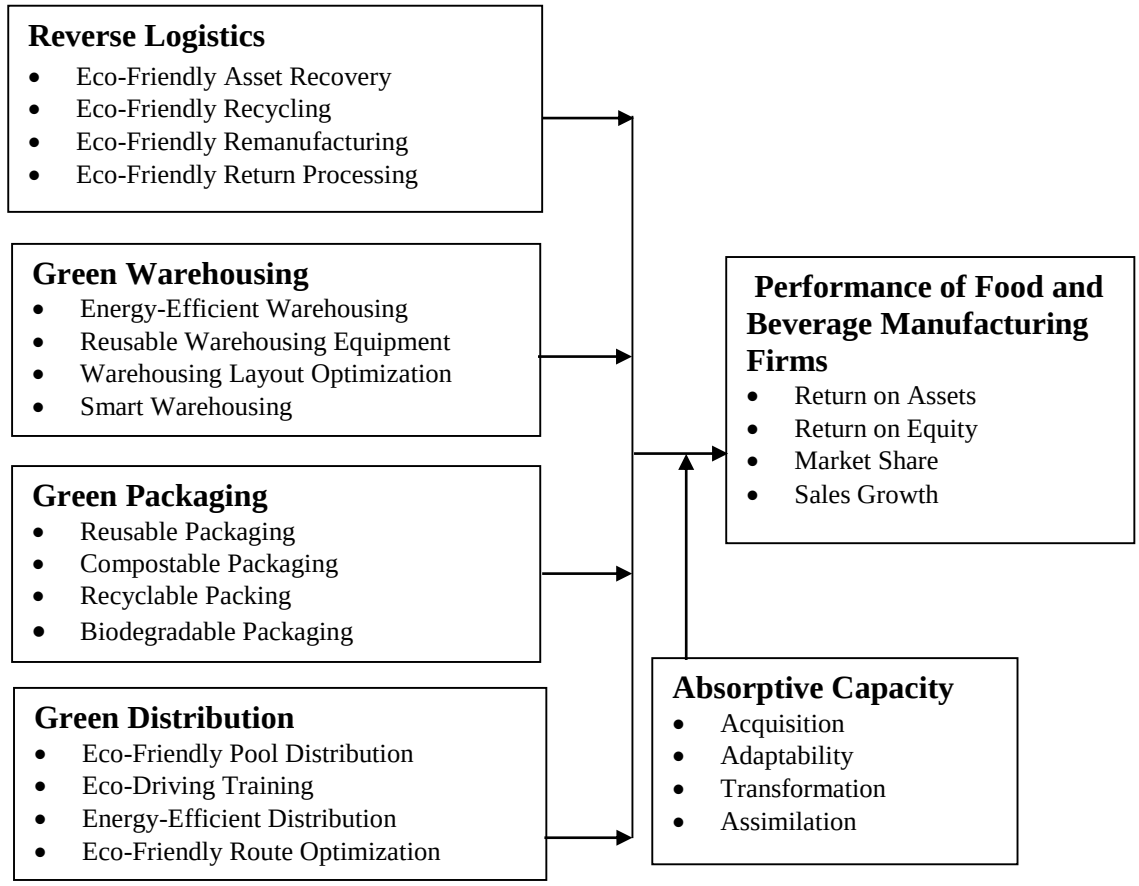

Figure 2.1: Conceptual Framework

2.4 Review of Literature on Study Variables

This section presents a review of the literature on the study variables.

2.4.1 Reverse Logistics

Reverse logistics is a logistics function concentrating on the backward flow of products from customers to suppliers. Reverse logistics is a process to recycle used, outdated or damaged products from customers to final treatment (Chen & Liao, 2022). In the context of the sustainable management of resources, a new trend in logistics has been observed, that of reverse logistics, for which there are synonymous terms such as environmentalism, logistics in the field of recycling, or waste logistics (Scriosteanu &

Criveanu, 2024). Reverse logistics is returning goods and materials to the manufacturer or supplier (Khan *et al.*, 2024). It represents a process of planning and implementing a flow of raw materials, stocks, and also finished products, with the aim of recovering their value and of their elimination through environmentally friendly methods (Erdal & İpçioğlu, 2024).

Without reverse logistics, a sustainable circular economy cannot be implemented. Reverse logistics promotes the creation of a system at the organization level with the help of which environmental problems can be mitigated with the help of procedures designed to ensure the sustainability of the actions undertaken (Valizadeh, Azizi, Hosseini, & Mahoor, 2024). It allows the realization of the idea of a circular economy by significantly reducing the entropy of the modern economy while increasing the recycling rate of the resources used (Khan *et al.*, 2024). Reverse logistics is the basis for closing the economic cycle and reducing gas emissions (Matthews, Moran, & Jaiswal, 2021). In recent years, there has been a significant increase in interest in the reverse logistics of plastic packaging in support of the various forms of recovery, reuse, regeneration, and recycling required by the principles of the circular economy (Scriosteanu & Criveanu, 2024).

The difference between reverse logistics and traditional forward logistics lies in the flow direction of goods. Whereas forward logistics are used to manage the forward movement of goods as they transition from raw materials to end-consumers, reverse logistics refer to moving products and materials back into the supply chain post-delivery (Scriosteanu & Criveanu, 2024). In traditional forward logistics, goods flow from manufacturers to intermediaries, and after the interaction of intermediaries at all levels, goods are delivered to the customers (Chen & Liao, 2022). On the contrary, reverse logistics refers to the process of returning goods from the point of consumption back to the starting point of production (Valizadeh *et al.*, 2024).

In recent years, reverse logistics has attracted increasing attention from both academics and practitioners. Reverse logistics has attracted the attention of a large number of scholars as it can improve the efficiency of recycling (Chen & Liao, 2022). Reverse logistics can help companies save money on disposal costs and create efficiencies in

the supply chain (Khan *et al.*, 2024). Due to its contribution to environmental protection and resource conservation, reverse logistics has gradually attracted the attention of academia and enterprises (Erdal & İpçioğlu, 2024). Reverse logistics has attracted increasing attention from both academics and practitioners, because of its great significance for building an environment-friendly and resource-saving society (Scrioșteanu & Criveanu, 2024).

2.4.2 Green Warehousing

Green warehousing refers to making updates that reduce the energy used, tap into sustainable energy sources and materials, and reduce the amounts of non-recyclable waste created during warehouse operations (Roy & Mohanty, 2024). It is a managerial concept integrating and implementing environmentally friendly operations with the objective of minimizing energy consumption, energy cost and greenhouse gas emissions of warehouses (Perotti & Colicchia, 2023; Sandra *et al.*, 2024). Green warehousing, or sustainable warehousing is an approach to maximizing the efficiency and effectiveness of warehouse operations in such a way that the firm's economic objectives can be reached, without a negative impact on the surrounding environment and society (Cannava, Perotti, & Petrillo, 2023). The term green warehousing is used to denote a managerial concept integrating and implementing environmentally friendly operations with the objective of minimizing energy consumption, energy cost and greenhouse gas emissions of a warehouse (Domagała, 2022).

The debate on managing green warehousing, low-carbon and sustainable warehousing has gained popularity. Managing energy consumption and carbon emission in the warehouse has become a critical success factor towards low-carbon practices (Ibrahim, Fernando, Tseng, & Lim, 2024). Low-carbon warehousing plays a special unique role in mitigating carbon emissions across the building and logistics sectors (Sandra *et al.*, 2024; Yasir & Ghobadi Samani, 2024). The comprehensive reduction of carbon emissions in industrial warehouses involves a broad spectrum of strategies, from the adoption of energy-efficient operations and the integration of renewable energy sources to thoughtful material selection and design innovations (Korra & Valaboju, 2024). The eco-friendly warehousing employs green procurement strategies that are

part of a complex strategy to reduce environmental impact throughout the supply chain (Ismail, Yamin, & Yaacob, 2022).

2.4.3 Green Packaging

Green packaging uses materials and manufacturing methods to lessen energy use and reduce the harmful effects of packaging on the environment (Piva, 2024). It is an eco-friendly alternative to traditional plastic packaging that reduces carbon footprint and promotes human and ecological longevity (Sunita, 2023). Green packaging reflects the concerns of the environment through monetary terms and this important and can be transferred to the customer (Vafaeva *et al.*, 2024). Green packing focuses on having goods packed into smaller units in order to reduce the amount of material and space used so as to save and utilize space in the warehouses and trailers (Ghosh, 2023). The green packing solutions regularly include biodegradable and recyclable materials in preference to materials like plastic and Styrofoam (Rao, Nair, More, Roy, More, & Anantharaju, 2021).

Green packaging should optimize the use of space both in storage and during transport. Additionally, it should be made of recyclable or reusable materials. In particular, the creation of sustainable packaging involves different areas of production, from design to recycling, and has the following features (Piva, 2024). The quality of most food products is highly dependent on the oxidation of the existent lipid fraction present in the food, which can be promoted depending on the ultraviolet light transmittance through the packaging material (Mostafa *et al.*, 2024). Edible films and coatings have gained wide interest in packaging of several food products such as fruits, vegetables, meats, and dairy products (Maan, Ahmed, Khan, Riaz, & Nazir, 2021). Thermal tolerance of food packaging materials is often required to enable them to withstand harsh processing conditions in the food industry (Wang, Chi, Lou, & Chen, 2023). Therefore, the optical properties of the packaging material such as the UV-visible light barrier property are as crucial as the physical, chemical, and thermal behaviors to validate the effectiveness of the packaging material in protecting food products from the degradative effects of light (Roy, Ramakrishnan, Goksen, Singh, & Łopusiewicz, 2023).

In a world grappling with pressing environmental challenges, the symbiotic relationship between eco-friendly product packaging and consumer perception emerges as a critical juncture where commerce and sustainability intersect (Chang, 2023; Sruthi, 2023). The eco-friendly packaging refers to packaging materials that are renewable, biodegradable, compostable, or recyclable (Moshood *et al.*, 2022). Environmentally conscious packaging is an important instrument for developing and conveying brand equity, gaining an edge in the marketplace, and shaping consumer buying behavior (Igbomor, 2024). Green packaging mainly focuses on utilizing eco-friendly and recyclable materials (Ghosh, 2023). Green packaging aims is to reduce energy consumption and mitigate negative impacts on the environment (Kannan, Parashar, & Chaurasia, 2024). As the green supply chain concept gains popularity, companies worldwide are embracing sustainable and environmentally friendly packaging practices (Sunita, 2023). However, previous green logistics research focusing on plastic packaging issues is scarce despite the impact it has on the environment (Scrioșteanu & Criveanu, 2024).

2.4.4 Green Distribution

Green distribution refers to logistics practices that minimize environmental harm (Panghal, Vern, & Mor, 2024). In green supply chain management, green distribution is a crucial activity that significantly affects green supply chain performance (Al Masri & Wimanda, 2024). The distribution of products is an essential aspect of green supply chain management (Amjad, Abbass, Hussain, Khan, & Sadiq, 2022). The green distribution practices range from changing the way distribution centers and vehicles are powered to implementing greater transparency regarding the environment and distribution practices (Dzwigol, Trushkina, & Kwilinski, 2021). The sustainable distribution practices are those that reduce carbon dioxide, are economically viable, and will bring about a better quality of life for the earth's future inhabitants (Cai, Yan, Tang, & Liu, 2024). The green distribution practices prioritize efficiency to prevent wasted energy. As environmental concerns increase, the integration of environmental issues into supply chain studies has become a thriving subfield (Amjad, Abbass, Hussain, Khan, & Sadiq, 2022).

Today, businesses are fortunate to have many options for achieving green distribution. Green distribution or sustainable distribution methods reduce carbon (IV) oxide (CO_2), a greenhouse gas causing global warming (Bharti *et al.*, 2024). The inequitable distribution of urban green spaces has attracted increasing attention given the important role of green environments for sustainable development (Panghal *et al.*, 2024). Committing to green distribution practices is key to keeping your organization top of mind for environmentally conscious consumers (Panghal *et al.*, 2024; Obiso, Maendo, Musau, & Waribu, 2023). The dynamic green distribution systems of interest are intended to support the decisions that must be made by the dispatcher, often under considerable time pressure (Gikonyo, 2023; Gikonyo, Ngugi, & Paul, 2022). Therefore, adopting green distribution methods can make a big difference, especially over a long period (Shabbir, Farwa, Khan, & Hafeez, 2024).

2.4.5 Absorptive Capacity

Absorptive capacity is the firm's ability to recognize, assimilate, and apply external knowledge. It refers to a firm's ability to identify, absorb, and utilize valuable external information for commercial purposes (Yüksel, 2025). Absorptive capacity is a firm's ability to recognize the value of new external knowledge, assimilate it, and apply it to commercial ends (Gallardo, Morales, & Argüelles, 2025). It is the cornerstone of corporate innovation and sustainable competitive advantage (Arndt, Aharonson, Jansen, Jiang, & Ting, 2023). In an era of rapid technological transformation and knowledge-intensive competition, innovation remains crucial for long-term organizational success (Zhang, Xu, Grebinevych, & Chen, 2025). Therefore, absorptive capacity is viewed as a dynamic capability embedded in a firm's routines and processes, in order to transform its resources into the capabilities that all the organization needs to face changing environments (Zavazhenko, 2025). However, absorptive capacity has been defined and studied from various perspectives (Ahmed, Ahsan, Alam, & Kokash, 2025).

Despite the rapid growth of literature on absorptive capacity, uncertainties remain regarding its fundamental dimensions and interaction with strategic management practices (Yüksel, 2025). While recognized as essential for innovation and adapting to

competitive environments, the absorptive capacity literature faces ambiguities in defining its theoretical domain, dimensions (potential vs. realized), and validation (Gallardo *et al.*, 2025). Existent literature suggests that four organizational capabilities of knowledge acquisition, assimilation, transformation, and exploitation build on each other to yield absorptive capacity (Henao-García, 2026). The four dimensions, often classified into potential absorptive capacity (acquisition, assimilation) and realized absorptive capacity (transformation, exploitation), build upon each other to create a cumulative learning process (Chang, Chen, & Tseng, 2025). However, empirical evidence on the relationship between each of the variables of absorptive capacity is limited (de Lima Figueiredo, Fernandes, & Abrantes, 2026).

Absorptive capacity is a dynamic, multidimensional capability consisting of four sequential, interrelated routines - acquisition, assimilation, transformation, and exploitation (Han & Zhao, 2025). Acquisition is the firm's capability to identify and acquire externally generated knowledge that is critical to its operations (Iqbal, Ullah, Rizwan, Nazeer, Rasheed, & Siddiqi, 2026). However, assimilation is the firm's routines and processes allowing it to analyze, process, interpret, and understand the information obtained from external sources (Chang, Chen, & Tseng, 2025). Transformation is the firm's capability to develop and refine the routines that facilitate combining existing knowledge with newly acquired and assimilated knowledge (Ni & Abdullah, 2025). In contrast, exploitation is the organizational capability based on the routines allowing firms to refine, extend, and leverage existing competencies or to create new ones by incorporating acquired and transformed knowledge into their operations (Abudetse & Sikalumbi, 2025).

2.4.6 Performance of Food and Beverage Manufacturing Firms

The performance of food and beverage manufacturing firms is a multidimensional concept with diverse definition and indicators of measurement. It is the actual output or results of an organization as measured against its intended outputs or goals and objectives (Chong, Abdul Rasid, Khalid, & Ramayah, 2024). It is the final achievement of a firm, which is measured either in financial and non-financial indicators (Álvarez-Torres, Schiuma, & López-Torres, 2024; Nzuma & Ndeto, 2023).

The performance of food and beverage manufacturing firms has a number of parameters, such as the existence of certain targets to be achieved, the period of time in achieving the targets and the realization of efficiency and effectiveness (Khasanah, 2024; Santoso, Ratnawati, & Sihab, 2024).

To measure the performance of food and beverage manufacturing firms, traditional measures such as financial statements have been valued as an important control tool (Krstić, Bonić, Rađenović, Jovanović Vujatović, & Ognjanović, 2023). In the traditional measures, the tangible resources are usually well detailed, since they meet the standards such as the accurate determination of historical costs and the flow of benefits to the company (Malko, 2024). Considering the constraints and weaknesses of the traditional performance measurement systems, studies have been turning their focus towards developing integrated methods that would capture the non-financial facets of performance (Santoso *et al.*, 2024).

Manufacturing firms are turning to performance measurement and management based on the international organization for standardization (ISO) certifications (Escoto, Gebrehewot, & Morris, 2022). However, measuring the impact of network variables on a firm performance is complex, especially in the context of small and medium-sized enterprises (Álvarez-Torres *et al.*, 2024). Performance monitoring and quality control are critical for growing the efficiency and quality of their processes and products to face the competitive market (Krstić *et al.*, 2023). The performance measurement matrices are critical parameters in the production plant (Contini & Peruzzini, 2022). The well-defined key performance indicators allow to find the performance gaps between the current and desired operations, which can monitor the progress toward closing the gaps in today's data-driven manufacturing industries (Tambare, Meshram, Lee, Ramteke, & Imoize, 2021). The firms that have implemented the balanced scorecard performance measurement system have shown much better results (Hegazy, Hegazy, & Eldeeb, 2022).

2.5 Empirical Review

This section presents the empirical review.

2.5.1 Reverse Logistics and Firm Performance

Kenei and Wachiuri (2024) examined the influence of reverse logistics on the performance of the food and beverage firms in Nairobi City County, Kenya. The findings indicated that reverse logistics had a positive and significant relationship with the performance of the food and beverage firms. The results indicated that reverse logistics had a positive and significant influence on the performance of the food and beverage firms.

Gikonyo (2023) examined the influence of reverse logistics on performance of building and construction manufacturing firms in Kenya. The findings indicated that reverse logistics had a positive and significant relationship with the performance of building and construction manufacturing firms. The results indicated that reverse logistics had a positive and significant influence on the performance of building and construction manufacturing firms.

Kamanga (2024) examined the influence of reverse logistics on the performance of large manufacturing firms in Kenya. The results indicated that reverse logistics had a positive and significant relationship with the performance of large manufacturing firms. The findings indicated that firm resources significantly moderated the relationship between reverse logistics practice and the performance of large manufacturing firms. The results showed that value addition had a significant moderating influence on the relationship between reverse logistics and the performance of horticultural firms.

Thiga, Chege, and Arani (2023) examined the influence of reverse logistics on the performance of food and beverage manufacturing firms in Kenya. The findings indicated that reverse logistics had a positive and significant relationship with the performance of the food and beverage firms. The results indicated that reverse logistics

had a positive and significant influence on the performance of the food and beverage firms.

Khan *et al.* (2024) examined the influence of reverse logistics practices on competitive advantage in manufacturing industries of Pakistan with organizational performance as a mediator. The results indicated that reverse logistics had a positive and significant influence on organizational performance. The findings indicated that reverse logistics had a positive and significant influence on competitive advantage. The results showed that organizational performance had a partial moderating influence on the relationship between reverse logistics and competitive advantage.

Nzuma and Ndeto (2023) examined the influence of reverse logistics on performance of food and beverage manufacturing firms in Nairobi City County, Kenya. The results indicated that reverse logistics had a positive and significant relationship with the performance of manufacturing firms. The findings indicated that reverse logistics had a positive and significant effect the performance of manufacturing firms.

Akpevwe and Kaine (2023) examined the effect of reverse logistics on marketing performance of Unilever Nigeria PLC. The results indicated that reverse logistics had a positive and significant relationship with marketing performance. The findings indicated that reverse logistics had a positive and significant effect marketing performance.

Mungazu (2023) examined the influence of reverse logistics on performance of manufacturing firms in northern Uganda. The results indicated that reverse logistics had a positive and significant relationship with the performance of manufacturing firms. The findings indicated that reverse logistics had a positive and significant effect the performance of manufacturing firms.

Bor (2021) examined the effect of reverse logistics and performance of food and beverage processing sector in Kenya. The results indicated that reverse logistics had a positive and significant relationship with the performance of food and beverage processing firms. The findings indicated that reverse logistics had a positive and

significant effect the performance of food and beverage processing firms. The results showed that legislations had a significant moderating effect on the relationship between reverse logistics and the performance of food and beverage processing firms.

Thiro *et al.* (2023) examined the relationship between reverse logistics and sustainability of tea factories in Nyeri County, Kenya. The results indicated that reverse logistics had a positive and significant relationship with the sustainability of tea factories. The findings indicated that reverse logistics had a positive and significant effect the sustainability of tea factories.

Kariuki (2023) examined the influence of reverse logistics practices on the performance of horticultural firms in Kenya. The results indicated that reverse logistics had a positive and significant relationship with the performance of horticultural firms in Kenya. The findings indicated that reverse logistics had a positive and significant influence on the performance of horticultural firms in Kenya.

Dabees, Lisec, Elbarky and Barakat (2024) examined the role of reverse logistics in sustaining competitive advantage and organizational performance in Egypt. The results indicated that reverse logistics had a positive and significant influence on organizational performance. The results indicated that reverse logistics activities (recycling, remanufacturing, repair, recondition and disposal) fully mediated the relationship between organizational performance (financial and nonfinancial) and sustainable competitive advantage. However, the results indicated that the remanufacturing and recycling mediating roles between financial performance and sustainable competitive advantage were not significant.

Nazir, Mehmood, Nazir and Zhaolei (2024) examined the influence of reverse logistics practices on the performance of manufacturing companies in Pakistani. The results indicated that reverse logistics had a positive and significant influence on firm performance. The findings indicated that reverse logistics improved and moderated the relationship between knowledge sharing, knowledge management, supply chain efficiency and integration and firm performance.

Despite the valuable insights provided by these recent studies on the positive relationship between reverse logistics and corporate outcomes, critical knowledge gaps remain unaddressed. Contextually, prior research has heavily concentrated on specialized sub-sectors like building and construction manufacturing (Gikonyo, 2023), heavy manufacturing (Kamanga,2024; Mungazu, 2023; Nazir *et al.*, 2024), or horticultural (Kariuki, 2023), leaving a contextual gap regarding how these dynamics manifest across other diverse operational environments. Methodologically, the reliance on basic linear regression frameworks fails to account for complex multi-tiered supply chain behaviors, creating a structural gap in evaluating indirect operational impacts. Conceptually, while firm resources and value addition have been examined as moderators (Kamanga, 2024), there is a distinct shortage of literature exploring modern digital configurations or strategic agility as intervening variables. The study sought to fill these combined empirical gaps by investigating the multi-dimensional pathways through which reverse logistics optimizes performance under varying strategic conditions.

2.5.2 Green Warehousing and Firm Performance

Visamitanan and Assarut (2021) examined the effect of green warehousing and green distribution on employee engagement and organizational commitment with mediating role of firm performance in Thailand. The findings indicated that green warehousing and green distribution had positive and significant effect on employee engagement and organizational commitment. The results showed that social and operating performance mediated the relationship between green warehousing and green distribution and employee engagement and organizational commitment.

Wahyuni *et al.* (2024) examined the effect of green warehousing on performance of manufacturing firms in Indonesia. The results indicated that green warehousing had a positive and significant relationship with the performance of manufacturing firms. The findings indicated that green warehousing had a positive and significant effect on the performance of manufacturing firms.

Alvarenga, Rodriguez, Peña-Montoya, Sartori, & Oliveira (2023) examined the effect of green warehousing on efficiency performance of logistics service providers in Brazil. The results indicated that green warehousing had a positive and significant relationship with the efficiency performance of logistics service providers. The findings indicated that green warehousing had a positive and significant effect on the efficiency performance of logistics service providers.

Despite the valuable insights provided by these recent studies on the positive relationship between green warehousing and firm performance, critical knowledge gaps remain unaddressed. Most current literature focuses heavily on specific emerging markets like Thailand (Visamitanan & Assarut, 2021), Indonesia (Wahyuni *et al.*, 2024), and Brazil (Alvarenga *et al.*, 2023), leaving a gap in understanding how green warehousing dynamics translate to highly industrialized or resource-constrained regions. Contextually, prior research has heavily concentrated on specialized sub-sectors like logistics (Alvarenga *et al.*, 2023) or heavy manufacturing (Wahyuni *et al.*, 2024), leaving a contextual gap regarding how these dynamics manifest across other diverse operational environments. This study sought to fill these combined empirical gaps by investigating the multi-dimensional pathways through which green warehousing optimizes firm performance under varying strategic conditions, especially in the Kenyan context.

2.5.3 Green Packaging and Firm Performance

Kariuki (2023) examined the influence of green packaging on the performance of horticultural firms in Kenya. The results indicated that green packaging had a positive and significant relationship with the performance of horticultural firms in Kenya. The findings indicated that green packaging had a positive and significant influence on the performance of horticultural firms in Kenya. The results showed that value addition had a significant moderating influence on the relationship between green packaging and the performance of horticultural firms in Kenya.

Gikonyo (2023) examined the influence of green packaging on performance of building and construction manufacturing firms in Kenya. The findings indicated that green packaging had a positive and significant relationship with the performance of building and construction manufacturing firms. The results indicated that green packaging had a positive and significant influence on the performance of building and construction manufacturing firms.

Mungazu (2023) examined the influence of green packaging on performance of manufacturing firms in northern Uganda. The results indicated that green packaging had a positive and significant relationship with the performance of manufacturing firms. The findings indicated that green packaging had a positive and significant effect the performance of manufacturing firms.

Mumbi, Karanja, and Kiarie (2021) examined the influence of green packaging on competitive advantage of horticultural firms in Kenya. The results indicated that green packaging had a positive and significant relationship with the competitive advantage of horticultural firms. The findings indicated that green packaging had a positive and significant influence on the competitive advantage of horticultural firms. The results showed that value addition had a significant moderating influence on the relationship between green packaging and the competitive advantage of horticultural firms.

Jepchumba, Ngugi, Shale and Odhiambo (2022) examined the effect of product packaging on firm performance in the food and beverage manufacturing firms in Kenya. The findings indicated that product packaging had a significant influence on the performance of food and beverage processing firms. The results showed that product packaging was critical in enhancing the performance of food and beverage processing firms in Kenya.

Kariuki, Ngugi, and Mburu (2022) examined the influence of green packaging on the performance of horticultural firms in Kenya. The results indicated that green packaging had a positive and significant relationship with the performance of horticultural firms. The findings indicated that green packaging had a positive and significant influence on the performance of horticultural firms.

Bor (2021) examined the effect of green packaging and performance of food and beverage processing sector in Kenya. The results indicated that reverse logistics green packaging had a positive and significant relationship with the performance of food and beverage processing firms. The findings indicated that green packaging had a positive and significant effect the performance of food and beverage processing firms. The results showed that legislations had a significant moderating effect on the relationship between green packaging and the performance of food and beverage processing firms.

Thiga, Chege, and Arani (2023) examined the influence of green packaging and performance of food and beverage manufacturing firms in Kenya. The results indicated that reverse logistics green packaging had a positive and significant relationship with the performance of food and beverage manufacturing firms. The findings indicated that green packaging had a positive and significant effect the performance of food and beverage manufacturing firms.

Gikonyo, Ngugi, and Paul (2022b) examined the influence of green packaging on performance of building and construction manufacturing firms in Kenya. The results indicated that green packaging had a positive and significant relationship with the performance of building and construction manufacturing firms. The findings indicated that green packaging had a positive and significant effect the performance of building and construction manufacturing firms.

Despite the valuable insights provided by these recent studies on the positive relationship between green packaging and firm performance, critical knowledge gaps remain unaddressed. Contextually, prior research has heavily concentrated on specialized sub-sectors like building and construction manufacturing (Gikonyo, 2023; Gikonyo *et al.*, 2022b), heavy manufacturing (Mungazu, 2023), or horticultural (Kariuki, 2023; Kariuki *et al.*, 2022), leaving a contextual gap regarding how these dynamics manifest across other diverse operational environments. The study sought to fill these empirical gaps by investigating the multi-dimensional pathways through which green packaging optimizes firm performance under varying strategic conditions, especially in the Kenyan context.

2.5.4 Green Distribution and Firm Performance

Kariuki (2023) examined the influence of green distribution on the performance of horticultural firms in Kenya. The results indicated that green distribution had a positive and significant relationship with the performance of horticultural firms. The findings indicated that green distribution had a positive and significant influence on the performance of horticultural firms. The results showed that value addition had a significant moderating influence on the relationship between green distribution and the performance of horticultural firms.

Gikonyo (2023) examined the influence of green distribution on performance of building and construction manufacturing firms in Kenya. The findings indicated that green distribution had a positive and significant relationship with the performance of building and construction manufacturing firms. The results indicated that green distribution had a positive and significant influence on the performance of building and construction manufacturing firms.

Mumbi *et al.* (2021) examined the influence of green distribution on competitive advantage of horticultural firms in Kenya. The results indicated that green distribution had a positive and significant relationship with the competitive advantage of horticultural firms. The findings indicated that green distribution had a positive and significant influence on the competitive advantage of horticultural firms. The results showed that value addition had a significant moderating influence on the relationship between green distribution and the competitive advantage of horticultural firms.

Kurgat and Kyule (2024) examined the effect of green distribution on the performance of construction firms in Nairobi City County, Kenya. The results indicated that green distribution had a positive and significant relationship with the performance of construction firms. The findings indicated that green distribution had a positive and significant influence on the performance of construction firms.

Auko (2023) examined the influence of green distribution on organizational competitiveness of commercial state corporations in Kenya. The results indicated that green distribution had a positive and significant relationship with the organizational competitiveness of commercial state corporations. The findings indicated that green distribution had a positive and significant effect the organizational competitiveness of commercial state corporations.

Gikonyo, Ngugi, and Paul (2022a) examined the influence of green distribution on performance of building and construction manufacturing firms in Kenya. The results indicated that green distribution had a positive and significant relationship with the performance of building and construction manufacturing firms. The findings indicated that green distribution had a positive and significant effect the performance of building and construction manufacturing firms.

Despite the valuable insights provided by these recent studies on the positive relationship between green distribution and firm performance, critical knowledge gaps remain unaddressed. Contextually, prior research has heavily concentrated on specialized sub-sectors like building and construction manufacturing (Gikonyo, 2023; Gikonyo *et al.*, 2022a), heavy manufacturing (Mungazu, 2023), construction (Kurgat & Kyule, 2024)) or horticultural (Kariuki, 2023; Mumbi *et al.*, 2021), leaving a contextual gap regarding how these dynamics manifest across other diverse operational environments. The study sought to fill these empirical gaps by investigating the multi-dimensional pathways through which green distribution optimizes firm performance under varying strategic conditions, especially in the Kenyan context.

2.5.5 Moderating Influence of Absorptive Capacity on the Relationship between Green Logistics Practices and Firm Performance

Kamanga (2024) examined the moderating influence of value addition on the relationship between sustainable supply chain management practices on the performance of horticultural firms in Kenya. The results indicated that reverse logistics, green packaging, green purchasing and green distribution had a positive and

significant relationship with the performance of horticultural firms. The findings indicated that reverse logistics, green packaging, green purchasing and green distribution had a positive and significant influence on the performance of horticultural firms. The results showed that value addition had a significant moderating influence on the relationship between reverse logistics, green packaging, green purchasing and green distribution and the performance of horticultural firms.

Riaz, Jie, Ali, and Chang (2024) examined the moderating effect of green absorptive capacity on the relationship between green leadership and green management support and green learning orientation and green innovation performance of manufacturing firms in Pakistan. The findings showed that leadership and green learning orientation had positive and significant effect on green innovation performance. The results indicated that green absorptive capacity had a significant moderating effect on the relationship between green leadership and green learning orientation and green innovation performance. The results showed that green absorptive capacity intensifies the impact of green learning orientation on green management support and the influence of green management support on green innovation performance, indicating a moderated mediation effect.

Salam, and Bajaba (2023) conducted a moderated-mediation analysis to examine the role of supply chain resilience and absorptive capacity in the relationship between marketing–supply chain management alignment and firm performance. The results indicated that the link between the marketing and supply chain management alignment capabilities provide a significant direct effect on supply chain resilience, and in turn, supply chain resilience also had a significant indirect effect on firm performance. The findings showed that there was a significant mediating effect of supply chain resilience on the link between marketing and supply chain management alignment capabilities and firm performance relationship. The results indicated that there was a statistically significant interaction effect and the interaction pattern supported that absorptive capacity would substitute the positive effect of supply chain resilience on firm performance, which implies that in the absence of supply chain resilience, absorptive

capacity can substitute the role of supply chain resilience. The findings showed that there was a significant moderation and mediation effect for the overall model.

Asamoah *et al.* (2024) examined the mediating role of green absorptive capacity in the relationship between green supply chain management practices and firm performance in manufacturing firms in Ghana. The results indicated that green purchasing, customer cooperation and investment recovery had a direct positive and significant effect on firm performance. The findings showed that while green purchasing and customer cooperation had a positive and significant effect on green absorptive capacity but investment recovery did not have a significant effect on green absorptive capacity. The results showed that the paths from green purchasing and customer cooperation to firm performance were positively mediated by green absorptive capacity.

Makhloufi, Djermani, and Meirun (2024) examined the moderation effect of green absorptive capacity on the managerial environmental concern - green entrepreneurship orientation and the managerial environmental concern - environmental performance relationships in Chinese manufacturing firms. The results indicated that green absorptive capacity positively influences managerial environmental concern, green entrepreneurship orientation and green innovation performance, and these last three constructs influence environmental performance. While managerial environmental concern positively affects green innovation performance, the managerial environmental concern - green entrepreneurship orientation relationship was insignificant. The study found that green absorptive capacity moderates the managerial environmental concern - green entrepreneurship orientation relationship, whereas green entrepreneurship orientation failed to do so between managerial environmental concern and environmental performance. The results confirm a partial mediation effect between green absorptive capacity - environmental performance through the three intermediary constructs.

Despite the valuable insights provided by these recent studies on the moderating influence of value addition on the relationship between green logistics practices and firm performance, critical knowledge gaps remain unaddressed. Most current literature focuses heavily on specific emerging markets like Pakistan (Riaz *et al.*, 2024) or China

(Makhloufi *et al.*, 2024), leaving a gap in understanding how green warehousing dynamics translate to highly industrialized or resource-constrained regions. Contextually, prior research has heavily concentrated on specialized sub-sectors like heavy manufacturing (Asamoah *et al.*, 2024; Makhloufi *et al.*, 2024), or horticultural (Kamanga, 2024), leaving a contextual gap regarding how these dynamics manifest across other diverse operational environments. The study sought to fill these empirical gaps by examining the moderating influence of absorptive capacity on the relationship between green logistics practices and performance of food and beverage manufacturing firms in Kenya.

2.6 Critique of the Existing Literature Relevant to the Study

The growing focus on sustainable practices has brought attention to the importance of green logistics which plays a crucial role in promoting awareness of environmental issues and encouraging stakeholders to consider the impact of their actions (Abbas & Hussien, 2021; Zhou *et al.*, 2023). However, there is a lack of theoretical foundation has been cited as a potential reason for the contradictory findings (Verma, 2024). The concept of green logistics practices has gained prominent attention in research, because of its numerous benefits including sustainable transportation, reverse logistics, green warehousing, green packaging, green distribution, monitoring, etc. (Sharma *et al.*, 2023). However, majority of the prior studies have largely been conducted in developed countries. As such, little information is known on the influence of green logistics on firm performance in the developing countries especially in Africa and particularly in the Kenyan context (Nthiwa *et al.*, 2024). Therefore, this lacuna deserves empirical examination in the context of other sectors in the developing countries, especially in the food and beverage sub sector in the Kenyan context.

Despite increasing scholarly attention to this concept, there remains considerable ambiguity surrounding its antecedents, practices, and performance outcomes (Kamewor *et al.*, 2024). There is a paucity of studies with empirical data and evidence researching on the influence of green logistics practices namely reverse logistics, green warehousing, green packaging and green distribution on firm performance of food and beverage manufacturing firms in the Kenyan context. While some research has found

a negligible correlation, others have revealed a significant relationship between green logistics and sustainable development (Verma, 2024) firm performance (Sharma *et al.*, 2023). In spite of the wide use of quantitative assessment to identify the relationship between green logistics practices and the sustainability performance of firms, results of these studies are inconsistent (Jayarathna *et al.*, 2024). There has been a growing empirical literature regarding the influence of green logistics on firm performance in different contexts and sectors. However, the extant empirical literature presents conflicting results and incomplete frameworks for investigating these dynamics and their resultant effects, often leading to fragmented perspectives, conceptual confusion, and paradoxical understandings (Zhou *et al.*, 2023).

2.7 Research Gaps

The growing focus on sustainable practices has brought attention to the importance of green logistics which plays a crucial role in promoting awareness of environmental issues and encouraging stakeholders to consider the impact of their actions (Zhou *et al.*, 2023). However, while the concept of green logistics practices has gained prominent attention in research, majority of the prior studies have largely been conducted in developed countries. As such, little information is known on the influence of green logistics on firm performance in the developing countries especially in Africa and particularly in the Kenyan context (Nthiwa *et al.*, 2024). Therefore, this lacuna deserves empirical examination in the context of other sectors in the developing countries, especially in the food and beverage sub sector in the Kenyan context.

Despite increasing scholarly attention to this concept, there remains considerable ambiguity surrounding its antecedents, practices, and performance outcomes (Kamewor *et al.*, 2024). There is a paucity of studies with empirical data and evidence researching on the influence of green logistics practices namely reverse logistics, green warehousing, green packaging and green distribution on firm performance of food and beverage manufacturing firms in the Kenyan context. In spite of the wide use of quantitative assessment to identify the relationship between green logistics practices and the sustainability performance of firms, results of these studies are inconsistent (Jayarathna *et al.*, 2024). While some research has found a negligible correlation, the

extant empirical literature has revealed a significant relationship between green logistics and sustainable development (Verma, 2024) firm performance (Sharma *et al.*, 2023).

There has been a growing empirical literature regarding the influence of green logistics on firm performance in different contexts and sectors. However, the extant empirical literature presents conflicting results and incomplete frameworks for investigating these dynamics and their resultant effects, often leading to fragmented perspectives, conceptual confusion, and paradoxical understandings (Zhou *et al.*, 2023). In today's competitive market, the priority giving to green practices has made green logistics practices a significant driver of organizational performance. Most prior studies suggest that green logistics practices positively influence firm performance (Gikonyo, 2023; Jayarathna *et al.*, 2024; Verma, 2024). However, some prior research revealed that green logistics practices positively influence social sustainability and environmental sustainability, but negatively influence business performance (Agyabeng-Mensah *et al.*, 2021). It highlights an important tension in sustainable supply chain management: while green logistics practices can improve environmental and social outcomes, they may simultaneously reduce short-term business performance.

2.8 Summary of the Reviewed Literature

This chapter reviewed the literature that informs the formation of study variables. In particular, it reviewed theoretical framework where complexity theory, ecological modernization theory, resource dependence theory and natural resource-based view theory. The chapter shower a diagrammatic representation of the conceptual framework, then reviewed the literature on variables drawn from green logistics practices in the food and beverage manufacturing firms as contended by other scholars and researchers. The chapter then presented the empirical review explaining in details previous studies' findings, conclusions and recommendations. The chapter also presented a critique of existing literature which is a detailed analysis of major weaknesses and shortcomings of prior literature. The chapter then discusses research gaps which point to the direction that future studies may be anchored regarding green logistics and firm performance of food and beverage manufacturing firms.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology. It describes the research philosophy, research design, target population, sampling frame, sample size and sampling techniques, data collection methods and data collection procedures. It presents pilot study, data processing and analysis, diagnostic tests, hypotheses testing, operationalization and measurement of study variables.

3.2 Research Philosophy

A research philosophy is a system of beliefs and assumptions regarding the development of knowledge, guiding how data about a phenomenon is gathered, analyzed, and used (Bergmann, 2023). The research philosophy serves as a foundation for research, influencing the choice of methodology and strategy (Matta, 2022; Mbanaso, Abrahams, & Okafor, 2023). The four key research philosophies are positivism, interpretivism, pragmatism, and realism (Zumitzavan, 2026). The study was guided by the positivism research philosophy which relies on quantifiable, objective data and measurements to test hypotheses. The positivist research philosophy served as the foundation for the quantitative research methodology, prioritizing objective, measurable, and observable data to test research hypotheses. The positivism research philosophy assumes a single, objective reality and is heavily associated with scientific methods, statistical analysis, and large-scale surveys to uncover general laws (Zumitzavan, 2025).

3.3 Research Design

Research design is the glue that holds all the elements of research together (Muzari, Shava, & Shonhiwa, 2022). The research design is a planned and structured investigation conceived to obtain answers to a research question or problem (Pandey & Pandey, 2021). The correlational cross-sectional survey research design was

employed to test non-causal relationships among variables without controlling any of the variables. A correlational cross-sectional survey research design involves collecting data from a sample of a population at a single, specific point in time to examine relationships between variables without manipulating any of the variables (Hunziker & Blankenagel, 2024). A correlational cross-sectional survey research design measures multiple variables within a specific sample at a single point in time to identify non-causal associations (Moreno-Menéndez *et al.*, 2026). It is a non-experimental, quantitative approach used to describe, compare, or explore relationships using surveys without manipulating variables (Shi, Chen, & Yuan, 2026).

3.4 Target Population

Target population is the whole population, or group, that a researcher is interested in researching and analyzing (Gray, 2021). The target population for this study consisted of the 217 food and beverage manufacturing firms in Kenya. The unit of observation consisted of the supply chain manager, while the unit of analysis consisted of the food and beverage manufacturing firm. The supply chain managers were considered key informants and respondents to the questionnaires due to their advanced knowledge in green logistics practices and their input was both relevant and reliable.

Table 3.1 presents the target population.

Table 3.1: Target Population

Strata	Target Population	Percentage
Alcoholic Beverages and Spirits	36	16.6%
Bakers and Millers	35	16.1%
Cocoa, Chocolate and Sugar Confectionery	24	11.1%
Dairy Products	21	9.6%
Juices, Water and Carbonated Soft Drinks	45	20.7%
Slaughtering and Preservation of Meat	22	10.1%
Tobacco	4	1.8%
Vegetable Oils	30	13.8%
Total	**217**	**100.0%**

3.5 Sampling Frame

Sampling frame is the complete and correct list of the target population from which a sample is chosen (Taylor *et al.*, 2025). It is a set of source materials from which a sample is selected (Pandey & Pandey, 2021). The sampling consisted of the list of the 217 food and beverage manufacturing firms in Kenya, as per the Kenya Association of Manufacturers (KAM, 2023) as at 31st December, 2023.

3.6 Sample Size and Sampling Techniques

This section presents the sample size and sampling techniques.

3.6.1 Sample Size

Sample size is defined as the total number of individuals, items, or observations included in a research study, chosen to represent a target population (Bisaria, Madhubala Kumari, & Patel, 2026). The Slovin (1960)'s formula was used for the determination of the sample size:

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

Where:

N = Target Population

n = Sample Size

e = Margin of Error

With a target population of 217 food and beverage manufacturing firms in Kenya, the minimum recommended sample size was determined as:

$$n = \frac{217}{1+217\ (0.05^2)}$$

$$n = 141$$

Therefore, the minimum recommended sample size consisted of 141 food and beverage manufacturing firms in Kenya.

Table 3.2 presents the sample size.

Table 3.2: Sample Size

Strata	**Target Population**	**Sample Size**
Alcoholic Beverages and Spirits	36	23
Bakers and Millers	35	23
Cocoa, Chocolate and Sugar Confectionery	24	16
Dairy Products	21	14
Juices, Water and Carbonated Soft Drinks	45	29
Slaughtering and Preservation of Meat	22	14
Tobacco	4	3
Vegetable Oils	30	19
Total	**217**	**141**

3.6.2 Sampling Techniques

The proportionate stratified random sampling technique was used to select a sample size of 141 food and beverage manufacturing firms from a target population of 217 food and beverage manufacturing firms in Kenya. The choice of the proportionate stratified random sampling technique was justified by the heterogeneous target population.

3.7 Data Collection Methods

Primary data was gathered using a structured, self-administered questionnaire (Appendix II). The survey questionnaire was anchored on a 5-point Likert scale. The 5-point Likert scale was designed to measure attitudes or opinions, ranging from 1 (strongly disagree) to 5 (strongly agree). The choice of the structured survey

questionnaire was justified by its ability to collect a large amount of information in a reasonably quick span of time (Karunarathna, Gunasena, Hapuarachchi, & Gunathilake, 2024). Self-administered, structured surveys are highly effective for collecting quantitative data from large, geographically dispersed samples due to their low cost, speed, and standardization (Konishi *et al.*, 2024).

3.8 Data Collection Procedures

A cross-sectional survey-based approach was used for the collection of primary data. The structured survey questionnaire was distributed to the random sample of 141 food and beverage manufacturing firms in Kenya. The researcher strictly adhered to the ethical issues relating to research undertaking. Prior to the data collection, permission to conduct research was sought from the management of Jomo Kenyatta University of Agriculture & Technology. A research permit was obtained from National Commission for Science, Technology and Innovation (NACOSTI). A request letter to the random sample was made to ensure voluntary participation in the research. Full disclosure of the entirety of activities regarding the study was explained to individual manufacturing firms' management confirming that the purpose of the research is only for academic purposes. Privacy and confidentiality were strictly adhered to.

The structured survey questionnaire was distributed through drop and pick method. The study adopted a drop and pick approach during the data collection process to enhance the response rate and reduce non-response bias. With the help of the 3 research assistants, the researcher hand delivered the survey questionnaire to the supply chain managers of the random sample of 141 food and beverage manufacturing firms in Kenya. A continuous follow up on responses will be made by the researcher assisted by the research assistants. With the help of the research assistants, the researcher personally collected the completed survey questionnaires.

3.9 Pilot Study

A pilot study was conducted to ascertain the validity and reliability of the constructed survey questionnaire. The pilot study was performed with pilot trial sample size of 14

food and beverage manufacturing firms in Kenya. The pilot trial sample size represented 10% of the study's sample size. The use of 14 firms was considered appropriate, because methodological literature recommends that a pilot study should comprise between 10% of the main study sample size to adequately test the research instruments and identify possible weaknesses before the actual data collection process (Dubey & Kothari, 2022; Leong, Hew, Ooi, Tan, & Koohang, 2025). However, the respondents in the pilot study were not be included in the main study. Extant literature posits that the participants in the pilot study should not be entered into the full-scale study (Azman & Majid, 2026).

3.9.1 Validity

Validity is the extent to which a measure adequately represents the underlying construct that it is supposed to measure (May & Perry, 2022). In this study, validity test was performed to assess the extent to which the constructed survey questionnaire adequately represented the underlying construct that it is supposed to measure. The constructed survey questionnaire was subjected to face validity test, content validity test, and construct validity test. Existent literature posits that face validity, content validity and construct validity are various types of validity (Zumitzavan, 2025; Supena, Darmuki, & Hariyadi, 2021).

Face validity refers to the extent to which a measure appears to measure what it is supposed to measure only on the its face (Semancik, Schmeler, Schein, & Hibbs, 2021). In this study, face validity was ensured by extensive literature survey on nature of the research problem and strengthened by developing the survey questionnaire based on validated scales. Face validity can be ensured by extensive literature survey on the research problem and developing the data collection instrument based on validated scales (Ishanuddin *et al.*, 2021).

For face validity test, the researcher shared the constructed survey questionnaire with an expert panel of 5 judges in the strategic management field to judge whether, on the face of it, the measure seemed to reflect the concept concerned. Existent literature posits that for face validity test, an expert panel of judges in the field of study is

recruited to judge whether, on the face of it, the measure seems to reflect the concept concerned (Cocchi *et al.*, 2023). Feedback from the panel of judges was used to refine the structure and layout of the constructed survey questionnaire.

Content validity is the extent to which a measure represents all facets of a given construct (Domingos, Troster, & Vieira, 2023). In this study, content validity was ensured by extensive literature survey on nature of the research problem and strengthened by constructing the survey questionnaire based on validated scales. Content validity is ensured by extensive literature survey on nature of the research problem and strengthened by constructing the data collection instrument based on validated scales (Seid, Bridgeland, Bridgeland, & Hartley, 2021).

For content validity test, the researcher shared the constructed survey questionnaire with an expert panel of 5 judges in the strategic management field to judge whether, subjectively, the measure seemed to cover all relevant parts of the construct it aims to measure. For content validity test, an expert panel of judges in the field of study may be employed to judge whether, subjectively, the measure seems to cover all relevant parts of the construct it aims to measure (Masoud & Mosli, 2023). Feedback from the peer-review panel of judges was used to determine the content validity index (CVI) of the constructed survey questionnaire.

Construct validity is about whether the measure is capturing what the researcher intends to measure (Coston, Kawakami, Zhu, Holstein, & Heidari, 2022). For construct validity test, factor analysis with varimax rotation were performed using SPSS package software version 26 for data reduction to detect the factor structure in the observed variables. However, prior to the extraction of the constructs to determine the appropriateness of the data for factor analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test of sphericity were conducted. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity are conducted prior to the extraction of the constructs to determine whether a variable is suitable for factor analysis (Shah, Zala, & Desai, 2023). The rule of thumb is that a KMO value of greater than 0.8, an associated significant Bartlett's test

of sphericity with a p-value of ≤ 0.05, and an anti-image correlation statistic of greater than 0.6 indicates that the data is suited for factor analysis (Obilor & Miwari, 2022).

3.9.2 Reliability

Reliability refers to the degree to which a measurement yields consistent and stable results (Yi, 2026). Reliability is the measure of the degree to which a measure yields consistent results across time and across the various items of the instrument (Hui & Wu, 2024). The Cronbach's alpha coefficients were calculated to measure the internal consistency reliability of the constructed survey questionnaire. The Cronbach's alpha coefficient is unquestionably the most frequently reported estimate of internal consistency reliability (Izah, Sylva, & Hait, 2023). The rule of thumb is that a Cronbach's alpha coefficient of 0.70 and above is good, 0.80 and above is better, and 0.90 and above is best internal consistency reliability (Kalkbrenner, 2023; Trabelsi, Saif, Driller, Vitiello, & Jahrami, 2024).

3.10 Diagnostic Tests

This section presents the diagnostic tests.

3.10.1 Normality Test

A normality test is a statistical procedure that determines whether a random sample was drawn from a normally distributed population (Dubey & Kothari, 2022). The normality test was conducted using the Kolmogorov-Smirnov test and Shapiro Wilk test. The null hypothesis (H_0) stated that the data does not significantly deviate from a normal distribution. Generally, if the p-value is greater than 0.05, then the null hypothesis not rejected and parametric tests can be performed (Hair *et al.*, 2021). However, if the p-value of the Shapiro-Wilk test is significant ($p \leq 0.05$), then the distribution in question is significantly different from a normal distribution and the non-parametric test can be performed (Hair & Alamer, 2022). The normality test results indicated that as the p-values of the Shapiro-Wilk Kolmogorov-Smirnov test and Shapiro Wilk test were greater than 0.05. The Shapiro-Wilk p-values ranged from

0.819 to 0.897, while the Kolmogorov-Smirnov p-values ranged from 0.090 to 0.200, which were all higher than the threshold value of 0.05

3.10.2 Heteroscedasticity Test

Heteroscedasticity refers to situations refers a situation where the variance of regression residuals is not constant across all levels of independent variables, violating the Ordinary Least Squares (OLS) assumption of homoscedasticity (Kumar, 2023). In contrast, homoscedasticity refers to situations where the variance of the error terms (residuals) is constant across all levels of the independent variables (Nguyen, 2026). The Levene (1960)'s test was used to test for heteroscedasticity. The null hypothesis (H_0) for the Levene's test is that the population variances are equal across all groups. Generally, if the p-value of the Levene's test is significant ($p \leq 0.05$), the decision is to reject the null hypothesis, and conclude that the assumption of equal variances is violated (Tomek & Eisner, 2025). However, if the p-value of the Levene's test is insignificant ($P > 0.05$), the decision is to fail to reject the null hypothesis, and conclude that the assumption of equal variances is met and can proceed with standard parametric tests (Montero, 2026). The heteroscedasticity test results showed that the p-values of Levene's test for all study variables were greater than 0.05, ranging from 0.274 to 0.378. The null hypothesis of equal variances was not rejected, because all the p-values were higher than the threshold value of 0.05

3.10.3 Linearity Test

A linearity test checks if a linear (straight-line) relationship exists between independent and dependent variables, a key assumption for linear regression (Nguyen, 2026). Multiple regression assumes a linear relationship between the dependent variable and the independent variables, the linearity assumption, which is tested using the scatterplots (Kline, 2023). An important assumption of multiple linear regression is that there is a linear relationship between the dependent variable and each of the independent variables (Ozili, 2023). The linearity assumption in regression analysis states that the relationship between independent (predictor) variables and the dependent (outcome) variable is linear (Nguyen, 2025). For the linearity test, the

Pearson's correlation analysis was conducted. The common methods include visual inspection of scatter plots, calculating the Pearson correlation, or using statistical tests in software (e.g., ANOVA, CUSUM) to identify deviations from linearity (Gallo & McKinney, 2025). The linearity test results indicated that all the independent variables had positive and significant linear relationships with the performance of food and beverage manufacturing firms in Kenya. The relationships were statistically significant, confirming that the assumption of linearity was met, because all p-values were lower than 0.05

3.10.4 Autocorrelation Test

Autocorrelation occurs when the error terms (residuals) are correlated with each other over time or space, violating the assumption of independent errors (Ahlawat, 2025). Multiple regression assumes that the error terms are independent or the given data set should not be autocorrelated, an assumption most commonly tested using the Durbin-Watson test (Nguyen, 2025)**.** For the test autocorrelation test, the Durbin-Watson test was performed. The Durbin-Watson test statistic is a test statistic used in statistics to detect autocorrelation in the residuals from a regression analysis (Campbell & Jacques, 2023). If the Durbin-Watson statistic is between 1.5 and 2.5, then autocorrelation is likely not a cause for concern (Hair Jr *et al.*, 2021; Nguyen, 2026). The autocorrelation test results indicated that the Durbin-Watson statistic was 2.177. Therefore, there was no severe autocorrelation among the residuals in the dataset, because the statistic falls within the acceptable range of 1.5 to 2.5.

3.10.5 Multicollinearity Test

Multicollinearity occurs when independent variables (predictors) in a regression model are highly correlated with each other (Hushchyna, Sabir, Mclellan, & Nguyen-Quang, 2023). Multiple regression assumes that the independent variables are not highly correlated with each other (Noramli *et al.*, 2026). For the multicollinearity test, the variance inflation factor (VIF) and tolerance values for each of the independent variables were calculated. The absence of multicollinearity, an assumption tested using VIF values and tolerance values for each of the independent variables (Nguyen, 2026).

If the VIF is higher than 10 or tolerance is lower than 0.1, there is significant multicollinearity that needs to be corrected (Lenz, Haktanir, & Flores, 2026). The multicollinearity test results indicated that the tolerance values for all predictor variables ranged from 0.562 to 0.747, which were higher than the recommended minimum threshold of 0.1

3.11 Data Processing and Analysis

This section presents the data processing and analysis.

3.11.1 Data Processing

Prior to the data analysis, data processing was conducted. The collected data was checked for completeness, accuracy and consistency. The collected data was coded, edited and entered into the Statistical Package for Social Sciences (SPSS) version 26 to create a data sheet that was used for data analysis.

3.11.2 Descriptive Analysis

Descriptive statistics such as percentages, frequencies, means and standard deviations were used to compute, summarize the data in respect to each variable, and describe the sample's characteristics. The descriptive statistics are used to compute, summarize data in respect to the study variables and describe the sample's characteristics (Nguyen, 2026).

3.11.3 Correlation Analysis

The Pearson's product moment correlation analysis was performed to confirm or deny the relationship between the study variables. The Pearson's product moment correlation analysis performed to determine the nature and the strength of the linear relationship between the variables (Arumugam, 2026).

3.11.4 Regression Analysis

A standard multiple regression analysis was conducted with the performance of food and beverage manufacturing firms as the dependent variable and green distribution, reverse logistics, green warehousing and green packaging as predictor variables. The standard multiple regression analysis provides a reliable statistical technique that is used to investigate two or more independent variables and predicts the dependent outcome variable (Dey *et al.*, 2025). The standard multiple analysis provides a means of objectively assessing the magnitude and direction of each predictor's relationship to its outcome variable (Dubey & Kothari, 2022).

A hierarchical moderated multiple regressions was used to determine the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. However, prior to the moderation analysis, a composite index (green logistics practices) was computed for the 4 independent variables (reverse logistics, green warehousing, green packaging and green distribution). The composite index (green logistics practices) provided for the different weights associated with the 4 independent variables.

The composite index (green logistics practices) formed the basis for testing the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms, using regression models. The independent variable (green logistics practices) was interacted with the moderating variable (absorptive capacity) to create an interactive variable (green logistics practices * absorptive capacity). The interactive variable (green logistics practices * absorptive capacity) was then introduced to the model as a moderator. The moderation analysis involved three steps.

In the first step for the moderation analysis, the independent variable (green logistics practices) was regressed on the dependent variable (the performance of food and beverage manufacturing firms). In the second step for the moderation analysis, the independent variable (green logistics practices) and the moderating variable (absorptive capacity) were regressed on the dependent variable (the performance of

food and beverage manufacturing firms). In the third step, the independent variable (green logistics practices), the moderating variable (absorptive capacity) and the interaction term (green logistics practices * absorptive capacity) were regressed on the dependent variable (the performance of food and beverage manufacturing firms).

The study set two alternative criteria for determining whether absorptive capacity had a significant the moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. First, if the change in coefficients was significant after introducing the interactive term, then absorptive capacity had a moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. Second, if the change in R^2 from model 1 to Model 3 was significant after introducing the interactive term, then absorptive capacity had a significant the moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya.

3.12 Model Specification

The standard multiple linear regressions model was specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \text{ ..... Model 3.1}$$

Where:

Y = Performance of Food and Beverage Manufacturing Firms

β_0 = Constant Term

$\beta_1 - \beta_4$ = Regression coefficients to be estimated

X_1 = Reverse Logistics

X_2 = Green Warehousing

X_3 = Green Packaging

X_4 = Green Distribution

ε = Stochastic Error Term

The hierarchical moderated regressions models were specified as:

$Y = \beta_0 + \beta_5 X + \varepsilon$ ……...…….. Model 3.2

$Y = \beta_0 + \beta_6 X + \beta_7 Z + \varepsilon$ ……... Model 3.3

$Y = \beta_0 + \beta_8 X + \beta_9 Z + \beta_{10} X*Z + \varepsilon$ …….…….... Model 3.4

Where:

Y = Performance of Food and Beverage Manufacturing Firms

β_0 = Constant Term

$\beta_5 - \beta_{10}$ = Regression coefficients to be estimated

X = Green Logistics Practices (Independent Variable)

Z = Absorptive Capacity (Moderating Variable)

X*Z = Interaction term of the Moderating Variable with the Independent Variable

ε = Stochastic Error Term

3.13 Hypotheses Testing

In this study, 5 null hypotheses were tested at 95% confidence level ($\alpha = 0.05$; $t = 1.960$) to statistically help draw acceptable and realistic inferences. Therefore, the decision rule was to reject the null hypothesis H_0i if the $P \leq 0.05$, and otherwise fail to reject the null hypothesis H_0i if the $P > 0.05$.

Table 3.3 presents the hypotheses testing procedure.

Table 3.3: Hypotheses Testing

Hypotheses		**Hypotheses Testing**	**Decision Rule**
$H_0$1:	Reverse logistics has no significant influence on performance of food and beverage manufacturing firms in Kenya.	Standard multiple regression analysis F-test	$H_0$1: $\beta_1 = 0$ $H_1$1: $\beta_1 \neq 0$ If the $P \leq 0.05$ reject the $H_0$1. If the $P > 0.05$ fail to reject the $H_0$1.
$H_0$2:	Green warehousing has no significant influence on performance of food and beverage manufacturing firms in Kenya.	T-test	$H_0$2: $\beta_2 = 0$ $H_1$2: $\beta_2 \neq 0$ If the $P \leq 0.05$ reject the $H_0$2. If the $P > 0.05$ fail to reject the $H_0$2.
$H_0$3:	Green packaging has no significant influence on performance of food and beverage manufacturing firms in Kenya.		$H_0$3: $\beta_3 = 0$ $H_1$3: $\beta_3 \neq 0$ If the $P \leq 0.05$ reject the $H_0$3. If the $P > 0.05$ fail to reject the $H_0$3.
$H_0$4:	Green distribution has no significant influence on performance of food and beverage manufacturing firms in Kenya.		$H_0$4: $\beta_4 = 0$ $H_1$4: $\beta_4 \neq 0$ If the $P \leq 0.05$ reject the $H_0$4. If the $P > 0.05$ fail to reject the $H_0$4.
$H_0$5:	Absorptive capacity has no significant moderating influence on the relationship between green logistics practices and performance of food and beverage manufacturing companies in Kenya.	Hierarchical moderated multiple regression analysis F-test T-test	$H_0$5: $\beta_4 = 0$ $H_1$5: $\beta_4 \neq 0$ If β_1, β_1, β_1 and β_4 are insignificant ($P > 0.05$) in model 3.2, but are significant ($P \leq 0.05$) in model 3.1, then Z is just an independent, hence fail to reject the $H_0$5.

3.14 Operationalization and Measurement of Study Variables

Operationalization of variables is the process of defining variables into measurable factors as used in the study. Each of the study variables was operationalized with 4 constructs and 8 items. Each of the study variables was measured on a 5-point Likert scale. Table 3.4 presents the operationalization and measurement of the study variables.

Table 3.4: Operationalization and Measurement of Study Variables

Variable		Operationalization	Scale
Independent Variable	Reverse Logistics	Eco-Friendly Asset Recovery Eco-Friendly Recycling Eco-Friendly Remanufacturing Eco-Friendly Return Processing	A 5-point Likert Scale, where:
	Green Warehousing	Energy-Efficient Warehousing Reusable Warehousing Equipment Warehousing Layout Optimization Smart Warehousing	1= Strongly Disagree
	Green Packaging	Reusable Packaging Compostable Packaging Recyclable Packing Biodegradable Packaging	2= Disagree
	Green Distribution	Eco-Friendly Pool Distribution Eco-Driving Training Energy-Efficient Distribution Eco-Friendly Route Optimization	3= Neither Agree nor Disagree
Moderating Variable	Absorptive Capacity	Acquisition Adaptability Transformation Assimilation	4= Agree
Dependent Variable	Performance of Food and Beverage Manufacturing Firms	Return on Assets Return on Equity Market Share Sales Growth	5= Strongly Agree

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter presents the findings of the study. It discusses the results in relation to the research objectives and hypotheses. The analysis is based on data collected from food and beverage manufacturing firms in Kenya and focuses on the relationship between green logistics practices, absorptive capacity, and firm performance. The chapter provides interpretation of statistical results, including descriptive statistics, diagnostic tests, correlation analysis, and regression analysis, in line with the study objectives.

4.2 Response Rate

Out of the 141 survey questionnaires distributed for the main survey, only 133 usable survey questionnaires were returned. Therefore, there was a valid response rate of 94.33%, which was sufficient for data processing and analysis. Table 4.1 presents the response rate.

Table 4.1: Response Rate

Strata	**Frequency**	**Percentage**
Response	133	94.33%
Non-Response	8	5.67%
Total	**141**	**100.00%**

4.3 Validity Test Results

In this study, face validity, content validity and construct validity tests were conducted.

4.3.1 Face Validity Test Results

Face validity was ensured by extensive literature survey on nature of the research problem and reinforced by developing the survey questionnaires based on validated scales. Extant literature suggests that face validity can be ensured by extensive literature survey on the research problem and developing survey questionnaire based on validated scales (Semancik *et al.*, 2021). For face validity test, the researcher shared the constructed survey questionnaire with an expert panel of five peer-review professionals in the supply chain management field to judge whether, on the face of it, the measure seems to reflect the concept concerned.

Existing literature posits that face validity test involves sharing the constructed data collection instrument with an expert panel of peer-review professionals with experience and expertise in the field to judge whether, on the face of it, the measure seems to reflect the concept concerned (Stribing *et al.*, 2022). Feedback from the peer-review panel was used to effect changes to the survey questionnaire to ensure that questions are more straightforward, more direct, and that the terms used are non-technical. From the results, the panel of experts deemed the face validity of the survey questionnaire acceptable. Their feedback related to the wording of some of the statements, the structure, and the layout of the survey questionnaire. Their comments were considered and various changes were made to refine of the items in terms of using more objective methods for measuring items and better wording.

4.3.2 Content Validity Test Results

The content validity was ensured by extensive literature survey on nature of the research problem and reinforced by developing the survey questionnaires based on validated scales. Scholars avow that content validity can be ensured by extensive literature survey on the research problem (Stribing *et al.*, 2022) and developing survey questionnaire based on validated scales (Coston *et al.*, 2022). For content validity test, the researcher shared the draft survey questionnaire with an expert panel of judges consisting of five peer-review professionals in the supply chain management field to examine content validity of constructs. Existent literature posits that content validity

could be conducted by the researcher sharing the constructed data collection instrument with an expert panel of peer review professionals with experience and expertise in the field to judge whether, the measure seems to reflect the concept concerned (Stribing *et al.*, 2022).

The expert panel of judges' responses provided by the expert panel judges were analyzed to establish the percentage representation using the content validity index. The content validity test results showed that the content validity index was 0.938 and the congruency percentage was 93.8%. From the content validity test results, the panel of experts ascertained that the survey questionnaire passed the content validity test. The expert panel of judges' feedback was utilized to revise the wording of some of the statements, the structure, and the layout of the survey questionnaire. The comments were also used to refine of the items in terms of using more objective methods for measuring items and better wording.

Table 4.2 presents the content validity test results.

Table 4.2: Content Validity Test Results

Variable	**No. of Items**	**Content Validity Index**	**Congruency Percentage**	**Decision**
Reverse Logistics	8	.940	94.0%	Valid
Green Warehousing	8	.937	93.7%	Valid
Green Packaging	8	.933	93.3%	Valid
Green Distribution	8	.948	94.8%	Valid
Absorptive Capacity	8	.936	93.6%	Valid
Performance of Food and Beverage Manufacturing Firms	8	.932	93.2%	Valid
Entire Scale	**48**	**.938**	**93.8%**	**Valid**

4.3.3 Construct Validity Test Results

The construct validity was performed using factor analysis. Factor analysis with varimax rotation was performed using SPSS package software version 26 for data reduction to detect the factor structure in the observed variables. However, prior to the extraction of the constructs, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and the Bartlett's Test of Sphericity were conducted to determine the appropriateness of the data for factor analysis. The results showed that for the entire scale, the KMO Measure of Sampling Adequacy was 0.846, greater than 0.7 and the Bartlett's Test of Sphericity was significant (Approx. Chi-Square = 527.248; df = 6; $p \leq 0.001$), suggesting the appropriateness of the data for factor analysis. A KMO statistic of greater than 0.7, and an associated Bartlett's p-value of less than or equal to 0.05, and an Anti-image correlation statistic of greater than 0.6 indicates that an adequate correlation exists to justify factor analysis (Saunders *et al.*, 2023).

Table 4.3 presents the results of the construct validity test results.

Table 4.3: Construct Validity Test Results

Variable	No. of Items	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	Bartlett's Test of Sphericity Approx. Chi-Square	df	Sig.
Reverse Logistics	8	.789	504.541	6	.000
Green Warehousing	8	.782	503.228	6	.000
Green Packaging	8	.792	505.158	6	.000
Green Distribution	8	.786	504.149	6	.000
Absorptive Capacity	8	.784	503.348	6	.000
Performance of Food and Beverage Manufacturing Firms	8	.787	504.428	6	.000
Entire Scale	**48**	**.846**	**527.248**	**6**	**.000**

4.4 Reliability Test Results

The Cronbach's alpha coefficient was the measure of the internal consistency reliability of the survey items of the constructed survey questionnaire. The pilot study results indicated that the Cronbach alpha coefficient of the entire scale (48 items) was 0.856, greater than the threshold 0.7, signifying that the entire scale passed the reliability test. From the results, the Cronbach alpha coefficients of the 5 variables were greater than the threshold 0.7, ranging from 0.834 and 0.848, implying that all variables had reliable internal consistency. Existent literature posits that Cronbach's alpha values > 0.70 indicate acceptable reliability (Hair & Alamer, 2022).

Table 4.4 presents the reliability test results.

Table 4.4: Reliability Results

Variable	No. of Items	Cronbach's Alpha	Decision
Reverse Logistics	8	.841	Reliable
Green Warehousing	8	.844	Reliable
Green Packaging	8	.837	Reliable
Green Distribution	8	.834	Reliable
Absorptive Capacity	8	.838	Reliable
Performance of Food and Beverage Manufacturing Firms	8	.848	Reliable
Entire Scale	**48**	**.856**	**Reliable**

4.5 Demographic Results

With regards to the firm age, the demographic results indicated that majority of the respondents were from food and beverage manufacturing firms with more than 10 years of operation, while about a quarter of the respondents were from firms with 6-10 years of operation. The demographic results indicated that about a sixth of the

respondents were from food and beverage manufacturing firms with 3-5 years of operation, while less than a tenth of the respondents were from firms with less than 3 years of operation.

With regards to the firm size, the demographic results indicated that majority of the respondents were from food and beverage manufacturing firms with more than 100 employees, while about a quarter of the respondents were from firms with 51-100 employees. The demographic results indicated that about a sixth of the respondents were from food and beverage manufacturing firms with 10-50 employees, while less than a tenth of the respondents were from firms with less than 10 employees. Table 4.5 presents the demographic results.

Table 4.5: Demographic Results

Firm Profile	Strata	Frequency	Percentage
Firm Age	Less than 3 years	9	6.77%
	3-5 years	21	15.79%
	6-10 years	35	26.32%
	More than 10 years	68	51.13%
Firm Size	Less than 10 employees	9	6.77%
	10-50 employees	21	15.79%
	51-100 employees	35	26.32%
	More than 100 employees	68	51.13%
	Total	**133**	**100.00%**

4.6 Descriptive Results

This section presents the descriptive results.

4.6.1 Descriptive Results for Reverse Logistics

On a 5-point Likert scale, the respondents were required to indicate their level of agreement or disagreement with regards to the reverse logistics in food and beverage manufacturing firms in Kenya. The descriptive results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.357, the respondents agreed that the eco-friendly asset recovery focuses on reclaiming value from used, broken, or end-of-life products with minimal energy consumption. The descriptive results indicated that

as reflected by a mean of 3.95 and a low standard deviation of 0.348, the respondents agreed that the eco-friendly asset recovery involves analyzing and triaging returned items to determine the most eco-efficient path. The descriptive results indicated that as reflected by a mean of 3.97 and a low standard deviation of 0.353, the respondents agreed that the eco-friendly recycling entails recovering materials from products that cannot be refurbished using processes that minimize carbon (IV) oxide emissions and energy use.

The descriptive results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.355, the respondents agreed that the eco-friendly recycling is crucial for reducing landfill usage and supporting the circular economy. The descriptive results indicated that as reflected by a mean of 3.99 and a low standard deviation of 0.349, the respondents agreed that the eco-friendly remanufacturing restores used or non-functional products to “like-new” condition, often including a performance warranty equivalent to a new product. The descriptive results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.356, the respondents agreed that the eco-friendly remanufacturing process is highly efficient for high-value goods, while simultaneously reducing the carbon footprint. The descriptive results indicated that as reflected by a mean of 3.95 and a low standard deviation of 0.353, the respondents agreed that the eco-friendly return processing reduces environmental impact and operational costs by optimizing product recovery through recycling, repairing, and refurbishing.

The descriptive results indicated that as reflected by a mean of 3.96 and a low standard deviation of 0.351, the respondents agreed that the eco-friendly return processing reduces environmental impact and operational costs by optimizing product recovery through recycling, repairing, and refurbishing. The descriptive results indicated that as reflected by a mean of 3.97 and a low standard deviation of 0.345, there was an agreement among the respondents with regards to the reverse logistics in food and beverage manufacturing firms in Kenya. Table 4.6 presents the descriptive results for reverse logistics in food and beverage manufacturing firms in Kenya.

Table 4.6: Descriptive Results for Reverse Logistics

Reverse Logistics	n	Mean	Std. Deviation
The eco-friendly asset recovery focuses on reclaiming value from used, broken, or end-of-life products with minimal energy consumption.	133	3.98	.357
The eco-friendly asset recovery involves analyzing and triaging returned items to determine the most eco-efficient path.	133	3.95	.348
The eco-friendly recycling entails recovering materials from products that cannot be refurbished using processes that minimize carbon (IV) oxide emissions and energy use.	133	3.97	.353
The eco-friendly recycling is crucial for reducing landfill usage and supporting the circular economy.	133	3.98	.355
The eco-friendly remanufacturing restores used or non-functional products to "like-new" condition, often including a performance warranty equivalent to a new product.	133	3.99	.349
The eco-friendly remanufacturing process is highly efficient for high-value goods, while simultaneously reducing the carbon footprint.	133	3.98	.356
The eco-friendly return processing reduces environmental impact and operational costs by optimizing product recovery through recycling, repairing, and refurbishing.	133	3.95	.353
The eco-friendly return processing reduces environmental impact and operational costs by optimizing product recovery through recycling, repairing, and refurbishing.	133	3.96	.351
Reverse Logistics	**133**	**3.97**	**.345**

1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree nor Disagree; 4 = Agree; 5= Strongly Agree

4.6.2 Descriptive Results for Green Warehousing

On a 5-point Likert scale, the respondents were required to indicate their level of agreement or disagreement with regards to the green warehousing in food and beverage manufacturing firms in Kenya. The descriptive results indicated that the respondents agreed that as reflected by a mean of 3.95 and a low standard deviation of 0.364, the energy efficient warehousing used reduces environmental impact by optimizing lighting, heating, ventilation, and air conditioning systems. The descriptive results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.357, the respondents agreed that the energy-efficient warehousing reduces operating costs by optimizing energy consumption, space utilization, and operational workflows.

The descriptive results indicated that as reflected by a mean of 3.96 and a low standard deviation of 0.359, the respondents agreed that reusable warehousing equipment is designed to reduce waste, lower long-term costs, and improve efficiency. The descriptive results indicated that as reflected by a mean of 3.94 and a low standard deviation of 0.358, the respondents agreed that the reusable warehousing equipment is specifically engineered to replace single-use, disposable alternatives, delivering significant benefits in environmental sustainability. The descriptive results indicated that as reflected by a mean of 3.97 and a low standard deviation of 0.356, the respondents agreed that in the warehousing layout optimization boosts picking accuracy, reduces congestion, and allows for flexible, scalable operations during peak demand.

The results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.361, the respondents agreed that the warehousing layout optimization increases operational efficiency by maximizing space utilization, reducing travel time, and improving throughput. The results indicated that as reflected by a mean of 3.97 and a low standard deviation of 0.364, the respondents agreed that the smart warehousing aims to improve overall service quality, productivity, and efficiency while lowering costs and failures. The results indicated that as reflected by a mean of 3.94 and a low standard deviation of 0.358, the respondents agreed that the smart warehousing solutions significantly improves operational efficiencies in inventory management. The descriptive results indicated that as reflected by a mean of 3.96 and a low standard deviation of 0.354, there was an agreement among the respondents with regards to the green warehousing in food and beverage manufacturing firms in Kenya.

Table 4.7 presents the descriptive results for green warehousing in food and beverage manufacturing firms in Kenya.

Table 4.7: Descriptive Results for Green Warehousing

Green Warehousing	n	Mean	Std. Deviation
The energy efficient warehousing used reduces environmental impact by optimizing lighting, heating, ventilation, and air conditioning systems.	133	3.95	.364
The energy-efficient warehousing reduces operating costs by optimizing energy consumption, space utilization, and operational workflows.	133	3.98	.357
Reusable warehousing equipment is designed to reduce waste, lower long-term costs, and improve efficiency.	133	3.96	.359
The reusable warehousing equipment is specifically engineered to replace single-use, disposable alternatives, delivering significant benefits in environmental sustainability.	133	3.94	.358
In the warehousing layout optimization boosts picking accuracy, reduces congestion, and allows for flexible, scalable operations during peak demand.	133	3.97	.356
The warehousing layout optimization increases operational efficiency by maximizing space utilization, reducing travel time, and improving throughput.	133	3.98	.361
The smart warehousing aims to improve overall service quality, productivity, and efficiency while lowering costs and failures.	133	3.97	.364
The smart warehousing solutions significantly improves operational efficiencies in inventory management.	133	3.94	.358
Green Warehousing	**133**	**3.96**	**.354**

1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree nor Disagree; 4 = Agree; 5= Strongly Agree

4.6.3 Descriptive Results for Green Packaging

On a 5-point Likert scale, the respondents were required to indicate their level of agreement or disagreement with regards to the green packaging in food and beverage manufacturing firms in Kenya. The descriptive results indicated that as reflected by a mean of 3.94 and a low standard deviation of 0.347, the respondents agreed that the firm offers products in durable, reusable packaging that is collected, professionally cleaned, and refilled, creating a closed-loop system. The results indicated that as reflected by a mean of 3.92 and a low standard deviation of 0.345, the respondents agreed that the packaging is developed to maintain its functionality and safety through multiple cycles of use, collection, cleaning, and refilling or repurposing.

The results indicated that as reflected by a mean of 3.95and a low standard deviation of 0.351, the respondents agreed that the packaging breaks down completely into natural elements in specific conditions, without leaving toxic residues. The indicated

that as reflected by a mean of 3.96 and a low standard deviation of 0.342, the respondents agreed that the firm uses compostable packaging designed to break down into natural elements in the right composting conditions. The descriptive results indicated that as reflected by a mean of 3.94 and a low standard deviation of 0.349, the respondents agreed that the firm uses recyclable packaging designed to minimize environmental impact, reduce waste, and support a circular economy.

The results indicated that as reflected by a mean of 3.94 and a low standard deviation of 0.353, the respondents agreed that the firm uses recyclable packaging to decrease reliance on virgin materials, saving natural resources and energy. The results indicated that as reflected by a mean of 3.92 and a low standard deviation of 0.344, the respondents agreed that the firm uses biodegradable packaging to decrease environmental footprint, appeal to eco-conscious consumers, and contribute to a more sustainable supply chain. The results indicated that as reflected by a mean of 3.95 and a low standard deviation of 0.341, the respondents agreed that the firm offers products using biodegradable packaging to attract and retain environmentally conscious customers. The results indicated that as reflected by a mean of 3.94 and a low standard deviation of 0.338, there was an agreement among the respondents with regards to the green packaging in food and beverage manufacturing firms in Kenya.

Table 4.8 presents the descriptive results for green packaging in food and beverage manufacturing firms in Kenya.

Table 4.8: Descriptive Results for Green Packaging

Green Packaging	n	Mean	Std. Deviation
The firm offers products in durable, reusable packaging that is collected, professionally cleaned, and refilled, creating a closed-loop system.	133	3.94	.347
The packaging is developed to maintain its functionality and safety through multiple cycles of use, collection, cleaning, and refilling or repurposing.	133	3.92	.345
The packaging breaks down completely into natural elements in specific conditions, without leaving toxic residues.	133	3.95	.351
The firm uses compostable packaging designed to break down into natural elements in the right composting conditions.	133	3.96	.342
The firm uses recyclable packaging designed to minimize environmental impact, reduce waste, and support a circular economy.	133	3.94	.349
The firm uses recyclable packaging to decrease reliance on virgin materials, saving natural resources and energy.	133	3.94	.353
The firm uses biodegradable packaging to decrease environmental footprint, appeal to eco-conscious consumers, and contribute to a more sustainable supply chain.	133	3.92	.344
The firm offers products using biodegradable packaging to attract and retain environmentally conscious customers.	133	3.95	.341
Green Packaging	**133**	**3.94**	**.338**

1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree nor Disagree; 4 = Agree; 5= Strongly Agree

4.6.4 Descriptive Results for Green Distribution

On a 5-point Likert scale, the respondents were required to indicate their level of agreement or disagreement with regards to the green distribution in food and beverage manufacturing firms in Kenya. The descriptive results indicated that as reflected by a mean of 3.94 and a low standard deviation of 0.351, the respondents agreed that the eco-friendly pool distribution solutions significantly can significantly reduce energy consumption, chemical usage, and water waste. The descriptive results indicated that as reflected by a mean of 3.96 and a low standard deviation of 0.348, the respondents

agreed that the eco-friendly pool distribution reduces environmental impact by consolidating multiple, smaller shipments destined for a specific region into a single, full truckload for the long-haul portion of the journey.

The descriptive results indicated that as reflected by a mean of 3.95 and a low standard deviation of 0.355, the respondents agreed that the eco-driving training programs are designed to teach drivers techniques that reduce fuel consumption and emissions. The descriptive results indicated that as reflected by a mean of 3.97 and a low standard deviation of 0.356, the respondents agreed that the eco-driving training programs focus on smoother driving, such as early gear shifting, maintaining steady speeds, avoiding excessive acceleration/braking, and optimizing vehicle maintenance. The descriptive results indicated that as reflected by a mean of 3.93 and a low standard deviation of 0.349, the respondents agreed that the energy-efficient distribution practices involve optimizing logistics and utility infrastructure to reduce energy consumption and carbon emissions. The descriptive results indicated that as reflected by a mean of 3.92 and a low standard deviation of 0.348, the respondents agreed that the energy-efficient distribution modes reduce carbon emissions, lower fuel consumption, and minimize the ecological footprint of supply chains.

The descriptive results indicated that as reflected by a mean of 3.92 and a low standard deviation of 0.355, the respondents agreed that the eco-friendly route optimization approach significantly enhances sustainability by lowering emissions and improves service efficiency through real-time adjustments. The descriptive results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.354, the respondents agreed that the eco-friendly route optimization approach lowers carbon footprints, decreases fuel costs, and improves logistics efficiency. The descriptive results indicated that as reflected by a mean of 3.95 and a low standard deviation of 0.346, there was an agreement among the respondents with regards to the green distribution in food and beverage manufacturing firms in Kenya.

Table 4.9 presents the descriptive results for green distribution in food and beverage manufacturing firms in Kenya

Table 4.9: Descriptive Results for Green Distribution

Green Distribution	n	Mean	Std. Deviation
The eco-friendly pool distribution solutions significantly can significantly reduce energy consumption, chemical usage, and water waste.	133	3.94	.351
The eco-friendly pool distribution reduces environmental impact by consolidating multiple, smaller shipments destined for a specific region into a single, full truckload for the long-haul portion of the journey.	133	3.96	.348
The eco-driving training programs are designed to teach drivers techniques that reduce fuel consumption and emissions.	133	3.95	.355
The eco-driving training programs focus on smoother driving, such as early gear shifting, maintaining steady speeds, avoiding excessive acceleration/braking, and optimizing vehicle maintenance.	133	3.97	.356
The energy-efficient distribution practices involve optimizing logistics and utility infrastructure to reduce energy consumption and carbon emissions.	133	3.93	.349
The energy-efficient distribution modes reduce carbon emissions, lower fuel consumption, and minimize the ecological footprint of supply chains.	133	3.92	.348
The eco-friendly route optimization approach significantly enhances sustainability by lowering emissions and improves service efficiency through real-time adjustments.	133	3.92	.355
The eco-friendly route optimization approach lowers carbon footprints, decreases fuel costs, and improves logistics efficiency.	133	3.98	.354
Green Distribution	**133**	**3.95**	**.346**

1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree nor Disagree; 4 = Agree; 5= Strongly Agree

4.6.5 Descriptive Results for Absorptive Capacity

On a 5-point Likert scale, the respondents were required to indicate their level of agreement or disagreement with regards to the absorptive capacity in food and beverage manufacturing firms in Kenya. The descriptive results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.354, the respondents agreed that the firm collects information about developments in the sub sector through discussions with business stakeholders. The descriptive results indicated that as reflected by a mean of 3.97 and a low standard deviation of 0.348, the respondents agreed that within the firm, we have sufficient skills to link up with parties who are good in innovations in the sub sector. The descriptive results indicated that as reflected

by a mean of 4.01 and a low standard deviation of 0.328, the respondents agreed that the search for relevant information concerning our industry is every-day in the firm.

The descriptive results indicated that as reflected by a mean of 3.96 and a low standard deviation of 0.361, the respondents agreed that the firm is always among the first to recognize shifts in technical possibilities in the sub sector. The descriptive results indicated that as reflected by a mean of 3.95 and a low standard deviation of 0.349, the respondents agreed that the firm allocates enough time to deliberate with experts in order to recognize changes in the market early. The descriptive results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.353, the respondents agreed that the appropriate use of external information by the firm contributes to profitability. The descriptive results indicated that the respondents agreed that the firm translates external information into use for new business applications, as reflected by a mean of 3.93 and a low standard deviation of 0.352. The descriptive results indicated that as reflected by a mean of 3.94 and a low standard deviation of 0.357, the respondents agreed that the firm supports the development of prototypes before eventual deployment of products. The descriptive results indicated that as reflected by a mean of 3.96 and a low standard deviation of 0.347, there was an agreement among the respondents with regards to the absorptive capacity in food and beverage manufacturing firms in Kenya. Table 4.10 presents the descriptive results for absorptive capacity in food and beverage manufacturing firms in Kenya.

Table 4.10: Descriptive Results for Absorptive Capacity

Absorptive Capacity	n	Mean	Std. Deviation
The firm collects information about developments in the sub sector through discussions with business stakeholders.	133	3.98	.354
Within the firm, we have sufficient skills to link up with parties who are good in innovations in the sub sector.	133	3.96	.352
The search for relevant information concerning our industry is every-day in the firm.	133	3.97	.348
The firm is always among the first to recognize shifts in technical possibilities in the sub sector.	133	3.96	.361
The firm allocates enough time to deliberate with experts in order to recognize changes in the market early.	133	3.95	.349
The firm translates external information into use for new business applications.	133	3.98	.353
The appropriate use of external information by the firm contributes to profitability.	133	3.93	.352
The firm supports the development of prototypes before eventual deployment of products.	133	3.94	.357
Absorptive Capacity	**133**	**3.96**	**.347**

1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree nor Disagree; 4 = Agree; 5= Strongly Agree

4.6.6 Descriptive Results for Performance of Food and Beverage Manufacturing Firms

On a 5-point Likert scale, the respondents were required to indicate their level of agreement or disagreement with regards to the performance of food and beverage manufacturing firms in Kenya. The descriptive results indicated that as reflected by a mean of 3.93 and a low standard deviation of 0.347, the respondents agreed that relative to the competitors, the firm's return on assets was much better. The descriptive

results indicated that as reflected by a mean of 3.96 and a low standard deviation of 0.349, the respondents agreed that relative to the competitors, the firm has experienced high growth return on assets. The descriptive results indicated that as reflected by a mean of 3.97 and a low standard deviation of 0.343, the respondents agreed that relative to the competitors, the firm's return on equity was much better.

The descriptive results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.355, the respondents agreed that relative to the competitors, the firm's market share position was much better. The descriptive results indicated that as reflected by a mean of 3.99 and a low standard deviation of 0.349, the respondents agreed that relative to the competitors, the firm has experienced high growth market share position. The descriptive results indicated that as reflected by a mean of 3.98 and a low standard deviation of 0.356, the respondents agreed that with green logistics practices, the firm has grown its value-added productivity. The descriptive results indicated that as reflected by a mean of 3.95 and a low standard deviation of 0.348, the respondents agreed that relative to the competitors, the firm's sales revenue growth position was much better.

The descriptive results indicated that as reflected by a mean of 3.99 and a low standard deviation of 0.357, the respondents agreed that relative to the competitors, the firm has experienced high growth sales revenue growth position. The descriptive results indicated that as reflected by a mean of 3.97 and a low standard deviation of 0.339, there was an agreement among the respondents with regards to the performance of food and beverage manufacturing firms in Kenya. Table 4.11 presents the descriptive results for the performance of food and beverage manufacturing firms in Kenya.

Table 4.11: Descriptive Results for Performance of Food and Beverage Manufacturing Firms

Performance of Food and Beverage Manufacturing Firms	n	Mean	Std. Deviation
For the last three years:			
Relative to the competitors, the firm's return on assets was much better.	133	3.93	.347
Relative to the competitors, the firm has experienced high growth return on assets.	133	3.96	.349
Relative to the competitors, the firm's return on equity was much better.	133	3.97	.343
Relative to the competitors, the firm has experienced high growth return on equity.	133	3.98	.355
Relative to the competitors, the firm's market share position was much better.	133	3.99	.349
Relative to the competitors, the firm has experienced high growth market share position.	133	3.98	.356
Relative to the competitors, the firm's sales revenue growth position was much better.	133	3.95	.348
Relative to the competitors, the firm has experienced high growth sales revenue growth position.	133	3.99	.357
Performance of Food and Beverage Manufacturing Firms	**133**	**3.97**	**.339**

1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree nor Disagree; 4 = Agree; 5= Strongly Agree

4.7 Diagnostic Test Results

This section presents the diagnostic test results.

4.7.1 Normality Test Results

The normality test results indicated that as the p-values of the Shapiro-Wilk Kolmogorov-Smirnov test and Shapiro Wilk test were greater than 0.05. The Shapiro-Wilk p-values ranged from 0.819 to 0.897, while the Kolmogorov-Smirnov p-values ranged from 0.090 to 0.200, which were all higher than the threshold value of 0.05.

Therefore, the null hypothesis of normal distribution was not rejected, implying that the data did not significantly deviate from normality and parametric tests could be performed. Generally, if the p-value is greater than 0.05, then the null hypothesis not rejected and parametric tests can be performed (Hair & Alamer, 2022).

Table 4.12 presents the normality test results.

Table 4.12: Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk			
Variable	**Statistic**	**df**	**Sig.**	**Statistic**	**df**	**Sig.**	**Decision**
Reverse Logistics	.154	133	.170	.964	133	.827	Normally Distributed
Green Warehousing	.158	133	.106	.961	133	.819	Normally Distributed
Green Packaging	.128	133	.096	.969	133	.882	Normally Distributed
Green Distribution	.087	133	.200*	.974	133	.897	Normally Distributed
Absorptive Capacity	.093	133	.200*	.973	133	.893	Normally Distributed
Performance of Food and Beverage Manufacturing Firms	.081	133	.090	.965	133	.837	Normally Distributed

a. Lilliefors Significance Correction

*. This a lower bound of the true significance.

4.7.2 Heteroscedasticity Test Results

The heteroscedasticity test results showed that the p-values of Levene's test for all study variables were greater than 0.05, ranging from 0.274 to 0.378. The null hypothesis of equal variances was not rejected, because all the p-values were higher than the threshold value of 0.05. Therefore, the assumption of homoscedasticity was satisfied and there was no evidence of heteroscedasticity in the data. If the p-value of the Levene's test is non-significant ($P > 0.05$), the decision is to fail to reject the null hypothesis, and conclude that the assumption of equal variances is met and can proceed with standard parametric tests (Montero, 2026).

Table 4.13 presents the heteroscedasticity test results.

Table 4.13: Heteroscedasticity Test Results

Variable	Levene's Statistic	df1	df2	sig	Remarks
Reverse Logistics	4.85	1	133	.378	Equal Variance Assumed
Green Warehousing	3.48	1	133	.274	Equal Variance Assumed
Green Packaging	4.64	1	133	.348	Equal Variance Assumed
Green Distribution	3.83	1	133	.318	Equal Variance Assumed
Absorptive Capacity	3.93	1	133	.327	Equal Variance Assumed
Performance of Food and Beverage Manufacturing Firms	4.51	1	133	.335	Equal Variance Assumed

4.7.3 Linearity Test Results

The linearity test results indicated that all the independent variables had positive and significant linear relationships with the performance of food and beverage manufacturing firms in Kenya. Reverse logistics had a moderately strong positive and significant linear relationship with the performance ($r = 0.569$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya. Green warehousing had a strong positive and significant linear relationship with the performance ($r = 0.736$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya. Green packaging had a strong positive and significant linear relationship with the performance ($r = 0.721$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya. Green distribution had a strong positive and significant linear relationship with the performance ($r = 0.705$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya. Absorptive capacity had a moderately strong positive and significant linear relationship with the performance ($r = 0.596$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya. The relationships were statistically significant, confirming that the assumption of linearity was met, because all p-values were lower than 0.05. Table 4.14 presents the linearity test results.

Table 4.14: Linearity Test Results

Variable		X_1	X_2	X_3	X_4	Z	Y
Reverse Logistics (X_1)	Pearson Correlation	1					
	Sig. (2-tailed)						
	n	133					
Green Warehousing (X_2)	Pearson Correlation	.484**	1				
	Sig. (2-tailed)	.000					
	n	133	133				
Green Packaging (X_3)	Pearson Correlation	.308**	.527**	1			
	Sig. (2-tailed)	.000	.000				
	n	133	133	133			
Green Distribution (X_4)	Pearson Correlation	.368**	.522**	.506**	1		
	Sig. (2-tailed)	.000	.000	.000			
	n	133	133	133	133		
Absorptive Capacity (Z)	Pearson Correlation	.256**	.370**	.285**	.455**	1	
	Sig. (2-tailed)	.003	.000	.001	.000		
	n	133	133	133	133	133	
Performance of Food and Beverage Manufacturing Firms (Y)	Pearson Correlation	.569**	.736**	.721**	.705**	.596**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	n	133	133	133	133	133	133

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

4.7.4 Autocorrelation Test Results

The autocorrelation test results indicated that the Durbin-Watson statistic was 2.177. Therefore, there was no severe autocorrelation among the residuals in the dataset, because the statistic falls within the acceptable range of 1.5 to 2.5. Durbin-Watson values between 1.5 and 2.5 indicate absence of serious autocorrelation problems.

Therefore, the autocorrelation assumption was satisfied (Hair Jr *et al.*, 2021; Nguyen, 2026).

Table 4.15 presents the autocorrelation test results.

Table 4.15: Autocorrelation Test Results

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate	Durbin-Watson
1	.893[a]	.798	.792	.168	2.177

a. Predictors: (Constant), Green Distribution, Reverse Logistics, Green Packaging, Green Warehousing

b. Dependent Variable: Performance of Food and Beverage Manufacturing Firms

4.7.4 Multicollinearity Test Results

The multicollinearity test results indicated that the tolerance values for all predictor variables ranged from 0.562 to 0.747, which were higher than the recommended minimum threshold of 0.1. In addition, the variance inflation factor (VIF) values ranged from 1.338 to 1.781, which were lower than the maximum acceptable threshold of 10. These results indicate that there was no severe multicollinearity among the predictor variables. When the VIF values are less than 10 and the tolerance values are greater than 0.1, the assumption of absence multicollinearity is not violated (Hair *et al.*, 2021). Table 4.16 presents the multicollinearity test results.

Table 4.16: Multicollinearity Test Results

Variable	Collinearity Statistics		Decision
	Tolerance	VIF	
Reverse Logistics	.747	1.338	No Multicollinearity
Green Warehousing	.562	1.781	No Multicollinearity
Green Packaging	.649	1.541	No Multicollinearity
Green Distribution	.641	1.560	No Multicollinearity
Absorptive Capacity	.728	1.374	No Multicollinearity

a. Dependent Variable: Performance of Food and Beverage Manufacturing Firms

4.8 Correlation Results

The Pearson's product moment correlation analysis was performed to confirm or deny the relationship between the study variables. The correlation results indicated that reverse logistics had a moderately strong positive and significant relationship with the performance ($r = 0.569$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya. The results showed that green warehousing had a strong positive and significant relationship with the performance ($r = 0.736$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya.

The results indicated that green packaging had a strong positive and significant relationship with the performance ($r = 0.721$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya. The results showed that green distribution had a strong positive and significant relationship with the performance ($r = 0.705$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya. The results indicated that absorptive capacity had a moderately strong positive and significant relationship with the performance ($r = 0.596$, $p \leq 0.05$) of food and beverage manufacturing firms in Kenya.

Table 4.17 presents the correlation results.

Table 4.17: Correlation Results

Variable		X_1	X_2	X_3	X_4	Z	Y
Reverse Logistics (X_1)	Pearson Correlation	1					
	Sig. (2-tailed)						
	n	133					
Green Warehousing (X_2)	Pearson Correlation	.484**	1				
	Sig. (2-tailed)	.000					
	n	133	133				
Green Packaging (X_3)	Pearson Correlation	.308**	.527**	1			
	Sig. (2-tailed)	.000	.000				
	n	133	133	133			
Green Distribution (X_4)	Pearson Correlation	.368**	.522**	.506**	1		
	Sig. (2-tailed)	.000	.000	.000			
	n	133	133	133	133		
Absorptive Capacity (Z)	Pearson Correlation	.256**	.370**	.285**	.455**	1	
	Sig. (2-tailed)	.003	.000	.001	.000		
	n	133	133	133	133	133	
Performance of Food and Beverage Manufacturing Firms (Y)	Pearson Correlation	.569**	.736**	.721**	.705**	.596**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	n	133	133	133	133	133	133

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

4.9 Standard Multiple Regression Results

A standard multiple regression analysis was conducted with performance of food and beverage manufacturing firms as the dependent variable and green distribution, reverse logistics, green warehousing and green packaging as predictor variables.

4.9.1 Model Summary

From the model summary table, the value of coefficient of correlation (R) was 0.893, the value of coefficient of determination (R^2) was 0.798, the value of the adjusted R^2 was 0.792, value of the Std. Error of the Estimate was 0.168, and the value of the Durbin-Watson statistic was 2.177. The R value of 0.893 suggested that there was a strong positive correlation between the green logistics practices and performance of food and beverage manufacturing firms in Kenya. The R^2 value of 0.798 suggested

that the overall multiple regression model as a whole (the model involving constant, reverse logistics, green warehousing, green packaging and green distribution) was able to significantly predict and explain approximately 79.8 % of the variance in performance of food and beverage manufacturing firms in Kenya.

The Adjusted R Square value of 0.792 suggested that the overall multiple regression model as a whole (the model involving constant, reverse logistics, green warehousing, green packaging and green distribution) significantly predicted and explained approximately 79.2% of the variance in performance of food and beverage manufacturing firms in Kenya. The std. error of the estimate value of 0.168 suggested that there could be other factors not included in the model that could also predict and explain the variance in the performance of food and beverage manufacturing firms in Kenya. Subsequently, other factors not included in the model in the current study could predict the remaining 20.8% of the variance in the performance of food and beverage manufacturing firms in Kenya. Therefore, future research is called for to discover the other factors not included in the model in the current study that could predict and explain the remaining variance in the performance of food and beverage manufacturing firms in Kenya.

From the model summary table, the Durbin-Watson test statistic had a value of 2.177, falling within the optimum range of 1.5 to 2.5, suggesting that there was no severe autocorrelation detected in the in the residual values in the datasets. Existent literature posits that the Durbin-Watson statistics falling within the optimum range of 1.5 to 2.5 indicate that there is no severe autocorrelation detected in the in the residual values in the datasets (Hair *et al.*, 2021). Table 4.18 presents the model summary results.

Table 4.18: Model Summary[b]

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate	Durbin-Watson
1	.893[a]	.798	.792	.168	2.177

a. Predictors: (Constant), Green Distribution, Reverse Logistics, Green Packaging, Green Warehousing
b. Dependent Variable: Performance of Food and Beverage Manufacturing Firms

4.9.2 ANOVA

From the ANOVA table results, the overall multiple regression model as a whole (the model involving constant, reverse logistics, green warehousing, green packaging and green distribution), achieved a high degree of fit, as reflected by $R = 0.893$, $R^2 = 0.798$, adj. $R^2 = 0.792$, $F(4, 128) = 126.319$, $p \leq 0.05$. The null hypothesis was that the linear combination of the predictor variables (reverse logistics, green warehousing, green packaging and green distribution) was not able to significantly predict the performance of food and beverage manufacturing firms in Kenya. The alternative hypothesis was that the linear combination of the predictor variables (reverse logistics, green warehousing, green packaging and green distribution) was able to significantly predict the performance of food and beverage manufacturing firms in Kenya.

The results indicated that the model as a whole (the model involving constant, reverse logistics, green warehousing, green packaging and green distribution) as a whole was able to significantly predict the performance of food and beverage manufacturing firms in Kenya. Subsequently, the null hypothesis was rejected in favor of the alternative hypothesis. Therefore, the linear combination of predictor variables (reverse logistics, green warehousing, green packaging and green distribution) was able to significantly predict performance of food and beverage manufacturing firms in Kenya. Table 4.19 presents the ANOVA results.

Table 4.19: ANOVA[a] Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.256	4	3.564	126.319	.000[b]
	Residual	3.612	128	.028		
	Total	17.868	132			

a. Dependent Variable: Performance of Food and Beverage Manufacturing Firms
b. Predictors: (Constant), Green Distribution, Reverse Logistics, Green Packaging, Green Warehousing

4.9.3 Regression Coefficients

From the coefficients table, when the unstandardized regression coefficients (B) were substituted to the multiple regression model specified for the study, the final predictive equation was:

$$Y = 1.314 + 0.123X_1 + 0.171X_2 + 0.190X_3 + 0.192X_4$$

The final predictive equation suggested that holding all factors in to account constant (reverse logistics, green warehousing, green packaging and green distribution, constant at zero, the performance of food and beverage manufacturing firms would be 1.314. The final predictive equation suggested that with all other factors held constant, a unit increase in reverse logistics would lead to 0.123 unit increase in the performance of food and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in green warehousing would lead to 0.171 unit increase in the performance of food and beverage manufacturing firms in Kenya.

The final predictive equation suggested that with all other factors held constant, a unit increase in green packaging would lead to 0.190 unit increase in the performance of food and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in green distribution would lead to 0.192 unit increase in the performance of food and beverage

manufacturing firms in Kenya. Based on the magnitude of the unstandardized regression coefficients (B), green distribution was the best predictor of the variance in the performance of food and beverage manufacturing firms in Kenya.

The regression results indicated that reverse logistics had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_1 = 0.209$; $t = 4.553$; $p \leq 0.05$) in Kenya. The regression results showed that green warehousing had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_2 = 0.295$; $t = 5.557$; $p \leq 0.05$) in Kenya. The regression results indicated that green packaging had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_3 = 0.351$; $t = 7.114$; $p \leq 0.05$) in Kenya.

The regression results indicated that green distribution had a positive and a significant influence on the performance of food and beverage manufacturing firms ($\beta_4 = 0.297$; $t = 5.976$; $p \leq 0.05$) in Kenya. The tolerance values of each of the predictor variables were greater than 0.1, while the variance inflation factors (VIF) values were less than 10, suggesting that there was no severe multicollinearity among the predicator variables. Generally, when the VIF values are less than 10 and the tolerance values are greater than 0.1, the assumption of absence multicollinearity is not violated (Hair *et al.*, 2021). Table 4.20 presents the standard multiple regression coefficients results.

Table 4.20: Regression Coefficients[a] Results

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	1.314	.117		11.191	.000		
	Reverse Logistics	.123	.027	.209	4.553	.000	.747	1.338
	Green Warehousing	.171	.031	.295	5.557	.000	.562	1.781
	Green Packaging	.190	.027	.351	7.114	.000	.649	1.541
	Green Distribution	.192	.032	.297	5.976	.000	.641	1.560

a. Dependent Variable: Performance of Food and Beverage Manufacturing Firms

4.10 Moderated Multiple Regression Results

A hierarchical moderated multiple regressions was used to determine the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. However, prior to the moderation analysis, a composite index (green logistics practices) was computed for the 4 independent variables (reverse logistics, green warehousing, green packaging and green distribution). The composite index (green logistics practices) provided for the different weights associated with the 4 independent variables.

The composite index (green logistics practices) formed the basis for testing the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms, using regression models. The independent variable (green logistics practices) was

interacted with the moderating variable (absorptive capacity) to create an interactive variable (green logistics practices * absorptive capacity). The interactive variable (green logistics practices * absorptive capacity) was then introduced to the model as a moderator. The moderation analysis involved three steps.

In the first step for the moderation analysis, the independent variable (green logistics practices) was regressed on the dependent variable (the performance of food and beverage manufacturing firms). In the second step for the moderation analysis, the independent variable (green logistics practices) and the moderating variable (absorptive capacity) were regressed on the dependent variable (the performance of food and beverage manufacturing firms). In the third step, the independent variable (green logistics practices), the moderating variable (absorptive capacity) and the interaction term (green logistics practices * absorptive capacity) were regressed on the dependent variable (the performance of food and beverage manufacturing firms).

The study set two alternative criteria for determining whether absorptive capacity had a significant the moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. First, if the change in coefficients was significant after introducing the interactive term, then absorptive capacity had a moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. Second, if the change in R^2 from model 1 to Model 3 was significant after introducing the interactive term, then absorptive capacity had a significant the moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya.

4.10.1 Model Summary

From the model summary table, the value of coefficient of determination (R^2) was 0.603, suggesting that model 1 as a whole (the model involving constant, green logistics) was able to significantly predict and explain approximately 60.3% of the variance in performance of food and beverage manufacturing firms in Kenya. The

value of coefficient of determination (R^2) was 0.677, suggesting that model 2 as a whole (the model involving constant, green logistics, absorptive capacity) was able to significantly predict and explain approximately 67.7% of the variance in performance of food and beverage manufacturing firms in Kenya. The value of coefficient of determination (R^2) was 0.761, suggesting that model 3 as a whole (the model involving constant, green logistics, absorptive capacity, green logistics*absorptive capacity) was able to significantly predict and explain approximately 76.1% of the variance in performance of food and beverage manufacturing firms in Kenya. The results indicated that there was a significant R Square Change of .073 and .084, and F change of 29.538 and 45.173 for model 2 and model 3, respectively.

From the model summary table, the Durbin-Watson test statistic had a value of 2.251, falling within the optimum range of 1.5 to 2.5, suggesting that there was no severe autocorrelation detected in the in the residual values in the datasets. Existent literature posits that the Durbin-Watson statistics falling within the optimum range of 1.5 to 2.5 indicate that there is no severe autocorrelation detected in the in the residual values in the datasets (Hair *et al.*, 2021). Table 4.21 presents the model summary results. Table 4.20 presents the model summary results.

Table 4.21: Model Summary[d] Results

					Change Statistics					
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**R Square Change**	**F Change**	**df1**	**df2**	**Sig. F Change**	**Durbin-Watson**
1	.777[a]	.603	.600	.233	.603	199.114	1	131	.000	
2	.823[b]	.677	.672	.211	.073	29.538	1	130	.000	
3	.872[c]	.761	.755	.182	.084	45.173	1	129	.000	2.251

a. Predictors: (Constant), Green Logistics (X)
b. Predictors: (Constant), Green Logistics (X), Absorptive Capacity (Z)
c. Predictors: (Constant), Green Logistics (X), Absorptive Capacity (Z), Green Logistics*Absorptive Capacity (X*Z)
d. Dependent Variable: Performance of Food and Beverage Manufacturing Firms (Y)

4.10.2 ANOVA

From the ANOVA table results, the overall multiple regression model 1 as a whole (the model involving constant, green logistics), achieved a high degree of fit, as reflected by R = 0.777, R^2 = 0.603, adj. R^2 = 0.600, F (1, 131) = 199.114, $p \leq 0.05$. The overall multiple regression model 2 as a whole (the model involving constant, green logistics, absorptive capacity), achieved a high degree of fit, as reflected by R = 0.823, R^2 = 0.677, adj. R^2 = 0.672, F (2, 130) = 136.015, $p \leq 0.05$. The overall multiple regression model 3 as a whole (the model involving constant, green logistics, absorptive capacity, green logistics*absorptive capacity), achieved a high degree of fit, as reflected by R = 0.872, R^2 = 0.761, adj. R^2 = 0.755, F (3, 129) = 136.546, $p \leq 0.05$. Table 4.22 presents the ANOVA results.

Table 4.22: ANOVA[a] Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.777	1	10.777	199.114	.000[b]
	Residual	7.091	131	.054		
	Total	17.868	132			
2	Regression	12.090	2	6.045	136.015	.000[c]
	Residual	5.778	130	.044		
	Total	17.868	132			
3	Regression	13.589	3	4.530	136.546	.000[d]
	Residual	4.279	129	.033		
	Total	17.868	132			

a. Dependent Variable: Performance of Food and Beverage Manufacturing Firms (Y)
b. Predictors: (Constant), Green Logistics (X)
c. Predictors: (Constant), Green Logistics (X), Absorptive Capacity (Z)
d. Predictors: (Constant), Green Logistics (X), Absorptive Capacity (Z), Green Logistics*Absorptive Capacity (X*Z)

4.10.3 Regression Coefficients

From the coefficients table, when the unstandardized regression coefficients (B) were substituted to the multiple regression model 1, the final predictive equation was:

$Y = 3.087 + 0.004X$

The final predictive equation suggested that holding all factors in to account constant (green logistics, constant at zero, the performance of food and beverage manufacturing firms would be 3.087. The final predictive equation suggested that with all other factors held constant, a unit increase in green logistics would lead to 0.004 unit increase in the performance of food and beverage manufacturing firms in Kenya.

From the coefficients table, when the unstandardized regression coefficients (B) were substituted to the multiple regression model 2, the final predictive equation was:

$Y = 2.337 + 0.003X + 0.229Z$

The final predictive equation suggested that holding all factors in to account constant (green logistics, absorptive capacity, constant at zero, the performance of food and beverage manufacturing firms would be 2.337. The final predictive equation suggested that with all other factors held constant, a unit increase in green logistics would lead to 0.003 unit increase in the performance of food and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in absorptive capacity would lead to 0.229 unit increase in the performance of food and beverage manufacturing firms in Kenya.

From the coefficients table, when the unstandardized regression coefficients (B) were substituted to the multiple regression model 3, the final predictive equation was:

$Y = 1.771 + 0.002X + 0.193Z + 0.253X*Z$

The final predictive equation suggested that holding all factors in to account constant (green logistics, absorptive capacity, green logistics*absorptive capacity, constant at zero, the performance of food and beverage manufacturing firms would be 1.771. The final predictive equation suggested that with all other factors held constant, a unit increase in green logistics would lead to 0.002 unit increase in the performance of food

and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in absorptive capacity would lead to 0.193 unit increase in the performance of food and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in green logistics*absorptive capacity would lead to 0.253 unit increase in the performance of food and beverage manufacturing firms in Kenya.

In the first step for the moderation analysis, the independent variable (green logistics practices) was regressed on the dependent variable (the performance of food and beverage manufacturing firms). The regression results indicated that the independent variable (green logistics practices) had positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_5 = 0.777$; $t = 14.111$; $p \leq 0.05$) in Kenya.

In the second step for the moderation analysis, the independent variable (green logistics practices) and the moderating variable (absorptive capacity) were regressed on the dependent variable (the performance of food and beverage manufacturing firms). The regression results indicated that the independent variable (green logistics practices) had positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_6 = 0.644$; $t = 11.608$; $p \leq 0.05$) in Kenya. The regression results showed that the moderating variable (absorptive capacity) had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_7 = 0.302$; $t = 5.435$; $p \leq 0.05$) in Kenya.

In the third step, the independent variable (green logistics practices), the moderating variable (absorptive capacity) and the interaction term (green logistics practices * absorptive capacity) were regressed on the dependent variable (the performance of food and beverage manufacturing firms). The regression results indicated that the independent variable (green logistics practices) had positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_8 = 0.351$; $t = 5.419$; $p \leq 0.05$) in Kenya. The regression results showed that the moderating variable (absorptive capacity) had a positive and significant influence on the performance of

food and beverage manufacturing firms ($\beta_9 = 0.255$; $t = 5.255$; $p \leq 0.05$) in Kenya. The regression results indicated that the interaction term (green logistics practices * absorptive capacity) had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_{10} = 0.429$; $t = 6.721$; $p \leq 0.05$) in Kenya. The regression results showed that absorptive capacity had a positive and significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya.

From the coefficients table, the tolerance values of each of the predictor variables were greater than 0.1, while the variance inflation factors (VIF) values were less than 10, suggesting that there was no severe multicollinearity among the predicator variables. Generally, when the VIF values are less than 10 and the tolerance values are greater than 0.1, the assumption of absence multicollinearity is not violated (Hair *et al.*, 2021). Table 4.23 presents the hierarchical moderated multiple regression coefficients results.

Table 4.23: Regression Coefficients[a] Results

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	3.087	.058		52.920	.000		
	Green Logistics (X)	.004	.000	.777	14.111	.000	1.000	1.000
2	(Constant)	2.337	.148		15.820	.000		
	Green Logistics (X)	.003	.000	.644	11.608	.000	.807	1.238
	Absorptive Capacity (Z)	.229	.042	.302	5.435	.000	.277	3.615
3	(Constant)	1.771	.153		11.575	.000		
	Green Logistics (X)	.002	.000	.351	5.419	.000	.442	2.262
	Absorptive Capacity (Z)	.193	.037	.255	5.255	.000	.288	3.475
	Green Logistics*Absorptive Capacity (X*Z)	.253	.038	.429	6.721	.000	.456	2.194

a. Dependent Variable: Performance of Food and Beverage Manufacturing Firms (Y)

4.11 Optimal Model

The optimal model illustrates that the performance of food and beverage manufacturing firms is conceptualized as the dependent variable. Reverse logistics, green warehousing, green packaging and green distribution are conceptualized as the independent variables. However, absorptive capacity is conceptualized as the moderating variable. A standard multiple regression analysis was conducted with performance of food and beverage manufacturing firms as the dependent variable and green distribution, reverse logistics, green warehousing and green packaging as predictor variables.

The regression results indicated that reverse logistics had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_1 = 0.209$; $t = 4.553$; $p \leq 0.05$) in Kenya. The regression results showed that green warehousing had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_2 = 0.295$; $t = 5.557$; $p \leq 0.05$) in Kenya. The regression results indicated that green packaging had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_3 = 0.351$; $t = 7.114$; $p \leq 0.05$) in Kenya. The regression results indicated that green distribution had a positive and a significant influence on the performance of food and beverage manufacturing firms ($\beta_4 = 0.297$; $t = 5.976$; $p \leq 0.05$) in Kenya. The final predictive equation was:

$$Y = 1.314 + 0.123X_1 + 0.171X_2 + 0.190X_3 + 0.192X_4$$

The final predictive equation suggested that holding all factors in to account constant (reverse logistics, green warehousing, green packaging and green distribution, constant at zero, the performance of food and beverage manufacturing firms would be 1.314. The final predictive equation suggested that with all other factors held constant, a unit increase in reverse logistics would lead to 0.123 unit increase in the performance of food and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in green warehousing would lead to 0.171 unit increase in the performance of food and beverage

manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in green packaging would lead to 0.190 unit increase in the performance of food and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in green distribution would lead to 0.192 unit increase in the performance of food and beverage manufacturing firms in Kenya. Based on the magnitude of the unstandardized regression coefficients (B), green distribution was the best predictor of the variance in the performance of food and beverage manufacturing firms in Kenya.

A hierarchical moderated multiple regressions was used to determine the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. In the first step for the moderation analysis, the independent variable (green logistics practices) was regressed on the dependent variable (the performance of food and beverage manufacturing firms). The regression results indicated that (green logistics practices) had positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_5 = 0.777$; $t = 14.111$; $p \leq 0.05$) in Kenya. The final predictive equation was:

$$Y = 3.087 + 0.004X$$

The final predictive equation suggested that holding all factors in to account constant (green logistics, constant at zero, the performance of food and beverage manufacturing firms would be 3.087. The final predictive equation suggested that with all other factors held constant, a unit increase in green logistics would lead to 0.004 unit increase in the performance of food and beverage manufacturing firms in Kenya.

In the second step for the moderation analysis, the independent variable (green logistics practices) and the moderating variable (absorptive capacity) were regressed on the dependent variable (the performance of food and beverage manufacturing firms). The regression results indicated that the independent variable (green logistics practices) had positive and significant influence on the performance of food and

beverage manufacturing firms (β_6 = 0.644; t = 11.608; $p \leq 0.05$) in Kenya. The regression results showed that the moderating variable (absorptive capacity) had a positive and significant influence on the performance of food and beverage manufacturing firms (β_7 = 0.302; t = 5.435; $p \leq 0.05$) in Kenya. The final predictive equation was:

$$Y = 2.337 + 0.003X + 0.229Z$$

The final predictive equation suggested that holding all factors in to account constant (green logistics, absorptive capacity, constant at zero, the performance of food and beverage manufacturing firms would be 2.337. The final predictive equation suggested that with all other factors held constant, a unit increase in green logistics would lead to 0.003 unit increase in the performance of food and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in absorptive capacity would lead to 0.229 unit increase in the performance of food and beverage manufacturing firms in Kenya.

In the third step for the moderation analysis, the independent variable (green logistics practices), the moderating variable (absorptive capacity) and the interaction term (green logistics practices * absorptive capacity) were regressed on the dependent variable (the performance of food and beverage manufacturing firms). The regression results indicated that the independent variable (green logistics practices) had positive and significant influence on the performance of food and beverage manufacturing firms (β_8 = 0.351; t = 5.419; $p \leq 0.05$) in Kenya. The regression results showed that the moderating variable (absorptive capacity) had a positive and significant influence on the performance of food and beverage manufacturing firms (β_9 = 0.255; t = 5.255; $p \leq 0.05$) in Kenya. The regression results indicated that the interaction term (green logistics practices * absorptive capacity) had a positive and significant influence on the performance of food and beverage manufacturing firms (β_{10} = 0.429; t = 6.721; $p \leq 0.05$) in Kenya. The regression results showed that absorptive capacity had a positive and significant moderating influence on the relationship between green

logistics practices and the performance of food and beverage manufacturing firms in Kenya. The final predictive equation was:

$$Y = 1.771 + 0.002X + 0.193Z + 0.253X*Z$$

The final predictive equation suggested that holding all factors in to account constant (green logistics, absorptive capacity, green logistics*absorptive capacity, constant at zero, the performance of food and beverage manufacturing firms would be 1.771. The final predictive equation suggested that with all other factors held constant, a unit increase in green logistics would lead to 0.002 unit increase in the performance of food and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in absorptive capacity would lead to 0.193 unit increase in the performance of food and beverage manufacturing firms in Kenya. The final predictive equation suggested that with all other factors held constant, a unit increase in green logistics*absorptive capacity would lead to 0.253 unit increase in the performance of food and beverage manufacturing firms in Kenya.

Figure 4.1 presents the optimal model.

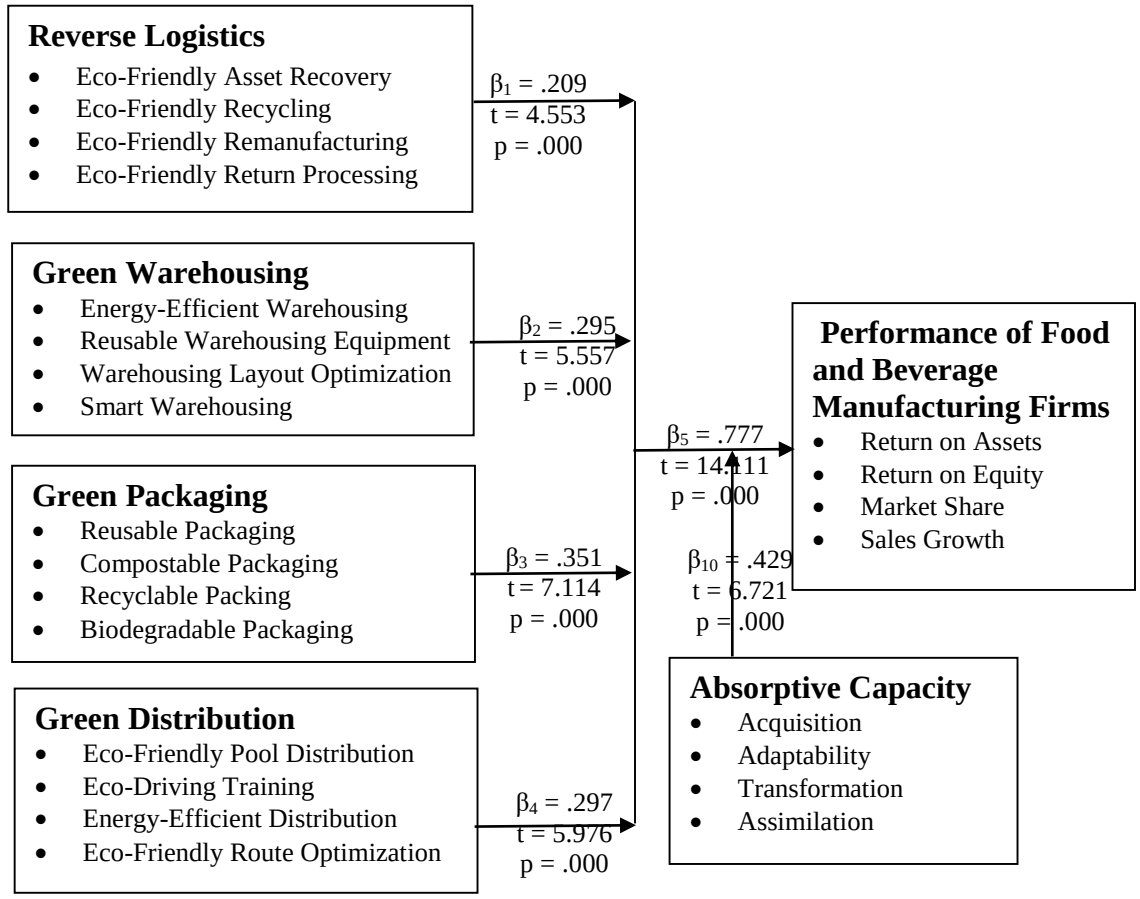

Figure 4.1: Optimal Model

4.12 Hypotheses Test Results

In this study, 5 null hypotheses were tested at 5% level of significance ($\alpha = 0.05$; $t = 1.960$) and 95% confidence level to statistically help draw acceptable and realistic inferences. Therefore, the decision rule was to reject the H_0i if the $P \leq 0.05$, and otherwise fail to reject the H_0i if the $P > 0.05$.

4.12.1 Hypothesis One Test Results

The $H_0$1 predicted that that reverse logistics has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The decision rule was to reject the $H_0$1 if the $\beta_1 \neq 0$, $t \geq 1.960$, $P \leq 0.05$, and otherwise fail to reject the $H_0$1 if the $\beta_1 = 0$, $t < 1.960$, $P > 0.05$. The regression results indicated that reverse logistics had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_1 = 0.209$; $t = 4.553$; $p \leq 0.05$) in Kenya. The $H_0$1 was rejected, providing the empirical support for $H_1$1. Therefore, reverse logistics has a significant influence on the performance of food and beverage manufacturing firms in Kenya.

4.12.2 Hypothesis Two Test Results

The $H_0$2 predicted that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The decision rule was to reject the $H_0$2 if the $\beta_2 \neq 0$, $t \geq 1.960$, $P \leq 0.05$, and otherwise fail to reject the $H_0$2 if the $\beta_2 = 0$, $t < 1.960$, $P > 0.05$. The regression results showed that green warehousing had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_2 = 0.295$; $t = 5.557$; $p \leq 0.05$) in Kenya. The $H_0$2 was rejected, providing the empirical support for $H_1$2. Therefore, green warehousing has a significant influence on the performance of food and beverage manufacturing firms in Kenya.

4.12.3 Hypothesis Three Test Results

The $H_0$3 predicted that green packaging has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The decision rule was to reject the $H_0$3 if the $\beta_3 \neq 0$, $t \geq 1.960$, $P \leq 0.05$, and otherwise fail to reject the $H_0$3 if the $\beta_3 = 0$, $t < 1.960$, $P > 0.05$. The regression results indicated that green packaging had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_3 = 0.351$; $t = 7.114$; $p \leq 0.05$) in Kenya. The $H_0$3 was rejected, providing the empirical support for $H_1$3. Therefore, green packaging has a

significant influence on the performance of food and beverage manufacturing firms in Kenya.

4.12.4 Hypothesis Four Test Results

The $H_0$4 predicted that green distribution has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The decision rule was to reject the $H_0$4 if the $\beta_4 \neq 0$, $t \geq 1.960$, $P \leq 0.05$, and otherwise fail to reject the $H_0$4 if the $\beta_4 = 0$, $t < 1.960$, $P > 0.05$. The regression results indicated that green distribution had a positive and a significant influence on the performance of food and beverage manufacturing firms ($\beta_4 = 0.297$; $t = 5.976$; $p \leq 0.05$) in Kenya. The $H_0$4 was rejected, providing the empirical support for $H_1$4. Therefore, green distribution has a significant influence on the performance of food and beverage manufacturing firms in Kenya.

4.12.5 Hypothesis Five Test Results

The ($H_0$5) predicted that absorptive capacity has no significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The decision rule was to reject the $H_0$5 if the $\beta_4 \neq 0$, $t \geq 1.960$, $P \leq 0.05$, and otherwise fail to reject the $H_0$5 if the $\beta_4 = 0$, $t < 1.960$, $P > 0.05$. A hierarchical moderated multiple regressions was used to determine the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya.

In the first step for the moderation analysis, the independent variable (green logistics practices) was regressed on the dependent variable (the performance of food and beverage manufacturing firms). The regression results indicated that the independent variable (green logistics practices) had positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_5 = 0.777$; $t = 14.111$; $p \leq 0.05$) in Kenya. The regression results suggested that there was a positive and significant relationship between green logistics practices and the relationship between

green logistics practices and the performance of food and beverage manufacturing firms that could be moderated by absorptive capacity.

In the second step for the moderation analysis, the independent variable (green logistics practices) and the moderating variable (absorptive capacity) were regressed on the dependent variable (the performance of food and beverage manufacturing firms). The regression results indicated that the independent variable (green logistics practices) had positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_6 = 0.644$; $t = 11.608$; $p \leq 0.05$) in Kenya. The regression results showed that the moderating variable (absorptive capacity) had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_7 = 0.302$; $t = 5.435$; $p \leq 0.05$) in Kenya. The regression results suggested that absorptive capacity could moderate the positive and significant relationship between green logistics practices and the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya.

In the third step, the independent variable (green logistics practices), the moderating variable (absorptive capacity) and the interaction term (green logistics practices * absorptive capacity) were regressed on the dependent variable (the performance of food and beverage manufacturing firms). The regression results indicated that the independent variable (green logistics practices) had positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_8 = 0.351$; $t = 5.419$; $p \leq 0.05$) in Kenya. The regression results showed that the moderating variable (absorptive capacity) had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_9 = 0.255$; $t = 5.255$; $p \leq 0.05$) in Kenya. The regression results showed that the interaction term (green logistics practices * absorptive capacity) had a positive and significant influence on the performance of food and beverage manufacturing firms ($\beta_{10} = 0.429$; $t = 6.721$; $p \leq 0.05$) in Kenya. The results suggested that absorptive capacity had a positive and significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The $H_0$5 was

rejected, providing the empirical support for $H_1$5. Therefore, absorptive capacity has a significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya.

Table 4.24 presents the hypotheses test results.

Table 4.24: Hypotheses Test Results

Hypothesis		Path	β	t	Sig.	Decision
$H_0$1:	Reverse logistics has no significant influence on performance of food and beverage manufacturing firms in Kenya.	$X_1 \rightarrow Y$	.209	4.553	.000	Reject the $H_0$1
$H_0$2:	Green warehousing has no significant influence on firm performance of food and beverage manufacturing companies in Kenya.	$X_2 \rightarrow Y$	.295	5.557	.000	Reject the $H_0$2
$H_0$3:	Green packaging has no significant influence on performance of food and beverage manufacturing firms in Kenya.	$X_3 \rightarrow Y$	.351	7.114	.000	Reject the $H_0$3
$H_0$4:	Green distribution has no significant influence on firm performance of food and beverage manufacturing companies in Kenya.	$X_4 \rightarrow Y$	.297	5.976	.000	Reject the $H_0$4
$H_0$5:	Absorptive capacity has no significant moderating influence on green logistics practices and firm performance of food and beverage manufacturing companies in Kenya.	(Constant)		52.920	.000	Reject the $H_0$5
		$X \rightarrow Y$	.777	14.111	.000	
		(Constant)		15.820	.000	
		$X \rightarrow Y$	.644	11.608	.000	
		$Z \rightarrow Y$	.302	5.435	.000	
		(Constant)		11.575	.000	
		$X \rightarrow Y$	.351	5.419	.000	
		$Z \rightarrow Y$	.255	5.255	.000	
		$X*Z \rightarrow Y$	.429	6.721	.000	

a. Dependent Variable: Performance of Food and Beverage Manufacturing Firms (Y)
b. Predictors: (Constant), Green Logistics (X)
c. Predictors: (Constant), Green Logistics (X), Absorptive Capacity (Z)
d. Predictors: (Constant), Green Logistics (X), Absorptive Capacity (Z), Green Logistics*Absorptive Capacity (X*Z)

4.13 Discussion of Key Findings

The purpose of this study was to examine the influence of green logistics practices on the performance of food and beverage manufacturing firms in Kenya. Specifically, the research examined the influence of reverse logistics, green warehousing, green packaging and green distribution on the performance of food and beverage manufacturing firms in Kenya. Additionally, the study examined the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The Pearson's product moment correlation analysis was performed to confirm or deny the relationship between the study variables. The correlation results indicated that green logistics practices had positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya.

A standard multiple regression analysis was conducted with the performance as the dependent variable and green distribution, reverse logistics, green warehousing and green packaging as predictor variables. The regression results indicated that green logistics practices had positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The findings are consistent with the results of prior studies (Daniel, 2023; Jayarathna *et al.*, 2024; Verma, 2024). The results are in line with the results of previous research (Gikonyo, 2023) which revealed that green logistics had a positive and significant influence on the performance of building and construction manufacturing firms in Kenya. The findings are consistent with the results of prior research (Odock, Mutua, Ndungu, & Mwangi, 2024) which revealed that green logistics practices had a positive and significant influence on the performance of environmental performance of logistics firms in Kenya. However, the findings are inconsistent with the results of some prior research (Agyabeng-Mensah *et al.*, 2021) that indicated that green logistics practices negatively influence business performance.

The first research objective sought to examine the influence of reverse logistics on the performance of food and beverage manufacturing firms in Kenya. The $H_0$1 predicted that that reverse logistics has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results indicated that reverse logistics had a moderately strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that reverse logistics had a positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0$1 was rejected, providing the empirical support for $H_1$1. Therefore, reverse logistics has a significant influence on the performance of food and beverage manufacturing firms in Kenya. The findings are consistent with the results of past studies (Akpevwe & Kaine, 2023; Dabees *et al.*, 2024). The results are in harmony with the findings of previous studies (Kariuki, 2023; Kenei & Wachiuri, 2024; Mungazu, 2023; Khan *et al.*, 2024). The findings are in line with the results of prior studies (Nazir *et al.*, 2024; Thiga *et al.*, 2023; Thiro *et al.*, 2023). The results are consistent with the results of previous research (Gikonyo, 2023) which indicated that reverse logistics had a positive and significant influence on the performance of building and construction manufacturing firms in Kenya. The findings are consistent with the results of past research (Kamanga, 2024) which revealed that reverse logistics practices had positive and significant influence on the performance of large manufacturing firms in Kenya.

The second research objective sought to examine the influence of green warehousing on the performance of food and beverage manufacturing firms in Kenya. The $H_0$2 predicted that that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results showed that green warehousing had a strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results showed that green warehousing had a positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0$2 was rejected, providing the empirical support for $H_1$2. Therefore, green warehousing has a significant influence on the performance of food and beverage manufacturing firms in Kenya. The findings are consistent with the results of prior studies (Alvarenga *et al.*,

2023; Nzuma & Ndeto, 2023; Wahyuni *et al.*, 2024). The results are in line with the results of previous research (Gikonyo, 2023) which indicated that reverse logistics had a positive and significant influence on the performance of building and construction manufacturing firms in Kenya. However, the results are inconsistent with the results of previous research (Visamitanan & Assarut, 2021), which indicated that green manufacturing had a negative effect on firm performance.

The third research objective sought to examine the influence of green packaging on the performance of food and beverage manufacturing firms in Kenya. The $H_0 3$ predicted that that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results indicated that green packaging had a strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that green packaging had a positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0 3$ was rejected, providing the empirical support for $H_1 3$. Therefore, green packaging has a significant influence on the performance of food and beverage manufacturing firms in Kenya. The results are in line with the results of prior studies (Jepchumba *et al.*, 2022; Mungazu, 2023; Thiga *et al.*, 2023). The results are consistent with the results of previous studies (Gikonyo *et al.*, 2022b; Gikonyo, 2023) which revealed that green packaging had a positive and significant influence on the performance of building and construction manufacturing firms in Kenya. The findings are consistent with the results of previous studies (Kariuki *et al.*, 2022; Kariuki, 2023) which indicated that green packaging had a positive and significant influence on the performance of horticultural firms in Kenya.

The fourth research objective sought to examine the influence of green distribution on the performance of food and beverage manufacturing firms in Kenya. The $H_0 4$ predicted that that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results showed that green distribution had a strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression

results indicated that green distribution had a positive and a significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0$4 was rejected, providing the empirical support for $H_1$4. Therefore, green distribution has a significant influence on the performance of food and beverage manufacturing firms in Kenya. The findings are consistent with the results of prior studies (Auko, 2023; Gikonyo, 2023; Kariuki, 2023; Kariuki *et al.*, 2022; Kurgat & Kyule (2024). The results are consistent with the results of previous studies (Gikonyo *et al.*, 2022a; Gikonyo, 2023) which indicated that green distribution had a positive and significant influence on the performance of building and construction manufacturing firms in Kenya.

The fifth research objective sought to examine the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The $H_0$5 predicted that that absorptive capacity has no significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The hierarchical moderated regression results indicated that absorptive capacity had a positive and significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The $H_0$5 was rejected, providing the empirical support for $H_1$5. Therefore, absorptive capacity has a significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The findings are consistent with the results of prior studies (Asamoah *et al.*, 2024; Salam & Bajaba, 2023). The results are consistent with the results of prior research (Kamanga, 2024) which revealed that value addition had a significant moderating influence on the relationship between sustainable supply chain management practices on the performance of horticultural firms in Kenya.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the study findings, conclusions, and recommendations based on the research objectives. The summary highlights the key results obtained from the analysis of green logistics practices, absorptive capacity, and firm performance in the food and beverage manufacturing sector in Kenya. The chapter also provides conclusions drawn from the study findings and offers recommendations for managerial practice, policy development, and future research.

5.2 Summary of the Major Findings

The purpose of this study was to examine the influence of green logistics practices on the performance of food and beverage manufacturing firms in Kenya. Specifically, the research examined the influence of reverse logistics, green warehousing, green packaging and green distribution on the performance of food and beverage manufacturing firms in Kenya. Additionally, the study examined the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya.

The Pearson's product moment correlation analysis was performed to confirm or deny the relationship between the study variables. The correlation results indicated that green logistics practices had positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. A standard multiple regression analysis was conducted with the performance as the dependent variable and reverse logistics, green warehousing, green packaging and green distribution as predictor variables. The regression results indicated that green logistics practices had positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya.

5.2.1 Reverse Logistics and Performance of Food and Beverage Manufacturing Firms

The first research objective sought to examine the influence of reverse logistics on the performance of food and beverage manufacturing firms in Kenya. The $H_0 1$ predicted that that reverse logistics has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results indicated that reverse logistics had a moderately strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that reverse logistics had a positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0 1$ was rejected, providing the empirical support for $H_1 1$. Therefore, reverse logistics has a significant influence on the performance of food and beverage manufacturing firms in Kenya.

5.2.2 Green Warehousing Practices and Performance of Food and Beverage Manufacturing Firms

The second research objective sought to examine the influence of green warehousing on the performance of food and beverage manufacturing firms in Kenya. The $H_0 2$ predicted that that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results showed that green warehousing had a strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results showed that green warehousing had a positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0 2$ was rejected, providing the empirical support for $H_1 2$. Therefore, green warehousing has a significant influence on the performance of food and beverage manufacturing firms in Kenya.

5.2.3 Green Packaging Practices and Performance of Food and Beverage Manufacturing Firms

The third research objective sought to examine the influence of green packaging on the performance of food and beverage manufacturing firms in Kenya. The $H_0$3 predicted that that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results indicated that green packaging had a strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that green packaging had a positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0$3 was rejected, providing the empirical support for $H_1$3. Therefore, green packaging has a significant influence on the performance of food and beverage manufacturing firms in Kenya.

5.2.4 Green Distribution and Performance of Food and Beverage Manufacturing Firms

The fourth research objective sought to examine the influence of green distribution on the performance of food and beverage manufacturing firms in Kenya. The $H_0$4 predicted that that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results showed that green distribution had a strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that green distribution had a positive and a significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0$4 was rejected, providing the empirical support for $H_1$4. Therefore, green distribution has a significant influence on the performance of food and beverage manufacturing firms in Kenya.

5.2.5 Moderating Influence of Absorptive Capacity on the Relationship Between Green Logistics Practices and Performance of Food and Beverage Manufacturing Firms

The fifth research objective sought to examine the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The $H_0$5 predicted that that absorptive capacity has no significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The hierarchical moderated regression results indicated that absorptive capacity had a positive and significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The $H_0$5 was rejected, providing the empirical support for $H_1$5. Therefore, absorptive capacity has a significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya.

5.2 Conclusions

The purpose of this study was to examine the influence of green logistics practices on the performance of food and beverage manufacturing firms in Kenya. Specifically, the research examined the influence of reverse logistics, green warehousing, green packaging and green distribution on the performance of food and beverage manufacturing firms in Kenya. Additionally, the study examined the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya.

The Pearson's product moment correlation analysis was performed to confirm or deny the relationship between the study variables. The correlation results indicated that green logistics practices had positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. A standard multiple regression analysis was conducted with the performance of food and beverage manufacturing firms as the dependent variable and green distribution, reverse logistics, green

warehousing and green packaging as predictor variables. The regression results indicated that green logistics practices had positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. Therefore, the conclusion was that green logistics practices positively and significantly influence on the performance of food and beverage manufacturing firms.

5.3.1 Reverse Logistics and Performance of Food and Beverage Manufacturing Firms

The first research objective sought to examine the influence of reverse logistics on the performance of food and beverage manufacturing firms in Kenya. The $H_0$1 predicted that that reverse logistics has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results indicated that reverse logistics had a moderately strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that reverse logistics had a positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0$1 was rejected, providing the empirical support for $H_1$1. Therefore, the first conclusion was that reverse logistics has a significant influence on the performance of food and beverage manufacturing firms.

5.3.2 Green Warehousing Practices and Performance of Food and Beverage Manufacturing Firms

The second research objective sought to examine the influence of green warehousing on the performance of food and beverage manufacturing firms in Kenya. The $H_0$2 predicted that that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results showed that green warehousing had a strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results showed that green warehousing had a positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0$2 was

rejected, providing the empirical support for $H_1$2. Therefore, the second conclusion was that green warehousing has a significant influence on the performance of food and beverage manufacturing firms.

5.3.3 Green Packaging Practices and Performance of Food and Beverage Manufacturing Firms

The third research objective sought to examine the influence of green packaging on the performance of food and beverage manufacturing firms in Kenya. The $H_0$3 predicted that that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results indicated that green packaging had a strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that green packaging had a positive and significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0$3 was rejected, providing the empirical support for $H_1$3. Therefore, the third conclusion was that green packaging has a significant influence on the performance of food and beverage manufacturing firms.

5.3.4 Green Distribution and Performance of Food and Beverage Manufacturing Firms

The fourth research objective sought to examine the influence of green distribution on the performance of food and beverage manufacturing firms in Kenya. The $H_0$4 predicted that that green warehousing has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The correlation results showed that green distribution had a strong positive and significant relationship with the performance of food and beverage manufacturing firms in Kenya. The regression results indicated that green distribution had a positive and a significant influence on the performance of food and beverage manufacturing firms in Kenya. The $H_0$4 was rejected, providing the empirical support for $H_1$4. Therefore, the fourth conclusion was that green distribution has a significant influence on the performance of food and beverage manufacturing firms.

5.3.5 Moderating Influence of Absorptive Capacity on the Relationship Between Green Logistics Practices and Performance of Food and Beverage Manufacturing Firms

The fifth research objective sought to examine the moderating influence of absorptive capacity on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The $H_0 5$ predicted that that absorptive capacity has no significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The hierarchical moderated regression results indicated that absorptive capacity had a positive and significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms in Kenya. The $H_0 5$ was rejected, providing the empirical support for $H_1 5$. Therefore, the fifth conclusion was that absorptive capacity has a significant moderating influence on the relationship between green logistics practices and the performance of food and beverage manufacturing firms.

5.4 Recommendations

This section presents the managerial recommendations, policy recommendations and areas for further research.

5.4.1 Managerial Recommendations

The study recommends that the managers and practitioners should conduct a holistic reassessment and implementation of green logistics practices tailored to the unique dynamics of the food and beverage sub sector to enhance the performance of the food and beverage manufacturing firms. First, managers and practitioners should redesign the reverse logistics processes for handling returns, waste, and recycling to improve the performance of the food and beverage manufacturing firms. Second, managers and practitioners should implement green warehousing placing a renewed focus on eco-friendly storage solutions, energy-efficient lighting, and sustainable inventory management to foster the performance of the food and beverage manufacturing firms.

Third, managers and practitioners should adopt green packaging placing a renewed focus on sustainable, recyclable, or biodegradable materials that align with industry safety standards to enhance the performance of the food and beverage manufacturing firms. Fourth, managers and practitioners should conduct a holistic reassessment and implementation of the green distribution while optimizing transportation routes and adopting eco-friendly transport methods to reduce carbon footprints to foster the performance of the food and beverage manufacturing firms.

5.4.2 Policy Recommendations

The study recommends that policymakers should strengthen the regulatory and institutional framework guiding the adoption of green logistics practices by developing clear implementation guidelines that support practical adoption within manufacturing firms. First, policymakers should establish clear operational guidelines on reverse logistics, particularly on waste take-back systems, recycling standards, and safe disposal mechanisms, to enhance firm performance in the food and beverage manufacturing sector. Second, policymakers should develop specific energy-efficiency and sustainability implementation frameworks for green warehousing, including standards for energy use, storage emissions reduction, and adoption of eco-friendly warehouse technologies. Third, there is need for policy guidelines that promote the use of sustainable packaging materials by setting minimum standards for recyclable, biodegradable, and environmentally safe packaging within manufacturing operations. Fourth, policymakers should provide clear implementation frameworks for green distribution, including guidance on route optimization, emissions reduction targets, and promotion of low-carbon transport systems. Finally, policies should incorporate clear provisions that promote absorptive capacity development by encouraging firms to invest in training, knowledge sharing, and innovation systems that enhance their ability to adopt and integrate green logistics practices effectively.

5.5 Areas for Further Research

The study provides significant insights into to our understanding of the influence of green logistics practices on firm performance and the moderating influence of absorptive capacity in that relationship. However, the limitations suggest several intriguing paths for future research. First, as the study focused on only four green logistics practices, future research should broaden the scope to include additional green logistics practices for a more comprehensive analysis. Second, as the study was confined to the food and beverage manufacturing sub sector, replication across various manufacturing sub sectors would enhance the generalizability of findings. Third, as the study focused on the manufacturing sector, future studies should consider examining the influence of green logistics practices on firm performance in other sectors to diversify the scope of research. Fifth, as the study relied on a cross-sectional survey approach, future researchers should consider utilizing the longitudinal survey approach to understand the influence of green logistics practices on firm performance over a period to time. Finally, given the predominantly quantitative nature of this study, future research could incorporate qualitative methodologies to provide a more holistic understanding of the dynamics between green logistics practices and firm performance.

REFERENCES

Abade, A., Noor, I. S., Namusonge, E., & Wachiuri, E. (2024). Supply chain automation on performance of food and beverage manufacturing firms in Kenya. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME)*, *8*(1), 308-328.

Abbas, T. M., & Hussien, F. M. (2021). The effects of green supply chain management practices on firm performance: Empirical evidence from restaurants in Egypt. *Tourism and Hospitality Research*, *21*(3), 358-373.

Abudetse, R. K., & Sikalumbi, D. A. (2025). Leadership styles and open innovation in higher education: A theoretical review of employee absorptive capacity and performance in colleges of education in Ghana. *Journal for Business, Development and Leadership*, *1*(2957-7136).

Adhiambo, R. M., & Osoro, A. (2024). Supply chain scalability and performance of large food and beverage processors in Nairobi City County, Kenya. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME)*, *8*(2), 175-188.

Adıgüzel, S. (2024). Green logistics: A bibliometric analysis of the concept scanned in web of science in the period 1980-2024. *European Journal of Studies in Management and Business*, *30*(1), 76-95. doi.org/10.32038/mbrq.2024.30.05

Agyabeng-Mensah, Y., Afum, E., Acquah, I. S. K., Dacosta, E., Baah, C., & Ahenkorah, E. (2021). The role of green logistics management practices, supply chain traceability and logistics ecocentricity in sustainability performance. *The International Journal of Logistics Management*, *32*(2), 538-566.

Agyabeng-Mensah, Y., & Tang, L. (2021). The relationship among green human capital, green logistics practices, green competitiveness, social performance and financial performance. *Journal of Manufacturing Technology Management*, *32*(7), 1377-1398.

Ahlawat, S. (2025). Linear regression. In *Statistical Quantitative Methods in Finance: From Theory to Quantitative Portfolio Management* (pp. 3-40). Berkeley, CA: Apress.

Ahmed, S., Ahsan, N., Alam, S. S., & Kokash, H. A. (2025). Advancing circular economy implementation in Malaysian SMEs: The role of financial resources, operational alignment, and absorptive capacity. *Circular Economy and Sustainability*, *5*(4), 2843-2871.

Akpevwe, O. S., & Kaine, F. O. (2023). Effect of green supply chain management on marketing performance of Unilever Nigeria PLC. *Innovations*, *74*(1), 1543-1561.

Al Masri, R., & Wimanda, E. (2024). The role of green supply chain management in corporate sustainability performance. *Journal of Energy and Environmental Policy Options*, *7*(2), 1-9.

Alharasis, E. E., Alshdaifat, S. M., & Ab Aziz, N. H. (2026). Bridging power and policy: political connections as moderators of CEO traits and ESG disclosure - A resource dependence and upper echelons perspective. *Corporate Social Responsibility and Environmental Management*, *33*(1), 1300-1319.

Alkhuzaim, L., Kouhizadeh, M., & Sarkis, J. (2022). Resource and natural resource dependence theories in supply chains. In *Handbook of theories for purchasing, supply chain and management research* (pp. 153-167). Edward Elgar Publishing.

Amjad, A., Abbass, K., Hussain, Y., Khan, F., & Sadiq, S. (2022). Effects of the green supply chain management practices on firm performance and sustainable development. *Environmental Science and Pollution Research, 29*(44), 66622-66639.

Alvarenga, T. H. P., Rodriguez, C. M. T., Peña-Montoya, C. C., Sartori, S., & Oliveira, R. R. (2023). Institutional pressures, green logistics activities and efficiency performance: a survey with logistics service providers in Brazil. *Journal of applied research and technology, 21*(2), 265-280.

Álvarez-Torres, F. J., Schiuma, G., & López-Torres, G. C. (2024). Collaborative managers' networks and a multidimensional approach to SMEs' firm performance: A framework for measuring manager dynamics. *International Journal of Electronic Trade, 1*(2), 159-183.

Arndt, F., Aharonson, B., Jansen, J., Jiang, J., & Ting, C. (2023). The past and future of absorptive capacity. *Academy of Management Collections*, *2*(4), 45-59.

Arroyo, L. Á. B., Barreto, C. A. D. L. S., Vasquez, O. B. S., & Nicola, R. J. V. (2023). The importance of reverse logistics and green logistics for sustainability in supply chains. *Journal of business and entrepreneurial studie*, *7*(4), 46-72.

Arumugam, R. (2026). Leveraging correlation analysis for effective feature selection in AI model development. *AI Trust, Risk, and Security Management: Framework, Principles, and Practices*, 43-71.

Asamoah, D., Acquah, I. N., Nuertey, D., Agyei-Owusu, B., & Kumi, C. A. (2024). Unpacking the role of green absorptive capacity in the relationship between green supply chain management practices and firm performance. *Benchmarking: An International Journal, 31*(8), 2793-2818. doi.org/10.1108/IJPPM-09-2023-0455

Asante-Darko, D., & Osei, V. (2024). Sustainable supply chain management practices and firm performance: the mediating effect of firm capabilities. *Management of Environmental Quality: An International Journal*, *35*(4), 751-779.

Auko, M. O. C. (2023). *Green supply chain management practices and organizational competitiveness of commercial state corporations in Kenya.* Unpublished PhD Thesis, Nairobi: UON.

Aziz, M. A. (2023). The impact of green supply chain management practices on organizational performance. *ADRRI Journal of Procurement, Logistics and Supply Chain Management*, *1*(1 (1) October-December), 1-19.

Azman, A. B., & Majid, M. A. A. (2026). Testing the waters: Insights from our pilot interview study. *Electronic Journal of Business Research Methods*, *24*(1), 1-12.

Benjamin, A., Shee, H., & de Vass, T. (2023). Sequential impact of green supply chain initiatives on sustainable performance: food and beverage processing SMEs in Australia. *Operations and Supply Chain Management: An International Journal*, *16*(2), 214-228.

Bergmann, J. (2023). Research philosophy, methodological implications, and research design. In *At Risk of Deprivation: The Multidimensional Well-Being Impacts of Climate Migration and Immobility in Peru* (pp. 57-89). Wiesbaden: Springer Fachmedien Wiesbaden.

Bharti, M., Baswaraju, S., Nijhawan, G., Sharma, N., Kumar, A., Mashkour, M. S., & Nalli, N. (2024). Reduction of greenhouse gases emission: Towards a sustainable future. In *E3S Web of Conferences* (Vol. 552, p. 01116). EDP Sciences.

Bisaria, C., Madhubala Kumari, D. S. S., & Patel, B. K. (2026). *Research methodology: Tools and techniques*. BR Publications.

Boiko, K. (2022). R&D activity and firm performance: Mapping the field. *Management Review Quarterly*, *72*(4), 1051-1087. doi.org/10.1007/s11301-021-00220-1

Bor, J. K. M. (2021). *Green supply chain management practices and performance of food and beverage processing sector in Kenya.* Unpublished PhD Thesis, Juja: JKUAT.

Cai, L., Yan, Y., Tang, Z., & Liu, A. (2024). Collaborative distribution optimization model and algorithm for an intelligent supply chain based on green computing energy management. *Computing*, *106*(8), 2521-2539.

Cannava, L., Perotti, S., & Petrillo, S. (2023). Green warehousing: Improving energy efficiency through digitalisation. In *Proceedings of the Innovation and Value Creation 2023 (IVC23)* (pp. 1-6).

Chakabwata, W., & McKay, V. (2026). Applying theoretical and conceptual frameworks to doctoral research in education. In *Navigating Theory, Methodology, and Researcher Development in Doctoral Research* (pp. 1-28). IGI Global Scientific Publishing.

Chang, C. H., Chen, Y. S., & Tseng, C. W. (2025). Digital transformation anxiety: Absorptive capacity, dynamic capability, and digital innovation performance. *Management Decision*, *63*(3), 734-755.

Chang, T. W. (2023). Double-edged sword effect of packaging: Antecedents and consumer consequences of a company's green packaging design. *Journal of Cleaner Production*, *406*, 137037-137047. doi.org/10.1016/j.jclepro.2023.137037

Chen, Q., & Liao, W. (2022). Collaborative routing optimization model for reverse logistics of construction and demolition waste from sustainable perspective. *International Journal of Environmental Research and Public Health*, *19*(12), 7366.

Cheng, Y., Masukujjaman, M., Sobhani, F. A., Hamayun, M., & Alam, S. S. (2023). Green logistics, green human capital, and circular economy: the mediating role of sustainable production. *Sustainability*, *15*(2), 1045-1067.

Chicksand, D., Watson, G., Walker, H., Radnor, Z., & Johnston, R. (2012). Theoretical perspectives in purchasing and supply chain management: an analysis of the literature. *Supply Chain Management: An International Journal*, *17*(4), 454-472.

Chong, C. L., Abdul Rasid, S. Z., Khalid, H., & Ramayah, T. (2024). Big data analytics capability for competitive advantage and firm performance in Malaysian manufacturing firms. *International Journal of Productivity and Performance Management*, *73*(7), 2305-2328.

Contini, G., & Peruzzini, M. (2022). Sustainability and industry 4.0: Definition of a set of key performance indicators for manufacturing companies. *Sustainability*, *14*(17), 11004.

Corigliano, O., & Algieri, A. (2024). A comprehensive investigation on energy consumptions, impacts, and challenges of the food industry. *Energy Conversion and Management: X*, 100661.

Coşkun, R., & Öztürk, O. (2024). Dependence as strategy: Extending resource dependence theory and clarifying its understanding of the strategic options of dependent firms. *International Journal of Organizational Analysis*, *32*(9), 1982-2009.

Dabees, A., Lisec, A., Elbarky, S., & Barakat, M. (2024). The role of organizational performance in sustaining competitive advantage through reverse logistics activities. *Business Process Management Journal*, Vol. ahead-of-print No. ahead-of-print. doi.org/10.1108/K-02-2024-0356

Dadsena, K. K., Rathore, P., Mathiyazhagan, K., Jayaraman, R., & Saha, E. (2026). Adoption of circular economy practices in supply chains to enhance firm performance: industrial symbiosis and ecological modernization theory perspective. *The International Journal of Logistics Management*, 1-31.

Datche, E., Kising'u, T. M., & Kalimbo, A. M. (2023). The moderating effect of environmental dynamism in the relationship between innovation capability and performance of manufacturing firms in Nairobi City County, Kenya. *Reviewed Journal International of Business Management*, *4*(1), 294-322.

Daniel, M. M. (2023). Green logistics practices, firm characteristics and firm performance of logistics firms in Kenya. *African Journal of Business and Management (AJBUMA)*, *8*(1), 92-114.

de Lima Figueiredo, N., Fernandes, C. I., & Abrantes, J. L. (2026). The moderating effect of absorptive capacity on the relationship between knowledge transfer and innovative capacity. *Technology in Society*, 103248.

De Souza, E. D., Kerber, J. C., Bouzon, M., & Rodriguez, C. M. T. (2022). Performance evaluation of green logistics: Paving the way towards circular economy. *Cleaner Logistics and Supply Chain*, *3*, 100019. doi.org/10.1016/j.clscn.2021.100019

Dewi, H. E., Muhaimin, A. W., Setiawan, B., & Maulidah, S. (2024, April). A design framework for food small medium enterprises resilience and performance in

Indonesia. In *IOP Conference Series: Earth and Environmental Science* (, 1323(1), 1-13. doi.org/10.1088/1755-1315/1323/1/012010

Dey, D., Haque, M. S., Islam, M. M., Aishi, U. I., Shammy, S. S., Mayen, M. S. A., ... & Uddin, M. J. (2025). The proper application of logistic regression model in complex survey data: A systematic review. *BMC Medical Research Methodology*, *25*(1), 15.

Dido, S. G., & Shale, N. (2023). Green supply chain management practices and performance of state corporations in the energy sector in Kenya. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME)*, *7*(1), 348-360.

Domagała, J. (2022). Green warehousing: A state-of-the-art literature review. *Sustainable Logistics*, 43-71.

Dubey, U. K. B., & Kothari, D. P. (2022). *Research methodology: Techniques and trends*. Chapman and Hall/CRC.

Dzwigol, H., Trushkina, N., & Kwilinski, A. (2021). *The organizational and economic mechanism of implementing the concept of green logistics*. Management and information Technology impact on Global Economy in the Era of Pandemic.

Engelke, D. H., Pearse, N. J., Correa, F. M., & Skae, F. O. (2024). The relationship between culture, sustainable use of resources, and financial performance: An institutional and natural-resource-based perspective. *Economic and Business Review*, *26*(2), 61-80. doi.org/10.15458/2335-4216.1335

Erdal, E., & İpçioğlu, N. D. (2024). The role of logistics in responsible consumption and production: SDG-12. In *Effective Logistics for Sustainable Development Goals* (pp. 145-172). IGI Global.

Escoto, X., Gebrehewot, D., & Morris, K. C. (2022). Refocusing the barriers to sustainability for small and medium-sized manufacturers. *Journal of Cleaner Production*, *338*, 130589.

Freeman, A. M. (1984a). The sign and size of option value. *Land Economics, 60*(1), 1-13.

Freeman, R. E. (1984b). The politics of stakeholder theory: Some future directions. *Business ethics quarterly*, 409-421.

Freeman, R. E. (1984c). *Strategic management: A stokcholder approach*. Boston, MA: Pitman.

Freeman, R. E. (2010). *Strategic management: A stakeholder approach*. Cambridge University Press.

Freeman, R. E. (2023). The politics of stakeholder theory: Some future directions. In *R. Edward Freeman's Selected Works on Stakeholder Theory and Business Ethics* (pp. 119-132). Cham: Springer International Publishing. doi.org/10.1007/978-3-031-04564-6_5

Freeman, R. E., & Phillips, R. A. (2002). Stakeholder theory: A libertarian defense. *Business ethics quarterly*, *12*(3), 331-349.

Gallardo, J. Q., Morales, S. N., & Argüelles, V. T. (2025). Transformational leadership and absorptive capacity: A bibliometric review. *TEM Journal*, *14*(2), 1344-1354.

Gallo, M. A., & McKinney, U. O. (2025). *Applied multiple regression/correlation analysis for aviation research*. Taylor & Francis.

Ghosh, B. M. (2023). A case study on green packaging practices between two leading e-commerce platform of India. *Available at SSRN 4663407*.

Gibson, D. C., & Ifenthaler, D. (2024). Complexity theory and learning. in *computational learning theories: Models for artificial intelligence promoting learning processes* (pp. 61-78). Cham: Springer Nature Switzerland.

Gikonyo, P. K. (2023). *Green logistics and performance of building and construction manufacturing firms in Kenya*. Unpublished PhD Thesis, Juja: JKUAT.

Gikonyo, P. K., Ngugi, P. K., & Paul, S. N. A. (2022a). Green distribution systems and performance of building and construction manufacturing firms in Kenya. *International Journal of Supply Chain and Logistics*, *6*(3), 16-30.

Gikonyo, P. K., Ngugi, P. K., & Paul, S. N. A. (2022b). Influence of green packaging on performance of building and construction manufacturing firms in Kenya. *Int. J. Sci. Res. Publ*, *12*, 137-144.

Gray, D. E. (2021). Doing research in the real world. Sage.

Gružauskas, V., & Burinskienė, A. (2022). Managing supply chain complexity and sustainability: The case of the food Industry. *Processes*, *10*(5), 852-867.

Hager, P., & Beckett, D. (2024). Refurbishing learning via complexity theory: Introduction. *Educational Philosophy and Theory*, *56*(5), 407-419.

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). An introduction to structural equation modeling. In *Partial least squares structural equation modeling (PLS-SEM) using R: a workbook* (pp. 1-29). Cham: Springer International Publishing.

Hair, J., & Alamer, A. (2022). Partial least squares structural equation modeling (PLS-SEM) in second language and education research: Guidelines using an applied example. *Research methods in applied linguistics*, *1*(3), 100027.

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review*, 20(4), 986-1014.

Hegazy, M., Hegazy, K., & Eldeeb, M. (2022). The balanced scorecard: Measures that drive performance evaluation in auditing firms. *Journal of Accounting, Auditing & Finance*, *37*(4), 902-927.

Henao-García, E. A. (2026). Bridging absorptive capacity, innovation, and performance: management innovation as a social integration mechanism. *Knowledge Management Research & Practice*, 1-21.

Hurriyah, M. S., Indiastuti, R., Septiani, B. A., & Kharisma, B. (2024). The effect of business cycle on the relationship between market structure and industrial performance in the Indonesian food and beverage industry. *Cogent Economics & Finance*, *12*(1), 2399954.

Ibrahim, A., Fernando, Y., Tseng, M. L., & Lim, M. K. (2024). Low-carbon warehousing practices and challenges: insights from emerging country. *International Journal of Logistics Research and Applications*, *27*(8), 1410-1429.

Igbomor, E. (2024). The effect of green packaging on consumers buying behavior. *Ekonomika a spoločnosť*, *1*(25), 111-123.

Ismail, R. M., Yamin, F. M., & Yaacob, N. A. (2022). 4 green procurement: Gearing for the environmentally efficient supply chain. *Greening The Supply Chain: Responsive and Responsible Approaches (UUM Press)*, 61.

Hui, B., & Wu, Z. (2024). Estimating reliability for response-time difference measures: Toward a standardized, model-based approach. *Studies in Second Language Acquisition*, *46*(1), 227-250.

Hunziker, S., & Blankenagel, M. (2024). Cross-sectional research design. In *Research design in business and management: A practical guide for students and researchers* (pp. 187-199). Wiesbaden: Springer Fachmedien Wiesbaden.

Hushchyna, K., Sabir, Q. U. A., Mclellan, K., & Nguyen-Quang, T. (2023). Multicollinearity and multi-regression analysis for main drivers of cyanobacterial harmful algal bloom (CHAB) in the Lake Torment, Nova Scotia, Canada. *Environmental Modeling & Assessment*, *28*(6), 1011-1022.

Izah, S. C., Sylva, L., & Hait, M. (2023). Cronbach's alpha: A cornerstone in ensuring reliability and validity in environmental health assessment. *ES Energy and Environment*, *23*, 1057.

Jalonen, H. (2024). A complexity theory perspective on politico-administrative systems: Insights from a systematic literature review. *International Public Management Journal*, 1-21.

Jayarathna, C. P., Agdas, D., & Dawes, L. (2024). Perceived relationship between green logistics practices and sustainability performance: A multi-methodology approach. *The International Journal of Logistics Management*, *35*(5), 1522-1548. doi.org/10.1108/IJLM-09-2022-0367

Jepchumba, N. (2024). *Fourth party logistics service and performance of food and beverage manufacturing firms in Kenya*. Unpublished PhD Thesis, Juja: JKUAT.

Jepchumba, N. J., Ngugi, P. K., Shale, N. I., & Odhiambo, R. O. (2022). The effect of product packaging on firm performance: A study on the food and beverage

manufacturing firms in Kenya. *International Journal of Supply Chain and Logistics, 6*(2), 69-88. doi.org/10.47941/ijscl.1092

Ju, C., Liu, H., Xu, A., & Zhang, J. (2023). Green logistics of fossil fuels and E-commerce: Implications for sustainable economic development. *Resources Policy, 85*, 103991. doi.org/10.1016/j.resourpol.2023.103991

Kalkbrenner, M. T. (2023). Alpha, omega, and H internal consistency reliability estimates: Reviewing these options and when to use them. *Counseling Outcome Research and Evaluation, 14*(1), 77-88.

Kalkbrenner, M. T. (2024). Choosing between Cronbach's coefficient alpha, McDonald's coefficient omega, and coefficient H: Confidence intervals and the advantages and drawbacks of interpretive guidelines. *Measurement and Evaluation in Counseling and Development, 57*(2), 93-105.

Kalubanga, M., & Mbekeka, W. (2024). Compliance with government and firm's own policy, reverse logistics practices and firm environmental performance. *International Journal of Productivity and Performance Management, 73*(5), 1427-1478.

Kamanga, F. N. (2024). *Reverse logistics practices and the performance of large manufacturing firms in Kenya.* Unpublished PhD Thesis, Juja: JKUAT.

Kamewor, F. T., Kwateng, K. O., & Mensah, J. (2024). Green logistics practices: A bibliometric and systematic methodological review and future research opportunities. *Journal of Cleaner Production*, 143735. doi.org/10.1016/j.jclepro.2024.143735

Kannan, S., Parashar, B., & Chaurasia, A. (2024). E-commerce and green packaging: sustainable business trends. In *Green Innovations for Industrial Development and Business Sustainability* (pp. 22-39). CRC Press.

Kariuki, M. M. (2023). *Sustainable supply chain management practices and performance of horticultural firms in Kenya*. Unpublished PhD Thesis, Juja: JKUAT.

Kariuki, M. M., Ngugi, P. K., & Mburu, D. K. (2022). Green distribution and performance the horticultural sector in Kenya. *International Journal of Interdisciplinary Research and Innovations*, *10*(2), 30-40. doi.org/10.5281/zenodo.6579724

Kenei, K., & Wachiuri, E. (2024). Green supply chain practices and performance of the food and beverage firms in Nairobi City County, Kenya. *International Journal of Management and Business Research*, *6*(1), 225-238.

Khan, K. A., Ma, F., Akbar, M. A., Islam, M. S., Ali, M., & Noor, S. (2024). Reverse logistics practices: A dilemma to gain competitive advantage in manufacturing industries of Pakistan with organization performance as a mediator. *Sustainability*, *16*(8), 3223.

Khasanah, M. (2024). *The effect of capital structure and liquidity on the financial performance of manufacturing companies in the food and beverage sub-sector on the Indonesia Stock Exchange (IDX) for the 2020-2023 Period.* Unpublished PhD Thesis, Jombang: Universitas Darul Ulum.

Kim, M. (2015). The effect of strategic alliances and firm productivity in South Korea. *Applied Economics*, 47(47), 5033-5044.

Kline, R. B. (2023). *Principles and practice of structural equation modeling*. Guilford publications.

Klocek, A., Premus, J., & Řiháček, T. (2024). Applying dynamic systems theory and complexity theory methods in psychotherapy research: A systematic literature review. *Psychotherapy Research*, 1-17.

Kolasińska-Morawska, K., Sułkowski, Ł., Buła, P., Brzozowska, M., & Morawski, P. (2022). Smart logistics - Sustainable technological innovations in customer service at the last-mile stage: The polish perspective. *Energies, 15*(17), 6395.

Konishi, S., Kuwata, M., Matsumoto, Y., Yoshikawa, Y., Takata, K., Haraguchi, H., ... & Kumazaki, H. (2024). Self-administered questionnaires enhance emotion estimation of individuals with autism spectrum disorders in a robotic interview setting. *Frontiers in Psychiatry, 15*, 1249000.

Korra, C., & Valaboju, A. S. (2024). Green warehouses: The benefits, challenges, and strategies of industrial building decarbonization. *Journal of Sustainable Industrial Practices*, *1*(1), 1-12.

Krstić, B., Bonić, L., Rađenović, T., Jovanović Vujatović, M., & Ognjanović, J. (2023). Improving profitability measurement: impact of intellectual capital efficiency on return on total employed resources in smart and knowledge-intensive companies. *Sustainability*, *15*(15), 12076.

Kumar, N. K. (2023). Autocorrelation and heteroscedasticity in regression analysis. *Journal of Business and Social Sciences*, *5*(1), 9-20.

Kurgat, M. J., & Kyule, A. (2024). Effect of green supply chain management practices on the perfomance of construction firms within Nairobi City County. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME)*, *8*(1), 1139-1149.

Kuwornu, J. K., Khaipetch, J., Gunawan, E., Bannor, R. K., & Ho, T. D. (2023). The adoption of sustainable supply chain management practices on performance and quality assurance of food companies. *Sustainable Futures*, *5*, 100103.

Larson, P. D. (2021). Relationships between logistics performance and aspects of sustainability: A cross-country analysis. *Sustainability*, *13*(2), 623-636.

Le, T. T. (2023). Linking big data, sustainable supply chain management and corporate performance: The moderating role of circular economy thinking. *The International Journal of Logistics Management*, *34*(3), 744-771. doi.org/10.1108/IJLM-01-2022-0011

Lenz, A. S., Haktanir, A., & Flores, D. (2026). Statistical power, reliability, and model assumptions in multiple linear regression: Assessing and addressing common issues. *MeasureMent and evaluation in Counseling and developMent*, *59*(1), 94-107.

Leong, L. Y., Hew, T. S., Ooi, K. B., Tan, G. W. H., & Koohang, A. (2025). An SEM-ANN approach-guidelines in information systems research. *Journal of Computer Information Systems*, *65*(6), 706-737.

Luft, J. A., Jeong, S., Idsardi, R., & Gardner, G. (2022). Literature reviews, theoretical frameworks, and conceptual frameworks: An introduction for new biology education researchers. *CBE—Life Sciences Education*, *21*(3), rm33.

Maan, A. A., Ahmed, Z. F. R., Khan, M. K. I., Riaz, A., & Nazir, A. (2021). Aloe vera gel, an excellent base material for edible films and coatings. *Trends in Food Science & Technology*, *116*, 329-341.

Makhloufi, L., Djermani, F., & Meirun, T. (2024). Mediation-moderation model of green absorptive capacity and green entrepreneurship orientation for corporate

environmental performance. *Management of Environmental Quality: An International Journal*, *35*(1), 139-157.

Malko, S. (2024). *The impact of IAS 36 on the quality of financial statements for UK companies: A multi-dimensional analysis of impairment of assets* (Doctoral dissertation, University of Westminster).

Manzoor, K. M., & Jahangir, J. (2024). Green intellectual capital: Boosting sustainability via innovation, value creation & resource efficiency. *Administrative and Management Sciences Journal*, *2*(2), 172-186.

Mason, M. (2024). Complexity theory and the enhancement of learning in higher education: The case of the University of Cape Town. *Educational Philosophy and Theory*, *56*(5), 469-478.

Mata, M. N., Martins, J. M., & Inácio, P. L. (2023). Impact of absorptive capacity on project success through mediating role of strategic agility: Project complexity as a moderator. *Journal of Innovation & Knowledge*, *8*(1), 100327. doi.org/10.1016/j.jik.2023.100327

Matthews, C., Moran, F., & Jaiswal, A. K. (2021). A review on European Union's strategy for plastics in a circular economy and its impact on food safety. *Journal of cleaner production*, *283*, 125263.

Matta, C. (2022). Philosophical paradigms in qualitative research methods education: What is their pedagogical role?. *Scandinavian Journal of Educational Research*, *66*(6), 1049-1062. doi.org/10.1108/BJM-10-2017-0304

May, T., & Perry, B. (2022). *Social research: Issues, methods and process*. McGraw-Hill Education (UK).

Mbanaso, U. M., Abrahams, L., & Okafor, K. C. (2023). Research philosophy, design and methodology. In *Research techniques for computer science, information systems and cybersecurity* (pp. 81-113). Cham: Springer Nature Switzerland.

Mbugua, A. N., Ngugi, P. K., Thogori, M., & Mwangi, P. (2024). Operations management and performance of food and beverage manufacturing firms in Kenya. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME)*, *8*(3), 39-55.

Modica, T., Perotti, S., & Melacini, M. (2021). Green warehousing: exploration of organisational variables fostering the adoption of energy-efficient material handling equipment. *Sustainability*, *13*(23), 13237-13252.

Mogaka, C. O. (2023). *Supply chain integration and the competitive advantage of food and beverage manufacturing firms in Kenya* (Doctoral dissertation, JKUAT-COHRED).

Mohamed, J. H., & Nderui, D. N. U. (2024). Supply chain resilience strategies and performance of food and beverage manufacturing firms in Kenya. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME)*, *8*(3), 227-243.

Montero, J. A. (2026). A structured guide to univariate test selection based on normality, variance homogeneity, and graphical data exploration. *Journal of Surgical Research*, *318*, 230-240.

Moreno-Menéndez, F. M., Tapia-Silguera, R. D., González-Prida, V., Sánchez-Guzmán, C. R., Via-Rada-Vittes, J. F., Sánchez-Mattos, W. A., ... & Gutiérrez-Meza, F. P. (2026). Exploring Organizational Commitment as a Driver of Administrative Management in Local Public Institutions: Insights from a Low- and Middle-Income Country Governance Context. *Administrative Sciences*, *16*(2), 94.

Moshood, T. D., Nawanir, G., Mahmud, F., Mohamad, F., Ahmad, M. H., & AbdulGhani, A. (2022). Biodegradable plastic applications towards sustainability: A recent innovations in the green product. *Cleaner Engineering and Technology*, *6*, 100404.

Mostafa, H., Hamdi, M., Airouyuwaa, J. O., Hamed, F., Wang, Y., & Maqsood, S. (2024). Lignin and green solvent extracted phenolic compounds from date palm leaves as functional ingredients for the formulation of soy protein isolate biocomposite packaging materials: A circular packaging concept. *International Journal of Biological Macromolecules*, *279*, 134843.

Mungai, E., & Ndiritu, S. W. (2023). Peeling the onion! What are the drivers and barriers of cleaner production? A case of the Kenyan manufacturing SMEs. *Journal of Cleaner Production*, *383*, 135436.

Mumbi, K. M., Karanja, N. P., & Kiarie, M. D. (2021). Green packaging, green distribution and competitive advantage in the horticultural sector in Kenya. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME)*, *4*(2), 93-111.

Mungazu, I. (2023). *The influence of green supply chain management practices on performance of manufacturing firms in northern Uganda. a case of Takataka plastics ltd.* Unpublished PhD Thesis, Entebbe: Nkumba University.

Musau, E. G. (2024). Optimizing transportation and distribution for environmental sustainability: Green logistics. In *Green Supply Chain Management Practice and Principles* (pp. 84-101). IGI Global.

Mutie, M. D., Odock, S., & Litondo, K. (2023). Effect of green logistics practices on performance of logistics firms in Kenya. *DBA Africa Management Review*, *10*(4), 20-35.

Muzari, T., Shava, G. N., & Shonhiwa, S. (2022). Qualitative research paradigm, a key research design for educational researchers, processes and procedures: A theoretical overview. *Indiana Journal of Humanities and Social Sciences*, *3*(1), 14-20.

Nagy, G., & Szentesi, S. (2024). Green logistics: Transforming supply chains for a sustainable future. *Advanced Logistic Systems-Theory and Practice*, *18*(3), 29-42.

Nazir, S., Mehmood, S., Nazir, Z., & Zhaolei, L. (2024). Enhancing firm performance through knowledge sharing, knowledge management, supply chain efficiency and integration: exploring the moderating influence of reverse logistic. *Kybernetes*, Vol. ahead-of-print No. ahead-of-print. doi.org/10.1108/K-02-2024-0356

Ngatia, R. N., Osoro, A., & Nyang'au, S. P. (2024). Green supply chain management and performance of food and beverages manufacturing firms in Kenya. *African Journal of Emerging Issues*, *6*(11), 101-117.

Ngenoh, B. K., & Noor, I. S. (2024). Supply chain innovation strategies and performance of food and beverages manufacturing firms in Nairobi City County, Kenya. *Journal of Applied Social Sciences in Business and Management*, *3*(2), 153-169.

Nguyen, M. (2025). *Regression techniques for data analysis*. Springer Nature.

Nguyen, M. (2026). Linear regression. In *Regression Techniques for Data Analysis* (pp. 9-201). Cham: Springer Nature Switzerland.

Ni, C., & Abdullah, N. L. (2025). Research on absorptive capacity in the green context: A bibliometric and visualization analysis. *Cogent Business & Management*, *12*(1), 2435602.

Nienhüser, W. (2008). Resource dependence theory-how well does it explain behavior of organizations?. *management revue*, 9-32.

Nikseresht, A., Golmohammadi, D., & Zandieh, M. (2024). Sustainable green logistics and remanufacturing: A bibliometric analysis and future research directions. *The International Journal of Logistics Management*, *35*(3), 755-803. doi.org/10.1108/IJLM-03-2023-0085

Noramli, N. A. S., Sabri, N. A. S. A., Roslan, M. I., Ismail, N., Yusoff, Z. M., & Taib, M. N. (2026). Data-driven modelling of Aquilaria essential oils via dual GC profiling and multicollinearity diagnostics. *Bulletin of Electrical Engineering and Informatics*, *15*(1), 350-360.

Nthiwa, C. M., Muli, S., & Kitheka, S. (2024). Reverse logistics and performance of food and beverage manufacturing firms in Kenya. *Reviewed Journal International of Business Management*, *5*(1), 28-40. doi.org/10.61426/business.v5i1.169

Nureen, N., Xin, Y., Irfan, M., & Fahad, S. (2023). Going green: how do green supply chain management and green training influence firm performance? Evidence from a developing country. *Environmental Science and Pollution Research*, *30*(20), 57448-57459. doi.org/10.1007/s11356-023-26609-x

Nzomo, F., & Wachiuri, E. (2023). Strategic supply chain practices and performance of soft drink manufacturing firms in Nairobi County, Kenya. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME)*, *7*(2), 343-354.

Nzuma, B. M., & Ndeto, C. (2023). Logistics management strategies and performance of food and beverage manufacturing firms in Nairobi City County,

Kenya. *International Journal of Social Sciences Management and Entrepreneurship (IJSSME)*, *7*(1), 204-223.

Obiso, E. I., Maendo, D., Musau, E., & Waribu, J. (2023). Influence of green distribution on performance of private oil and gas marketing firms in Kenya: Moderating influence of government regulations. *African Journal of Education, Science and Technology*, *7*(3), 293-309.

Odock, S. O., Mutua, D. M., Ndungu, C., & Mwangi, M. (2024). Green logistics practices and firm performance: The mediating effect of environmental performance among logistics firms in Kenya. *International Journal of Professional Business Review: Int. J. Prof. Bus. Rev.*, *9*(11), 2.

Okindo, V. M. (2022). *Effects of the fourth industrial revolution on Kenya's food and beverage manufacturing sector* (Doctoral dissertation, Macquarie University).

Ortega, J. A., Pedreira, O., & Piattini, M. (2024, May). Adaptive portfolio management based on complexity theory and sociotechnical design. In *International Conference on Research Challenges in Information Science* (pp. 357-375). Cham: Springer Nature Switzerland.

Osman, J. A. (2023). *Effect of production implementation practices on supply chain performance of food and beverage manufacturing firms in Kenya* (Masters dissertation, University of Nairobi).

Owusu, L., & Odartey, M. (2021). Green supply chain management and firm performance: Evidence from Ghana's food production and processing industry. *International Journal of Business*, *4*(1), 29-42.

Ozturk, O. (2021). Bibliometric review of resource dependence theory literature: an overview. *Management Review Quarterly*, *71*(3), 525-552.

Pandey, P., & Pandey, M. M. (2021). *Research methodology tools and techniques*. Bridge Center.

Panghal, A., P, A., Vern, P., & Mor, R. S. (2024). Adoption barriers to green logistics in the Indian food industry: A circular economy perspective. *International Social Science Journal*, *74*(252), 519-538.

Panya, K. O., & Marendi, P. G. (2021). Effects of reverse logistic practices on the performance of fast moving consumer goods companies in Kenya. *The Strategic Journal of Business & Change Management*, *8*(4), 747-762.

Panya, K. O., Ochiri, G., Achuora, J., & Gakure, R. W. (2021). Sustainable supply chain management and its effects on the performance of sugar sub-sector in Kenya. *The Strategic Journal of Business & Change Management*, *8*(3), 681-696.

Paul Jr, M., Nana, I., Zimmermann, A., & Jafari, Y. (2024). Trends and evolution of global value chains in food and agriculture: Implications for food security and nutrition. *Food Policy*, *127*, 102679.

Perotti, S., & Colicchia, C. (2023). Greening warehouses through energy efficiency and environmental impact reduction: A conceptual framework based on a systematic literature review. *The International Journal of Logistics Management*, *34*(7), 199-234.

Pfeffer, J. (1972). Merger as a response to organizational interdependence. *Administrative Science Quarterly*, *17*(3), 382-394.

Pfeffer, J. (1987). A resource dependence perspective on intercorporate relations. *Intercorporate relations: The structural analysis of business*, *1*(1), 25-55.

Pfeffer, J., & Nowak, P. (1976). Joint ventures and interorganizational interdependence. *Administrative Science Quarterly*, *21*(3), 398-418.

Pfeffer, J., & Salancik, G. R. (1974). Organizational decision making as a political process: The case of a university budget. *Administrative Science Quarterly*, 135-151. doi.org/10.2307/2393885

Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. Harper and Row, New York, NY.

Piva, E. (2024). Green logistics and new challenges of sustainability: a conceptual framework. *J-READING Journal of Research and Didactics in Geography*, *1*.

Ramanathan, R., Ramanathan, U., Pelc, K., & Hermens, I. (2024). How do existing organizational theories help in understanding the responses of food companies for reducing food waste?. *Sustainability*, *16*(4), 1534-1552.

Rao, A. S., Nair, A., More, S. S., Roy, A., More, V. S., & Anantharaju, K. S. (2021). A comparative study on biodegradable packaging materials: Current status and future prospects. *Microbial Polymers: Applications and Ecological Perspectives*, 675-693.

Raßmann, H. (2026). Putting water to work anew? The ecological modernisation of the environment in Leipzig, Germany. *Water History*, 1-29.

Riaz, M., Jie, W., Ali, S., & Chang, S. (2024). Assessing the role of organizational strategic factors in stimulating green innovation performance: moderating effects of green absorptive capacity. *Business Process Management Journal*, *30*(4), 1013-1043. 10.1108/BPMJ-12-2023-0967

Ricardianto, P., Kholdun, A., Fachrey, K., Nofrisel, N., Agusinta, L., Setiawan, E., ... & Endri, E. (2022). Building green supply chain management in pharmaceutical companies in Indonesia. *Uncertain Supply Chain Management*, *10*(2), 453-462. doi.org/10.5267/j.uscm.2021.12.006

Rizki, I. H., Syahputra, O., Masri, D., & Rinaldi, M. (2024). Application of tax avoidance and company size in influencing company value in the food and beverage sector. *International Journal of Applied Finance and Business Studies*, *12*(2), 126-131. doi.org/10.35335/ijafibs.v12i2.289

Roy, S., & Mohanty, R. P. (2024). Green logistics operations and its impact on supply chain sustainability: An empirical study. *Business Strategy and the Environment*, *33*(2), 1447-1476.

Roy, S., Ramakrishnan, R., Goksen, G., Singh, S., & Łopusiewicz, Ł. (2023). Recent progress on UV-light barrier food packaging films - A systematic review. *Innovative Food Science & Emerging Technologies*, 103550.

Saada, R. (2021). Green transportation in green supply chain management. *Green Supply Chain-Competitiveness and Sustainability*, 25-43. doi.org/10.5772/intechopen.93113

Salam, M. A., & Bajaba, S. (2023). The role of supply chain resilience and absorptive capacity in the relationship between marketing–supply chain management alignment and firm performance: A moderated-mediation analysis. *Journal of Business & Industrial Marketing*, *38*(7), 1545-1561.

Sandra, M., Narayanamoorthy, S., Ferrara, M., Innab, N., Ahmadian, A., & Kang, D. (2024). A novel decision support system for the appraisal and selection of green warehouses. *Socio-Economic Planning Sciences*, *91*, 101782.

Santoso, H. W., Ratnawati, T., & Sihab, M. (2024). The strategic orientation dimensions impact on the performance of micro enterprises in Kota Surabaya: Does the mediating role of innovation capability matter?. *Asian Journal of Management, Entrepreneurship and Social Science*, *4*(02), 1475-1496.

Sarpong, K. O., Adu-Aboagye, A., & Oppong, M. (2024). The mediation role of competitive environmental training, green logistics management, and supply environmental orientation on organizational performance: Evidence from a developing country, Ghana. *ADRRI Journal of Procurement, Logistics and Supply Chain Management*, *2*(1), 1-21.

Scrioșteanu, A., & Criveanu, M. M. (2024). Green and reserve logistics of packaging and plastic packaging waste under the conditions of circular economy at the level of the European Union Member States. *Energies*, *17*(12), 3015.

Setiadi, M. T. (2024). The impact of technological innovation on sustainability and competitiveness in the food and beverage industry sector. *International Journal of Management Science and Information Technology*, *4*(2), 438-449.

Shabbir, L. R., Farwa, U., Khan, A. R., & Hafeez, S. (2024). Greening the chain: How top management commitment shapes firm sustainability. *Journal of Excellence in Management Sciences*, *3*(2), 63-80.

Shamsul Bahrin, A., Mokhtar, A. R. M., Muhamed, A. A., & Kaliani Sundram, V. P. (2024). The mediating effect of eco-innovation on low-carbon supply chain practices toward manufacturing firm performance in Malaysia. *Journal of International Logistics and Trade*, *22*(3), 110-133. doi.org/10.1108/JILT-03-2023-0013

Sharma, M., Luthra, S., Joshi, S., Kumar, A., & Jain, A. (2023). Green logistics driven circular practices adoption in industry 4.0 Era: A moderating effect of institution pressure and supply chain flexibility. *Journal of Cleaner Production*, *383*, 135284.

Shi, M., Chen, X. S., & Yuan, B. (2026). Vigorous physical activity is associated with mental well-being: Indirect associations via resilience and physical self-esteem in university students. *Frontiers in Psychology*, *16*, 1747633.

Silva, M. E., Pereira, S. C. F., & Sehnem, S. (2025). Shaping supply chain circularity trajectory: the role of path dependence. *The International Journal of Logistics Management*, *36*(4), 1147-1171.

Sinha, A. K., Mishra, A. K., Manogna, R. L., & Prabhudesai, R. (2023). Determinants of sustainable financial and innovation performance: A panel data analysis of Indian manufacturing SMEs. *International Journal of Business and Globalisation*, *33*(1-2), 113-129. doi.org/10.1504/IJBG.2023.128325

Sodhi, M. S., Son, B. G., & Tang, C. S. (2012). Researchers' perspectives on supply chain risk management. *Production and operations management*, *21*(1), 1-13.

Sruthi, S. (2023). 21 Eco-friendly product packaging and consumer perception: a study of sustainable packaging's impact on green marketing. *Commerce, Economics & Management*, *1*(2), 145-159.

Stroparo, T. R., & Floriani, N. (2025). The territorial dimension of innovation in family farming: a critical reading in light of ecological modernization and the ecology of practices. *Revista de Gestão Social e Ambiental*, *19*(11), 1-20.

Sulistyowati, A. (2024). Analysis of financial statements to assess financial performance of food and beverage industry companies on the Indonesia Stock Exchange. *Advances In Social Humanities Research*, *2*(7), 915-923.

Sun, J. X., & Zhang, L. Y. (2026). Conceptual reframing and practical innovation in natural resources in the context of Chinese path to modernization. *Journal of Natural Resources*, *41*(2), 327-341.

Sunita, C. (2023). Consumer perception towards sustainable packaging in e-commerce industry: A factor analytic approach. *Quing: International Journal of Commerce and Management*, *3*(2), 177-185.

Tambare, P., Meshram, C., Lee, C. C., Ramteke, R. J., & Imoize, A. L. (2021). Performance measurement system and quality management in data-driven Industry 4.0: A review. *Sensors*, *22*(1), 224-238.

Taylor, S. M., De Groote, A., Hyder, K., Vølstad, J. H., Hartill, B. W., Foster, J., ... & Ryan, K. L. (2025). Coverage matters: identifying and mitigating sampling frame issues in recreational fishing surveys. *Reviews in Fish Biology and Fisheries*, *35*(2), 529-547.

Tembo-Mwanaumo, E., Mutono-Mwanza, B. G., & Siaminwe, L. (2023, August). The Effects of Green Supply Chain Management on Environmental Performance in the Zambian Beverage Manufacturing Industry. In *Applied Research Conference in Africa* (pp. 181-192). Cham: Springer Nature Switzerland.

Thiga, H. K., Chege, D., & Arani, W. (2023). Green packaging and performance of food and beverage manufacturing firms in Kenya. *African Journal of Emerging Issues*, *5*(11), 82-89.

Thiga, H. K., Chege, D., & Arani, W. (2023). Reverse logistics and performance of food and beverage manufacturing firms in Kenya. *Journal of Sustainable Development of Transport and Logistics*, *8*(2), 86-90.

Thiro, E. W., Kiumbe, P., & Kagure, E. (2023). Relationship between green supply chain practices and sustainability of tea factories in Nyeri County, Kenya. *International Journal of Arts and Social Science*, *6*(9), 56-74.

Thuita, T. M., Miriti, G. M., & Mwirigi, R. N. (2023). Influence of innovativeness on the performance of food and beverage manufacturing enterprises in Nairobi City County. *International Journal of Social Science and Economic Research*, *8*, 309-322. doi.org/10.46609/ijsser.2023.v08i02.009

Tomek, J., & Eisner, D. (2025). *Basic statistics for life scientists: A concise handbook of essential techniques*. John Wiley & Sons.

Uher, J. (2024). Three generations of complexity theories. *The Routledge International Handbook of Dialectical Thinking*, 259.

Vafaeva, K. M., Chhetri, A., Sudan, P., Mishra, M., Babu, B. S., & Mongal, B. N. (2024). Polymer matrix nanocomposites for sustainable packaging: a green approach. In *E3S Web of Conferences* (Vol. 537, p. 08001). EDP Sciences.

Valentinov, V., & Roth, S. (2024). Relationality in transaction cost economics and stakeholder theory: A new conceptual framework. *Business Ethics, the Environment & Responsibility*, *33*(3), 535-546.

Valizadeh, M., Azizi, M., Hosseini, M. R., & Mahoor, P. (2024). A hybrid analysis of reverse logistics barriers in Iranian construction. *Smart and Sustainable Built Environment*, Vol. ahead-of-print No. ahead-of-print. doi.org/10.1108/SASBE-02-2024-0067

van Trigt, V. R., Huynh, K. A., Bakker, L. E., Pelsma, I. C., Zandbergen, I. M., Zamanipoor Najafabadi, A. H., ... & Biermasz, N. R. (2026). How to define success in prolactinoma treatment - A systematic review and theoretical framework. *The Journal of Clinical Endocrinology & Metabolism*, *111*(2), 303-315.

Verma, A. (2024). Green logistics practices toward a circular economy: A way to sustainable development. *Management and Production Engineering Review*, *15*(2), 124-135. doi.org/10.24425/mper.2024.151136

Viera-Romero, A. M., Selfa, T. L., Luzadis, V. A., & Diemont, S. A. (2026). Ecological modernization in practice: A multiple case study in Ecuador. *Environmental Sociology*, *12*(1), 107-125.

Visamitanan, K., & Assarut, N. (2021). Impact of green supply chain management practices on employee engagement and organizational commitment: mediating role of firm performance. *Global Business Review*, *2*(1), 14-34. doi.org/10.1177/09721509211018569

Wahyuni, D. T. P., Fauzi, M. A., Winaryanto, A. P., Fitriyani, D., Jati, M. W., & Paramitha, A. L. (2024, May). Penerapan green warehouse dalam menghadapi era society 5.0 guna mendukung konsep eco-friendly. In *Indonesian Conference of Maritime* (Vol. 2, No. 1, pp. 238-251).

Wang, J., & Azam, W. (2024). Natural resource scarcity, fossil fuel energy consumption, and total greenhouse gas emissions in top emitting countries. *Geoscience Frontiers*, *15*(2), 101757. doi.org/10.1016/j.gsf.2023.101757

Widjaja, W. (2024). Boosting firm performance: Insights from the food & beverage sector's key drivers. *Ilomata International Journal of Tax and Accounting*, *5*(2), 338-352. doi.org/10.61194/ijtc.v5i2.1105

Wu, C. (2024). Investigation of foundation theory of safety & security complexity. *Journal of Safety and Sustainability*, *1*(1), 14-25.

Wu, D., Wang, J., Zhao, Y., Li, S., Yang, H., Tan, R., & Zhang, T. (2024). Bio-inspired seaweed-based nanocomposite materials with excellent degradability and multifunctional barrier properties for green packaging. *Chemical Engineering Journal*, *479*, 147285.

Xu, J., Yu, Y., Wu, Y., Zhang, J. Z., Liu, Y., Cao, Y., & Eachempati, P. (2022). Green supply chain management for operational performance: anteceding impact of corporate social responsibility and moderating effects of relational capital. *Journal of Enterprise Information Management*, *35*(6), 1613-1638.

Xu, T., & Ding, C. J. (2026). From dependence to transcendence: Exploring the effect of technological innovation and human capital between resource endowment and economic growth. *Energy Sources, Part B: Economics, Planning, and Policy*, *21*(1), 2609284.

Yang, Y., Wang, J., & Liu, Y. (2025). Exploring the role of digital economy in reducing natural resource dependence: An empirical study from resource-based cities in China. *Growth and Change*, *56*(2), e70034.

Yasir, K., & Ghobadi Samani, G. (2024). Sustainable logistics: Evaluating the impact of passive design and pv-battery systems on carbon footprint: Assessing a Swedish logistics centre using the technical criteria of BREEAM International V 6. ENE 04: LowCarbon Design Indicator.

Yaftiyan, F., Amoozad Mahdiraji, H., Hosseinzadeh, M., & Vrontis, D. (2025). Diffusing sustainable supply chains: a hybrid evolutionary game theory and system dynamics approach. *Annals of Operations Research*, 1-66.

Yi, K. H. (2026). Reliability of measurement. In *Statistical Research Methods for Dermatologists and Plastic Surgeons* (pp. 63-69). Singapore: Springer Nature Singapore.

Yuan, G., Abidin, R., & Zulhumadi, F. (2026). Bridging external capabilities and internal strategy: A resource dependence and dynamic capabilities perspective on green patent value creation. *Technology Analysis & Strategic Management*, 1-17.

Zavazhenko, A. (2025). Absorptive capacity and institutional environment as determinants of defence industry transformation. *Економіка розвитку систем*, *7*(2), 68-76.

Zhang, W., Xu, H., Grebinevych, O., & Chen, M. (2025). Sustainable development with Artificial Intelligence: Examining the absorptive capacity pathways to green innovation. *Journal of environmental management*, *381*, 125219.

Zhou, B., Siddik, A. B., Zheng, G. W., & Masukujjaman, M. (2023). Unveiling the role of green logistics management in improving SMEs' sustainability performance: Do circular economy practices and supply chain traceability matter?. *Systems*, *11*(4), 198. doi.org/10.3390/systems11040198

Zhou, R., Xu, J., Zhai, J., & Kong, Q. (2026). The influence mechanism of responsible leadership on sustainable reconfiguring in multi-tier supply chains. *Business Process Management Journal*, *32*(1), 127-147.

Zumitzavan, V. (2025). Social science methodologies for management research. *Springer Books*.

Zumitzavan, V. (2026). Foundation of research philosophy. In *Social Science Methodologies for Management Research: From Philosophy to Practice in the AI Era* (pp. 1-10). Singapore: Springer Nature Singapore.

APPENDICES

Appendix I: Letter of Introduction

Charles Mamu Nthiwa,
P.O Box 81310-80100,
Mombasa, Kenya.
E-mail: charlesnthiwa11@gmail.com
Mobile: 0722-610613

Dear Sir/Madam,

RE: REQUEST TO FILL A SURVEY QUESTIONNAIRE

I am a PhD candidate pursuing the degree of Doctor of Philosophy in Supply Chain Management of the Jomo Kenyatta University of Agriculture and Technology. The title of my thesis "Green logistics practices and performance of food and beverage manufacturing firms in Kenya."

I am currently on the data collection process. Your firm is in the random sample for the study. I would like to request you to participate in the survey. The purpose of the research is entirely for academic purposes. The information you provide will be treated with utmost confidentiality. Thank you.

Yours sincerely,

Charles Mamu Nthiwa
PhD Candidate
JKUAT, Kenya

Appendix II: Survey Questionnaire

Please answer the survey questionnaire honestly. The purpose of the research will be entirely for academic purposes only. Kindly note that the information you provide will be treated with utmost confidentiality.

SECTION A: BACKGROUND INFORMATION

Please tick (√) on the appropriate box:

1. What is the age of your firm?

1)	Less than 5 years	[ ]
2)	5 to 10 years	[ ]
3)	10 to 15years	[ ]
4)	15 to 20 years	[ ]
5)	More than 20 years	[ ]

2. What is the size of your firm?

1)	Less than 10 employees	[ ]
2)	10 to 49 employees	[ ]
3)	50 to 99 employees	[ ]
4)	More than 100 employees	[ ]

SECTION B: GREEN LOGISTICS PRACTICES

You are required to indicate your level of agreement or disagreement with the following statements with regards to green logistics practices in your firm.

SECTION B1: REVERSE LOGISTICS

On a 5-point Likert scale, please tick **(√)** on the appropriate box to indicate your level of agreement or disagreement with the following statements with regards to reverse logistics in your firm:

1.	**Reverse Logistics**	**1**	**2**	**3**	**4**	**5**
		Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
1.1	The eco-friendly asset recovery focuses on reclaiming value from used, broken, or end-of-life products with minimal energy consumption.					
1.2	The eco-friendly asset recovery involves analyzing and triaging returned items to determine the most eco-efficient path.					
1.3	The eco-friendly recycling entails recovering materials from products that cannot be refurbished using processes that minimize carbon (IV) oxide emissions and energy use.					
1.4	The eco-friendly recycling is crucial for reducing landfill usage and supporting the circular economy.					
1.5	The eco-friendly remanufacturing					

	restores used or non-functional products to "like-new" condition, often including a performance warranty equivalent to a new product.					
1.6	The eco-friendly remanufacturing process is highly efficient for high-value goods, while simultaneously reducing the carbon footprint.					
1.7	The eco-friendly return processing reduces environmental impact and operational costs by optimizing product recovery through recycling, repairing, and refurbishing.					
1.8	The eco-friendly return processing reduces environmental impact and operational costs by optimizing product recovery through recycling, repairing, and refurbishing.					

SECTION B2: GREEN WAREHOUSING

On a 5-point Likert scale, please tick **(√)** on the appropriate box to indicate your level of agreement or disagreement with the following statements with regards to green warehousing in your firm:

2.	**Green Warehousing**	**1**	**2**	**3**	**4**	**5**
		Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
2.1	The energy efficient warehousing used reduces environmental impact by optimizing lighting, heating, ventilation, and air conditioning systems.					
2.2	The energy-efficient warehousing reduces operating costs by optimizing energy consumption, space utilization, and operational workflows.					
2.3	The reusable warehousing equipment is designed to reduce waste, lower long-term costs, and improve efficiency.					
2.4	The reusable warehousing equipment is specifically engineered to replace single-use, disposable alternatives, delivering significant benefits in environmental sustainability.					
2.5	In the warehousing layout optimization boosts picking accuracy, reduces congestion, and allows for flexible, scalable operations during peak demand.					
2.6	The warehousing layout optimization increases operational efficiency by maximizing space utilization, reducing travel time, and improving throughput.					
2.7	The smart warehousing aims to improve overall service quality, productivity, and efficiency while lowering costs and failures.					
2.8	The smart warehousing solutions significantly improves operational efficiencies in inventory management.					

SECTION B3: GREEN PACKAGING

On a 5-point Likert scale, please tick **(√)** on the appropriate box to indicate your level of agreement or disagreement with the following statements with regards to green packaging in your firm:

3.	**Green Packaging**	**1**	**2**	**3**	**4**	**5**
		Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
3.1	The firm offers products in durable, reusable packaging that is collected, professionally cleaned, and refilled, creating a closed-loop system.					
3.2	The packaging is developed to maintain its functionality and safety through multiple cycles of use, collection, cleaning, and refilling or repurposing.					
3.3	The packaging breaks down completely into natural elements in specific conditions, without leaving toxic residues.					
3.4	The firm uses compostable packaging designed to break down into natural elements in the right composting conditions.					
3.5	The firm uses recyclable packaging designed to minimize environmental impact, reduce waste, and support a circular economy.					
3.6	The firm uses recyclable packaging to decrease reliance on virgin materials, saving natural resources and energy.					
3.7	The firm uses biodegradable packaging to decrease environmental footprint, appeal to eco-conscious consumers, and contribute to a more sustainable supply chain.					
3.8	The firm offers products using biodegradable packaging to attract and retain environmentally conscious customers.					

SECTION B2: GREEN DISTRIBUTION

On a 5-point Likert scale, please tick **(√)** on the appropriate box to indicate your level of agreement or disagreement with the following statements with regards to green distribution in your firm:

4.	**Green Distribution**	**1**	**2**	**3**	**4**	**5**
		Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
4.1	The eco-friendly pool distribution solutions significantly can significantly reduce energy consumption, chemical usage, and water waste.					
4.2	The eco-friendly pool distribution reduces environmental impact by consolidating multiple, smaller shipments destined for a specific region into a single, full truckload for the long-haul portion of the journey.					
4.3	The eco-driving training programs are designed to teach drivers techniques that reduce fuel consumption and emissions.					
4.4	The eco-driving training programs focus on smoother driving, such as early gear shifting, maintaining steady speeds, avoiding excessive acceleration/braking, and optimizing vehicle maintenance.					
4.5	The energy-efficient distribution practices involve optimizing logistics and utility infrastructure to reduce energy consumption and carbon emissions.					
4.6	The energy-efficient distribution modes reduce carbon emissions, lower fuel consumption, and minimize the ecological footprint of supply chains.					
4.7	The eco-friendly route optimization approach significantly enhances sustainability by lowering emissions and improves service efficiency through real-time adjustments.					
4.8	The eco-friendly route optimization approach lowers carbon footprints, decreases fuel costs, and improves logistics efficiency					

SECTION *C*: ABSORPTIVE CAPACITY

On a 5-point Likert scale, please tick **(√)** on the appropriate box to indicate your level of agreement or disagreement with the following statements with regards to absorptive capacity in your firm:

5.	**Absorptive Capacity**	**1**	**2**	**3**	**4**	**5**
		Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
5.1	The firm collects information about developments in the sub sector through discussions with business stakeholders.					
5.2	Within the firm, we have sufficient skills to link up with parties who are good in innovations in the sub sector.					
5.3	The search for relevant information concerning our industry is every-day business in the firm.					
5.4	The firm is always among the first to recognize shifts in technical possibilities in the sector.					
5.5	The firm allocates enough time to deliberate with experts in order to recognize changes in the market early.					
5.6	The firm translates external information into use for new business applications.					
5.7	The Appropriate use of external information by the firm contributes to profitability.					
5.8	The firm supports the development of prototypes before eventual deployment of products.					

SECTION D: PERFORMANCE OF FOOD AND BEVERAGE MANUFACTURING FIRMS

On a 5-point Likert scale, please tick **(√)** on the appropriate box to indicate your level of agreement or disagreement with the following statements with regards to the performance of food and beverage manufacturing firms:

6.	**Performance of Food and Beverage Manufacturing Firms**	**1**	**2**	**3**	**4**	**5**
		Strongly Disagree	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**
	For the last three years:					
6.1	Relative to the competitors, the firm's return on assets was much better.					
6.2	Relative to the competitors, the firm has experienced high growth return on assets.					
6.3	Relative to the competitors, the firm's return on equity was much better.					
6.4	Relative to the competitors, the firm has experienced high growth return on equity.					
6.5	Relative to the competitors, the firm's market share position was much better.					
6.6	Relative to the competitors, the firm has experienced high growth market share position.					
6.7	Relative to the competitors, the firm's sales revenue growth position was much better.					
6.8	Relative to the competitors, the firm has experienced high growth sales revenue growth position.					

Thank you for your Cooperation

Appendix III: List of Food and Beverage Manufacturing Firms (Sampling Frame)

1. Agriner Agricultural Development
2. Agri Pro-Pak Ltd
3. Agro Chemical and Food Company Ltd
4. Al-Mahra Industries Ltd
5. Alpha Fine Foods Ltd
6. Alpine Coolers Ltd
7. Arkay Industries Ltd
8. Aquamist Ltd
9. Associated Beverages Ltd
10. African Originals Ltd
11. African Coffee Roasters Ltd
12. Afrimac Nut Company Ltd
13. Agri Pro- Pak Ltd
14. Ava chem Ltd
15. Bakers Corner Ltd
16. Bakeville Ltd
17. Bakex Miller Ltd
18. Belat Enterprises
19. Belfast Millers Ltd
20. Beverage Services (K) Ltd
21. Bidco Africa Ltd
22. Bidcoro Africa Ltd
23. Bio Food Products Ltd
24. Bounty Ltd
25. Brava foods Industries Ltd
26. Breakfast Cereal Company (K) Ltd
27. Broadway Bakery Ltd
28. Brookside Dairy Ltd
29. Brown Plantations Kenya Ltd
30. Bunda Cakes & Fees Ltd

31. Bunge East Africa Ltd
32. Butali Sugar Mills Ltd
33. Buzeki Dairy Ltd
34. C Dorman Ltd
35. Cardbury Kenya Ltd
36. Caffe Del Duca Ltd
37. Candy Kenya Ltd
38. Capwell Industries Ltd
39. Centrofood Industries Ltd
40. Chai Trading Company Ltd
41. Chemelil Sugar Company Ltd
42. Chirag Kenya Ltd
43. Choice Meat Ltd
44. Coast Silos (K) Ltd
45. Coastal Bottlers Ltd
46. Coca-Cola East & Central Africa Ltd
47. Coffee Agriworks Ltd
48. Cofftea Agencies
49. Crown beverages Ltd
50. Daima Dairy Ltd
51. Danone Baby Nutrition Africa & Overseas
52. Darfords Industries Ltd
53. Deepa Industries Ltd
54. Tropical Brand (Africa) Ltd
55. Del Monte Kenya Ltd
56. Delsh & Nutri Ltd
57. De Heus Animal Nutrition Ltd
58. Diamond Industries Ltd
59. DPL Festive Ltd
60. Dutch Water Ltd
61. East Africa Breweries Ltd
62. East African Malt Ltd

63. East Africa Sea Food Ltd
64. Eastern Produce Ltd
65. Edible Oil Products
66. Eldoret Grains Ltd
67. Equator Bottlers Ltd
68. Erdemann Co. (K) Ltd
69. Europack Industries Ltd
70. Excel Chemicals Ltd
71. Executive Food Company Ltd
72. Farmers Choice Ltd
73. Fresh Produce Exporters Association of Kenya
74. Flora Food Manufacturing Ltd
75. Giloil Company Ltd
76. Githunguri Dairy Farmers Co-Operative Society
77. Glaciers Products
78. Global Fresh Ltd
79. Global Tea & Commodities (K) Ltd
80. Gold Crown Beverages (K) Ltd
81. Golden Africa Ltd
82. Gona Best Ltd
83. Gubanax Ventures Ltd
84. Grain Industries Ltd
85. Green Forest Foods Ltd
86. Groove Ltd
87. Happy Cow Ltd
88. Halisi Milling Ltd
89. Heritage Foods Kenya Ltd
90. Highlands Canners Ltd
91. Highlands Mineral Water Company Ltd
92. Insta Products (EPZ) Ltd
93. Ingredion Holding LLC Ltd
94. Jambo Biscuits (K) Ltd

95. Jamii Milling Ltd
96. James Finlay Kenya Ltd
97. Juja Coffee Exporters
98. Jungle Group Holdings
99. Joy Millers Ltd
100. Kabianga Dairy Ltd
101. Kapa Oil Ltd
102. Kerio Valley Development Authority
103. Kenstate Products Ltd
104. Eastern Produce (K) Kakuzi
105. Kabansora Millers Ltd
106. Kambu Distillers Ltd
107. Kamili Packers Ltd
108. Kappa Oil Refineries Ltd
109. Karirana Estate Ltd
110. Karibu Distillers K Ltd
111. Kenafric Bakery
112. Kenafric Industries Ltd
113. Kenblest Ltd
114. Kenchic Ltd
115. Kenlab Supplies Ltd
116. Kenstaste Products
117. Kenya Meat Commission
118. Kenya Nut Company Ltd
119. Kenya Sweets Ltd
120. Kenya Tea Development Agency
121. Kenya Tea Growers Association
122. Kenya Tea Packers Ltd (KETEPA)
123. Kenya Wine Agencies Ltd
124. Keroche Industries Ltd
125. Kenblest Foods Ltd
126. Kevian Kenya Ltd

127. Khetia Group Ltd
128. Kenafric Bakery Ltd
129. Kibos Sugar & Allied Industries
130. Kifaru Homebaking
131. Kinangop Dairy Ltd
132. Kisii Bottlers Ltd
133. Kirinyaga Flour Mills Ltd
134. Kitui Flour Mills Ltd
135. Koba Waters Ltd
136. Krish Commodities Ltd
137. Kuguru Food Complex Ltd
138. Lab International Ltd
139. London Distillers (K) Ltd
140. Mafuko Industries Ltd
141. Mama Millers Ltd
142. Manji Food Industries Ltd
143. Mayfeeds Kenya Ltd
144. Maisha Beverages Ltd
145. Mazao Yetu Ltd
146. Max Grains Ltd
147. Maria Agri Products Ltd
148. Melvin Marsh International
149. Menengai Oil Refineries Ltd
150. Milly Fruit Processors
151. Mini Bakeries
152. Miritini Kenya Ltd
153. Minda Millers Company Ltd
154. Mjengo Ltd
155. Mombasa Maize Millers
156. Morani Ltd
157. Mount Kenya Bottlers Ltd
158. Mount Elgon Ltd

159. Mumias Sugar Company Ltd
160. Mzuri Sweets Ltd
161. Minda Millers Ltd
162. MSH Bakers Ltd
163. Mvita Oild Ltd
164. Nairobi Bottlers Ltd
165. Nairobi Flour Mills Ltd
166. Nas Airport Services Ltd
167. New Kenya Co-operative Creameries Ltd
168. Nesfoods Industries Ltd
169. Nestle Foods Kenya Ltd
170. Nicey Nicey Maize Millers
171. Nicola Farms Ltd
172. Njoro Canning Factory (Kenya) Ltd
173. Nutro Manufacturing Epz Ltd
174. Norda Industries Ltd
175. Nzoia Sugar Company Ltd
176. Osho Grains Millers Ltd
177. Palmhouse Diaries Ltd
178. Patco Industries Ltd
179. Pavarti Industries Ltd
180. Pearl Industries Ltd
181. Pembe Flour Mills Ltd
182. Premier Foods Industries Ltd
183. Promasidor Kenya Ltd
184. Quality meat packers Ltd
185. Razo Ltd
186. Ridges Ritza Millers Ltd
187. Rift Sanitary Products Co Ltd
188. Redsquare Mania Ltd
189. Shalem Investments Ltd
190. Seven Twenty Holdings Ltd

191. Spice Ltd
192. Spice Ken EPZ Ltd
193. Selecta Kenya GmBH ltd
194. Soi Dairy Industries
195. Supa Loaf Ltd
196. Suguna Foods Ltd
197. Sunny Processors Ltd
198. Sigma Feeds Ltd
199. SBC Kenya Ltd
200. Shree Sai Industries Ltd
201. Two Cousins Distillers Ltd
202. Thirrika Brothers Ltd
203. The Chocolate Bar Ltd
204. The Fresh Bakers Ltd
205. Tropical Heat Ltd
206. Tru foods Ltd
207. Thika Coffee Mills Ltd
208. Leafde Ltd
209. Unga Ltd
210. United Millers Ltd
211. Uplands Crops Ltd
212. Ustawi Grains Millers Ltd
213. Xpressions Flora Ltd
214. Yatta Bee Keepers Ltd
215. VG Foods Ltd
216. Wafa Kenya Ltd
217. Weetabix East Africa Ltd

Appendix IV: University Authorization Letter

JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY
OFFICE OF THE DIRECTOR - MOMBASA CAMPUS
P.O Box 81310 – 80100, Mombasa. Tel: +254 735 628 272, 041 2315434 E-mail:director-mombasa@jkuat.ac.ke

08th December, 2022

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: PERMISSION TO COLLECT DATA BY CHARLES MAMU NTHIWA:- HDE423-C005-1576/2018

The above mentioned is a student at this Campus undertaking PhD in Supply Chain Management Course. CHARLES is expected to collect data on the topic, "GREEN LOGISTICS PRACTICES AND PERFORMANCE OF FOOD AND BEVERAGE MANUFACTURING FIRMS IN KENYA."

Any assistance given to him will be highly appreciated.

Thank you.

Yours Sincerely,

JKUAT MOMBASA CBD CAMPUS
08 DEC 2022
BUSINESS DEPARTMENT

BARRACK OKELLO
COD, BUSINESS DEPARTMENT

WMJ/BLO

Appendix V: Research License

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **436016**

Date of Issue: **05/April/2023**

RESEARCH LICENSE

This is to Certify that Mr.. CHARLES MAMU NTHIWA of Jomo Kenyatta University of Agriculture and Technology, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Bungoma, Embu, Kajiado, Kericho, Kiambu, Kilifi, Kisii, Kisumu, Kwale, Lamu, Makueni, Meru, Migori, Mombasa, Nairobi, Nakuru, Nyeri, Uasin-Gishu on the topic: GREEN LOGISTICS PRACTICES AND PERFORMANCE OF FOOD AND BEVERAGE FIRMS IN KENYA for the period ending : 05/April/2024.

License No: **NACOSTI/P/23/24775**

436016

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions