

SUSTAINABLE LOGISTICS PRACTICES AND PERFORMANCE OF THE FLORICULTURE EXPORT SECTOR IN KENYA

¹ Onchonga Davis Gethange, ² Dr. Miriam Thogori, PhD

¹ Msc. Scholar (Procurement and Logistics), Jomo Kenyatta University of Agriculture and Technology, Kenya

² Lecturer, Jomo Kenyatta University of Agriculture and Technology, Kenya

ABSTRACT

The performance of Kenya's floriculture export sector has been declining in recent years. In 2023, total horticulture export earnings dropped by 6.8%, with flower exports contributing significantly to this decline. The volume of cut flowers exported fell from 210,000 metric tons in 2021 to 185,000 metric tons in 2023. The general objective of the study is to determine the effect of sustainable logistics practices on floriculture export sector in Kenya. Specifically, the study sought to determine the influence of sustainable packaging on performance of the floriculture export sector in Kenya, and to establish the effect of route optimization on performance of the floriculture export sector in Kenya. This study was anchored on Resource-Based View (RBV) Theory and Systems Theory. This study used descriptive research design. This study targeted the floriculture export companies in Kenya in Kenya. According to Agriculture and Food Authority report (2024), there are 74 Registered floriculture export companies in Kenya in Kenya. This study targeted heads of logistics and procurement department in these companies hence the total target population was 148 respondents. The researcher used Stratified sampling. Yamane Formula (1967) was used to calculate the sample size. A sample size of 108 respondents participated in the study. Data from questionnaires were coded and analysed using the latest Statistical Package for Social Sciences (SPSS) computer software. The study employed mixed methods data analysis by applying the use of descriptive and inferential statistics. Quantitative data collected was analysed by the use of descriptive statistics which include percentages, means, standard deviations and frequencies. Pearson correlation analysis was used to test the strength and the direction of the relationship between the independent and the dependent variables. The study concludes that sustainable packaging has a positive and significant effect on performance of the floriculture export sector in Kenya. In addition, the study concludes that route optimization has a positive and significant effect on performance of the floriculture export sector in Kenya. From the results, the study recommends that floriculture export sector in Kenya should integrate real-time GPS and data analytics systems to streamline transportation from farms to export hubs and airports. By using intelligent route planning technologies, exporters can reduce delays, minimize fuel consumption, and ensure that flowers reach their destinations faster and in optimal condition.

Key Words: Sustainable Logistics Practices, Floriculture Export Sector, Sustainable Packaging, Route Optimization

Background of the Study

Agriculture is a fundamental pillar of the global economy, contributing approximately 4% of the world's GDP and employing over 27% of the global workforce (World Bank, 2023). In developing countries, agriculture plays an even more significant role, accounting for over 25% of GDP in Sub-Saharan Africa and South Asia. The sector provides food security, raw materials for industries, and is a key driver of international trade, with global agricultural exports exceeding \$1.8 trillion annually (FAO, 2023). Major agricultural economies like China, the United States, Brazil, and India dominate global production, with the U.S. alone exporting agricultural products worth \$196 billion in 2022 (Alam, 2023).

Floriculture is the branch of horticulture that focuses on the cultivation, production, and management of flowers and ornamental plants. It involves the growing of flowers, plants, and shrubs for various purposes, such as for decorative use, landscaping, and the production of cut flowers, potted plants, and floral arrangements (Umutoni & Akumuntu, 2024). Floriculture also includes the breeding, growing, and marketing of flowers for the global flower trade. The sector encompasses various stages, including seed production, propagation, cultivation, harvesting, processing, and distribution of flowers and ornamental plants (Kumar, 2022). The floriculture export sector plays a vital role in the global economy, driving the trade of flowers, plants, and ornamental products across international borders. As one of the most dynamic agricultural industries, floriculture involves the cultivation, production, and trade of flowers and plants used for decorative purposes, including cut flowers, potted plants, and seeds (Chatzoudes, Kadłubek & Maditinos, 2024). The sector's significance is underscored by its contribution to both developed and developing economies, where it provides employment and fosters trade relationships. The trade of ornamental plants has expanded beyond regional markets, reaching countries worldwide, with the United States, the European Union, Japan, and the United Arab Emirates being some of the largest importers (Andri *et al*, 2024). According to the International Trade Centre (ITC), the global floriculture trade was valued at around USD 14 billion in 2020, with significant trade flows observed between Europe and other regions like Asia and Africa (Agyabeng-Mensah *et al*, 2020).

The Netherlands, renowned for its floriculture industry, is a central hub for the global flower trade, often acting as a distribution point for flowers grown in countries like Kenya, Colombia, and Ethiopia (Alam, 2023). Dutch exports account for nearly 50% of global flower trade, with the country's flower auction houses playing a key role in ensuring efficient distribution to other markets. In 2021, the Netherlands exported flowers worth over USD 6 billion, primarily to Germany, the United Kingdom, and France. Additionally, countries in East Africa, particularly Kenya, have established themselves as major exporters, with Kenya supplying more than 50% of the cut flowers to the European Union market (Chatzoudes, Kadłubek & Maditinos, 2024). Floriculture in Kenya alone generates billions in revenue and provides jobs to hundreds of thousands of workers. The sector is crucial for economic growth in developing nations, helping lift communities out of poverty through employment and income generation (Chrisostom & Monari, 2022).

In the context of the global market, the floriculture export sector is also significantly impacted by consumer preferences, which are increasingly shifting towards sustainability and eco-friendly products (Kumar, 2022). The demand for organic flowers, biodegradable packaging, and flowers cultivated with minimal environmental impact is growing, particularly in Europe and North America. This trend is evident in the rise of certifications like Fair Trade and GlobalG.A.P., which ensure that flowers are grown sustainably, with fair labor practices (Chatzoudes, Kadłubek & Maditinos, 2024). Global statistics from the Food and Agriculture Organization (FAO) and ITC reflect this growing demand, as consumers increasingly favor ethically sourced products. Despite challenges such as climate change, fluctuating exchange rates, and geopolitical instability, the floriculture export sector remains a vital part of the global

agricultural landscape, with innovations in sustainability and logistics driving its growth into the future (Andri *et al.*, 2024).

Sustainable packaging involves using eco-friendly materials and methods to minimize environmental impact in the packaging process. This practice focuses on reducing the use of non-recyclable, non-biodegradable materials like plastic, and instead utilizing materials that are recyclable, biodegradable, or made from renewable resources (Githinji & Wachiuri, 2023). Sustainable packaging also emphasizes designing packaging that uses fewer resources, reduces weight, and is optimized for efficient transport, helping to reduce carbon emissions. By adopting sustainable packaging, companies can significantly lower their environmental footprint, enhance their brand reputation among eco-conscious consumers, and comply with increasingly strict environmental regulations. This practice also encourages innovation in material science and design, contributing to a more sustainable supply chain overall (Muttimos, 2021).

Route optimization involves using advanced software and data analytics to determine the most efficient paths for transportation, minimizing fuel consumption, travel time, and carbon emissions. This practice can help companies reduce transportation costs while simultaneously reducing their environmental impact (Muttimos, 2021). By optimizing routes, companies can ensure that vehicles carry full loads and avoid unnecessary detours, further reducing fuel consumption and vehicle wear and tear.

Additionally, adopting just-in-time inventory practices can prevent overstocking and reduce waste associated with unsold goods. By reducing waste, organizations not only lower disposal costs but also contribute to environmental sustainability, reduce resource consumption, and meet the increasing consumer demand for eco-friendly business practices (Adegoke *et al.*, 2021). This study aims to determine the effect of sustainable logistics practices on performance of the horticulture export sector in Kenya.

Statement of the Problem

Agriculture is the backbone of Kenya's economy, contributing approximately 21% of the Gross Domestic Product (GDP) and employing over 40% of the total workforce. Within the agricultural sector, the floriculture export industry plays a significant role in foreign exchange earnings, job creation, and rural development. Kenya is one of the world's leading exporters of cut flowers, supplying over 40% of the European Union's (EU) flower market (Githinji & Wachiuri, 2023). The sector contributes approximately KSh 108 billion (\$890 million) annually, with major export destinations including the Netherlands, the United Kingdom, and Germany. However, the industry's sustainability and long-term performance depend heavily on efficient logistics practices, including cold chain management, transport efficiency, and compliance with international trade regulations (Agriculture and Food Authority report, 2024). Kenya's floriculture industry holds a substantial position in the global market. In 2021, the country ranked as the fourth-largest exporter of cut flowers worldwide, with exports valued at approximately \$766 million. Major importers of Kenyan flowers include the Netherlands (\$322 million), the United Kingdom (\$147 million), Germany (\$38.9 million), Russia (\$33.4 million), and Saudi Arabia (\$32.9 million). Additionally, Kenyan flowers are sold across 60 destinations, underscoring the industry's extensive reach (Chrisostom, & Monari, 2022).

Despite its importance, the performance of Kenya's floriculture export sector has been declining in recent years. In 2023, total horticulture export earnings dropped by 6.8%, with flower exports contributing significantly to this decline. The volume of cut flowers exported fell from 210,000 metric tons in 2021 to 185,000 metric tons in 2023, mainly due to rising air freight costs, logistical inefficiencies, and strict international market regulations (Mutangili, 2021). Additionally, increased competition from emerging flower-exporting nations such as Ethiopia, Ecuador, and Colombia has put pressure on Kenya's flower exports. Climate change-

related challenges, including water scarcity and extreme weather fluctuations, have further impacted production and export consistency. These trends indicate a growing concern about the sustainability and efficiency of logistics practices in maintaining Kenya's competitive edge in the global floriculture market (Ochiri, et al, 2021). Customer satisfaction in the floriculture sector is closely linked to product quality and reliability. The recent pest-related challenges have raised concerns among international buyers, particularly in the EU market, which is sensitive to quality standards. Ensuring compliance with international standards and implementing effective pest control measures are vital for maintaining and enhancing customer satisfaction (Ekai, & Kamaara, 2024).

Sustainable logistics practices play a crucial role in enhancing the performance of organizations. Various studies have been conducted in different parts of the world on sustainable logistics practices and organization performance. For instance, Githinji and Wachiuri (2023) conducted a study on the sustainable logistics practices and performance of agricultural processing firms. Chrisostom and Monari (2022) assessed on the influence sustainable logistics practices on performance of registered automotive firms and Wasike and Juma (2021) examined on the influence of sustainable logistics practices on the performance of humanitarian organizations. However, none of these studies focused on sustainable packaging, and route optimization on performance of the floriculture export sector in Kenya. To fill the highlighted gaps, the current study sought to determine the effect of sustainable logistics practices (sustainable packaging, route optimization) on performance of the floriculture export sector in Kenya.

Objective of the Study

The general objective of the study is to determine the effect of sustainable logistics practices on performance of the floriculture export sector in Kenya

Specific Objectives

The study was guided by the following specific objectives;

- i. To determine the influence of sustainable packaging on performance of the floriculture export sector in Kenya.
- ii. To establish the effect of route optimization on performance of the floriculture export sector in Kenya.

LITERATURE REVIEW

Theoretical Framework

Resource-Based View (RBV) Theory

The Resource-Based View (RBV) Theory, initially developed by scholars Edith Penrose in 1959 and later advanced by Barney (1991), focuses on the strategic importance of a firm's internal resources in achieving a competitive advantage (Ingabire & Irechukwu, 2022). The theory argues that firms possess unique resources—tangible or intangible—that can help them outperform competitors if these resources are valuable, rare, inimitable, and non-substitutable (often referred to as VRIN attributes). According to the RBV, it is not just the firm's external market environment that determines its success, but the distinctive internal resources and capabilities it possesses. This view contrasts with traditional economic theories that emphasize market competition and external factors like industry structure (Nwawume & Yetude, 2024).

The Resource-Based View (RBV) Theory supports sustainable packaging by emphasizing the strategic importance of unique resources and capabilities in gaining a competitive advantage. According to this theory, firms that develop valuable, rare, inimitable, and non-substitutable (VRIN) resources can achieve long-term success (Gikonyo, Ngugi & Paul, 2022). In the

context of sustainable packaging, companies that invest in eco-friendly materials, innovative packaging technologies, and efficient waste management systems can differentiate themselves in the market. Sustainable packaging not only reduces environmental impact but also enhances brand reputation, regulatory compliance, and cost efficiency, ultimately improving organizational performance (Sambu, 2020).

The Resource-Based View (RBV) theory of strategic management is built upon several foundational assumptions that shape its approach to analyzing firm performance and competitive advantage. One key assumption of RBV is that firms are heterogeneous in terms of the resources and capabilities they possess. This means that each firm has a unique bundle of resources—both tangible and intangible—that is valuable, rare, difficult to imitate, and non-substitutable (VRIN) (Thiga, Chege & Arani, 2023). RBV posits that these distinctive resources and capabilities are the primary sources of sustained competitive advantage and superior performance. Another assumption of RBV is that firms are rational and profit-maximizing actors that seek to exploit their resources and capabilities to create value for stakeholders (Ingabire & Irechukwu, 2022). RBV theory also assumes that resources are not static, but can be developed, accumulated, and leveraged over time to enhance a firm's competitive position. This implies that firms can invest in building and renewing their resource base, as well as developing dynamic capabilities that enable them to adapt and respond effectively to changes in the external environment (Nwawume & Yetude, 2024). Additionally, RBV assumes that markets are imperfect and that firms can earn economic rents by possessing unique resources and capabilities that are not fully captured by market prices. These rents can arise from factors such as brand reputation, customer loyalty, and proprietary technology (Gikonyo, Ngugi & Paul, 2022).

Despite its strengths, RBV theory has faced several critiques over the years. One criticism is that RBV may be tautological or circular in its reasoning, as the concept of valuable, rare, inimitable, and non-substitutable resources (VRIN) is somewhat subjective and difficult to operationalize empirically (Sambu, 2020). Critics argue that firms may achieve competitive advantage through factors other than resources and capabilities, such as market positioning or network effects. Additionally, RBV has been criticized for its limited focus on external factors and industry dynamics, such as changes in customer preferences, technological innovation, and competitive rivalry (Thiga, Chege & Arani, 2023). Some scholars argue that RBV may overlook the importance of these external factors in shaping a firm's competitive position and performance. Moreover, RBV theory has been criticized for its lack of prescriptive guidance on how firms can identify and develop valuable resources and capabilities (Ingabire & Irechukwu, 2022). While RBV provides a useful framework for understanding the sources of competitive advantage, it offers limited practical guidance on how firms can systematically analyze their resource base and make strategic decisions to enhance their competitive position (Nwawume & Yetude, 2024). Critics also point out that RBV may be less relevant in industries characterized by rapid technological change and disruptive innovation, where traditional sources of competitive advantage may be short-lived (Gikonyo, Ngugi & Paul, 2022). This study used Resource-Based View (RBV) Theory to assess the influence of sustainable packaging on performance of the floriculture export sector in Kenya.

Systems Theory

Systems Theory, initially developed by Ludwig von Bertalanffy in (1946), is a multidisciplinary approach that views complex phenomena as a set of interrelated components working together as a whole (Kirabo, Namusonge & Iravo, 2022). Von Bertalanffy, a biologist, originally introduced the theory to understand biological systems, but it has since been applied to various fields, including business, management, and social sciences. The theory posits that any system—whether it's an organization, a machine, or a biological entity—can only be understood by examining the interactions between its components and how these components

work together to achieve a common goal (Adebayo & Aworemi, 2021). Systems theory emphasizes holistic thinking, where the whole is greater than the sum of its parts, and asserts that changes in one part of the system can have cascading effects on the other parts. It also highlights the importance of feedback loops, adaptation, and the environment in which the system operates (Ekai & Kamaara, 2024).

Systems Theory supports route optimization by focusing on the efficient movement of goods and people within a given system. This theory is based on the principle that transportation networks should minimize costs, time, and energy while maximizing the use of resources such as vehicles and infrastructure (Musau, *et al*, 2021). It emphasizes the importance of route planning, scheduling, and network design to improve overall efficiency in transportation. In the context of logistics and route optimization, this theory suggests that by using advanced algorithms and data analytics, companies can determine the most efficient paths for delivery, reduce fuel consumption, and decrease travel time (Ngesa & Namusnge, 2023). The theory aligns with sustainable logistics practices, advocating for optimizing routes to reduce environmental impact while maintaining cost-effectiveness (Kirabo, Namusonge & Iravo, 2022).

Systems Theory operates on several foundational assumptions that shape its application across various disciplines. One primary assumption is that systems can be understood as wholes, emphasizing the importance of the interconnections between components rather than just their individual characteristics (Adebayo & Aworemi, 2021). This holistic perspective suggests that the behavior of a system is not merely the sum of its parts, but rather a result of complex interactions. Another key assumption is the notion of stability and equilibrium, where systems tend to seek balance through feedback mechanisms. This implies that systems are self-regulating and can adapt to changes while maintaining their core functions (Ekai & Kamaara, 2024).

However, Systems Theory has faced critiques regarding its applicability and limitations. One critique is that the theory can sometimes oversimplify complex realities by focusing too heavily on interrelations and neglecting the unique characteristics of individual components (Musau, *et al*, 2021). In doing so, it may obscure critical nuances that are essential for understanding specific elements within a system. Additionally, the emphasis on equilibrium can be misleading; many real-world systems are dynamic and subject to constant change, with instability and unpredictability often being the norm rather than the exception (Ngesa & Namusnge, 2023). Critics argue that this focus on stability may lead to inadequate responses to crises or disruptions, as systems are not always capable of self-correcting. Another significant critique is related to the challenge of defining system boundaries. While establishing boundaries is crucial for understanding a system's interactions with its environment, determining where one system ends and another begins can be problematic (Kirabo, Namusonge & Iravo, 2022). This ambiguity can lead to issues in analysis and decision-making, particularly in complex scenarios where systems overlap or influence each other. For instance, in ecological studies, defining the boundary of an ecosystem can be contentious and can impact conservation efforts and policy formulation (Adebayo & Aworemi, 2021). This study used systems theory to assess the effect of route optimization on performance of the floriculture export sector in Kenya.

Conceptual Framework

A conceptual framework is a structured system of ideas and theories that guides research by defining key concepts, relationships, and variables. It serves as a foundation for understanding and interpreting the phenomena under study, helping researchers to outline their hypotheses and design their methodology (Miles, Huberman & Saldana 2019).

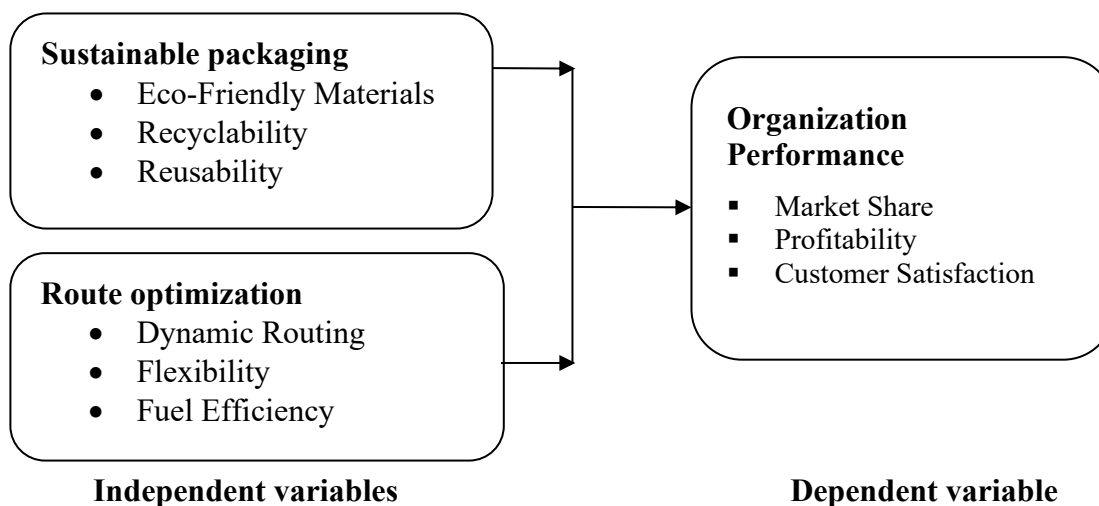


Figure 2. 1: Conceptual framework

Sustainable Packaging

Sustainable packaging refers to the use of materials and processes that reduce environmental impact and promote the efficient use of resources (Sambu, 2020). As concerns about climate change, pollution, and resource depletion rise, companies and industries have increasingly adopted sustainable packaging solutions to minimize waste and conserve natural resources. Sustainable packaging focuses on three key principles: the use of eco-friendly materials, ensuring recyclability, and promoting reusability (Thiga, Chege & Arani, 2023). One of the most fundamental components of sustainable packaging is the use of eco-friendly materials. These materials are typically sourced from renewable resources, such as plant-based products (e.g., cornstarch, bamboo, and hemp), or are biodegradable, meaning they break down naturally and pose less harm to the environment compared to conventional plastic (Ingabire & Irechukwu, 2022). For instance, paper and cardboard are commonly used in sustainable packaging because they are renewable, recyclable, and biodegradable. In some cases, companies are turning to alternative bioplastics made from organic materials like algae or plant starch, which have a much lower environmental footprint than petroleum-based plastics. The goal is to reduce the reliance on non-renewable and resource-intensive materials like conventional plastic, which is notorious for its contribution to long-lasting pollution in landfills and oceans. By utilizing materials that have a smaller environmental impact, businesses can significantly reduce the carbon footprint of their packaging and improve their sustainability credentials (Nwawume & Yetude, 2024).

Recyclability is another critical aspect of sustainable packaging. Packaging that is recyclable can be processed and reused into new products rather than being disposed of in landfills. By prioritizing recyclable packaging, companies help close the loop of material consumption, reducing the demand for new raw materials and the energy consumption associated with manufacturing new products (Gikonyo, Ngugi & Paul, 2022). Common recyclable materials include paper, glass, metal, and certain types of plastic, provided they meet local recycling criteria. To improve recyclability, packaging should be designed to avoid mixing materials that cannot be separated easily during the recycling process. Additionally, companies are increasingly designing packaging with labels that provide clear recycling instructions, ensuring that consumers can easily sort and dispose of materials correctly. This helps to increase the effectiveness of recycling programs and reduces the likelihood of recyclable materials ending up as waste (Ingabire & Irechukwu, 2022).

The concept of reusability in sustainable packaging emphasizes designing packaging that can be reused multiple times before being discarded. This approach minimizes waste and reduces the demand for single-use packaging. For example, reusable containers, bags, and jars are designed to have a longer life cycle, allowing consumers to repurpose them for various functions, reducing the need for new packaging altogether (Thiga, Chege & Arani, 2023). Some businesses even incentivize customers to return packaging, such as bottles or containers, for refills, further reducing packaging waste. Reusability encourages a shift away from a linear consumption model (take, make, dispose) to a circular model, where materials and products are kept in use for as long as possible (Ingabire & Irechukwu, 2022). This approach is gaining popularity in various industries, including food, beverage, and personal care sectors, where companies are exploring systems like bottle return schemes or refill stations. Reusable packaging not only reduces environmental impact but also offers long-term cost savings for both companies and consumers (Nwawume & Yetude, 2024).

Route Optimization

Route optimization is the process of determining the most efficient path or routes for vehicles or goods to travel in order to minimize time, distance, and cost, while maximizing operational efficiency. It involves using algorithms, technology, and data analysis to plan and adjust routes for deliveries, transportation, or logistics (Ekai & Kamaara, 2024). The goal of route optimization is to reduce fuel consumption, lower operational costs, improve delivery times, and enhance overall productivity. This is particularly important in industries like transportation, e-commerce, and supply chain management, where businesses are aiming to streamline operations, reduce their carbon footprint, and provide better service to customers (Musau, *et al*, 2021). Dynamic routing refers to the ability to adjust routes in real-time based on changing conditions such as traffic, weather, road closures, or customer requirements. Unlike static routes, which are pre-planned and fixed, dynamic routing uses live data to continuously optimize paths and ensure the most efficient delivery or transportation route is taken (Ngesa & Namusnge, 2023). This flexibility allows businesses to respond to unforeseen circumstances and make adjustments that can save time, reduce delays, and enhance customer satisfaction. By incorporating real-time factors, dynamic routing helps companies avoid bottlenecks and unnecessary detours, ensuring the most efficient and timely operations (Kirabo, Namusonge & Iravo, 2022).

Flexibility in route optimization refers to the ability to adapt routes based on fluctuating circumstances or evolving business needs. This could involve last-minute changes in delivery schedules, the addition of new destinations, or unexpected obstacles (Adebayo & Aworemi, 2021). Flexible routing systems allow companies to easily modify their plans without compromising efficiency. For instance, drivers might need to accommodate urgent shipments, new orders, or detours caused by traffic incidents (Ekai & Kamaara, 2024). By having the flexibility to modify routes quickly, businesses can meet customer demands more effectively, improve resource utilization, and avoid delays, all while maintaining a smooth operation. This ability to adjust on the fly helps businesses remain agile and responsive to changing market conditions (Musau, *et al*, 2021). Fuel efficiency in route optimization focuses on minimizing the amount of fuel consumed during transportation, which not only helps reduce costs but also lowers the environmental impact of logistics operations (Ngesa & Namusnge, 2023). Optimizing routes for fuel efficiency involves considering factors like the shortest or quickest routes, reducing idling time, avoiding congested areas, and using eco-friendly vehicles where possible. By improving fuel efficiency, companies can decrease their carbon footprint and reduce fuel expenses, which is increasingly important in today's climate-conscious business environment. Well-optimized routes that minimize unnecessary driving can lead to significant cost savings while contributing to sustainability goals, making fuel-efficient routing an essential aspect of modern logistics strategies (Kirabo, Namusonge & Iravo, 2022).

Empirical Review

Sustainable Packaging and Organization Performance

Ingabire and Irechukwu (2022) conducted a study on sustainable packaging and organizational performance in manufacturing industries in Rwanda: a case of Sulfo Industries Ltd. The study used a descriptive research in both quantitative and qualitative. The target population was 135 from which a sample of 100 respondents was selected using formula developed by Slovenes. The study found that sustainable packaging has led to industry performance. The study concluded that the relationship between sustainable packaging and organizational performance is statistically significant.

Nwawume and Yetude (2024) researched on sustainable packaging and marketing performance of sampled food and beverage manufacturing industries in South-South Nigeria. The study used questionnaires. The study sampled 83 registered food and beverage manufacturing firms in South-south Nigeria. The study found that sustainable packaging significantly improved customer satisfaction, repeat patronage and market share growth of sampled manufacturing firms in south-south Nigeria. The study concluded that there was a very strong significant linear effect between sustainable packaging and the dimensions of marketing performance of the manufacturing industry in south-south Nigeria.

Gikonyo, Ngugi and Paul (2022) assessed on the influence of sustainable packaging on performance of building and construction manufacturing firms in Kenya. The study used cross-sectional research design and surveyed 270 respondents drawn from the 54 building and construction manufacturing firms in Kenya. The study found that sustainable packaging had a significant influence on the performance of the building and construction manufacturing firms in Kenya. The study concluded that through embrace of sustainable packaging, performance of the manufacturing firms was obtained.

Sambu (2020) investigated on the effect of sustainable packaging on business performance in the manufacturing in Nairobi County, Kenya. The study adopted the explanatory research design. A census of 133 firm managers working for 47 firms in Nairobi County was done. The study found that sustainable packaging is key determinants of business performance in the manufacturing in Kenya. The study concluded that sustainable packaging has a positive and significant effect on firm performance in manufacturing industry.

Thiga, Chege and Arani (2023) examined on sustainable packaging and performance of food and beverage manufacturing firms in Kenya. An explanatory research design was employed in the study. All 172 of Kenya's registered food and manufacturing businesses were considered using the census approach. The study found that there is a positive correlation between sustainable packaging and the performance of Kenyan food and beverage manufacturing companies. The study concluded that sustainable packaging has a significant relationship on the performance of food and beverage manufacturing firms in Kenya.

Route Optimization and Organization Performance

Kirabo, Namusonge and Iravo (2022) assessed on route optimization and performance of manufacturing firms in Rwanda. This study applied descriptive survey design and utilized both qualitative and quantitative data. The study population included the 133 respondents and sampled 100. The study found that route optimization positively and significantly correlated with performance of manufacturing firms. The study concluded that there is a significant relationship between route optimization and performance of manufacturing firms in Rwanda.

Adebayo and Aworemi (2021) investigated on route optimization and firms' performance in Nigeria. The study was conducted in food and beverages companies in Lagos State, Nigeria. Ten food and beverages companies in Lagos State, Nigeria listed on the Nigerian Stock Exchange were selected from the study population using purposive sampling while three

hundred questionnaires were administered. The study found that route optimization has a significant effect on logistics performance of the selected food and beverages companies. The study concluded that route optimization positively influences firm performance.

Ekai and Kamaara (2024) examined on route optimization and performance of distribution firms in Nairobi City County, Kenya. The study adopted descriptive research design. The target population was 1061 distribution firms. The Yamane formula was adopted to calculate the study sample size. Therefore, the study sample size was 290 respondents. The study found that route optimization has a significant effect on performance of distribution firms in Nairobi City County, Kenya. The study concluded that route optimization has a positive and significant influence on performance of distribution firms in Nairobi City County, Kenya.

Musau, *et al* (2021) researched on the effect of route optimization on organizational performance among textile manufacturing firms in Kenya. The study adopted the convergent parallel mixed methods design. The study targeted a total of 196 respondents drawn from employees of procurement departments and departmental heads of respective 15 textile manufacturing industries operating in Nairobi County. The sample size was therefore 139 respondents. The study found that route optimization positively influences supply chain performance of Textile firms. The study concluded that route optimization have a positive significant effect on organizational performance of textile manufacturing firms in Kenya.

Ngesa and Namusnge (2023) conducted a study on the effect of route optimization on the performance of logistics firms in Nairobi County, Kenya. The study used questionnaires. Target population was popular top ten logistics services companies in Nairobi County. Sample size comprised of 88 employees from different departments in the 10 entities chosen. The study found that route optimization has a positive significant effect on performance of logistic firms in Nairobi County. The study concluded that route optimization leads to a significant performance of logistic firms in Nairobi County.

RESEARCH METHODOLOGY

The study adopted a descriptive research design, which is suitable for obtaining standardized information from a defined population using survey questionnaires (Orodho, 2019). This design enabled systematic collection and analysis of data on logistics sustainability practices and their relationship with performance in the floriculture export sector in Kenya. The target population comprised heads of logistics and procurement departments in registered floriculture export companies in Kenya. According to the Agriculture and Food Authority (2024), there are 74 registered floriculture export companies, yielding a total target population of 148 respondents (two per firm). This managerial-level focus ensured that information was obtained from respondents directly involved in logistics and supply chain decision-making.

The sample size was determined using Yamane's (1967) formula, based on the population of 148, resulting in a sample of 108 respondents. Stratified sampling was used to ensure representation across the firms, after which respondents were selected using probability procedures, consistent with recommendations that adequate sample size improves representativeness in descriptive surveys (Cooper & Schindler, 2019; Kothari, 2019; Mugenda & Mugenda, 2018). This approach enhanced the likelihood that the sample reflected the characteristics of the broader floriculture export sector.

Primary data were collected using structured questionnaires, which allowed standardized measurement of the study constructs (Crowther & Lancaster, 2018; Creswell, 2018). The questionnaire consisted mainly of closed-ended items designed to capture information on sustainable packaging, route optimization, and firm performance. Data were collected using a self-administered questionnaire approach, which is efficient for reaching many respondents across different locations (Cooper & Schindler, 2019). Prior to data collection, the researcher

obtained an introductory letter from the university, a research permit from the National Commission for Science, Technology and Innovation (NACOSTI), and permission from the chief executives of participating firms. Trained research assistants supported administration of the questionnaires, handled clarifications, and adhered to research ethics.

A pilot study was conducted on 10% of the sample (11 respondents) to test the clarity, relevance, and comprehensibility of the questionnaire items (Mugenda & Mugenda, 2019). The pilot helped identify ambiguous or misleading questions and ensured that items were appropriate for respondents with diverse backgrounds (Otieno & Omwoyo, 2023; Munywoki, 2021). Reliability of the instrument was assessed using Cronbach's alpha, with a threshold of 0.70 adopted as the minimum acceptable level of internal consistency (Cooper & Schindler, 2019). Content validity was enhanced through expert review by supervisors and lecturers, who evaluated the extent to which the questionnaire adequately captured the constructs of interest (Zikmund, 2019; Thietart, 2019).

Quantitative data from the questionnaires were coded and analyzed using the Statistical Package for Social Sciences (SPSS). Descriptive statistics including frequencies, percentages, means, and standard deviations were used to summarize respondents' views and to describe the distribution of key variables. Graphical presentations such as tables, bar charts, and pie charts were used to facilitate interpretation. Inferential statistics comprised Pearson correlation analysis to examine the strength and direction of relationships between the independent variables and firm performance, and multiple regression analysis to determine the combined and individual effects of sustainable packaging (X_1), route optimization (X_2), on the performance of the floriculture export sector in Kenya (Y).

RESEARCH FINDINGS AND DISCUSSIONS

The sample size of this study was 108. The researcher distributed 108 questionnaires to the respondents during data collection process and 95 were fully filled and returned to the researcher thus making a response rate of 88%. Kothari (2019) argues that a response rate which is more than 50% is considered adequate while excellent response rate is usually above 70%. This implies that the response rate in this research is good for making conclusions as well as recommendations.

Descriptive Statistics

Sustainable Packaging and Organization Performance

The first specific objective of the study was to determine the influence of sustainable packaging on performance of the floriculture export sector in Kenya. The respondents were requested to indicate their level of agreement on various statements related to sustainable packaging and performance of the floriculture export sector in Kenya. The results were as shown Table 1.

From the results, the respondents agreed that in their organization, using eco-friendly packaging materials boosts the marketability of Kenyan flowers internationally ($M=3.810$, $SD=0.736$). In addition, the respondents agreed that in their organization, the cost of eco-friendly packaging materials affects the profitability of floriculture exports ($M=3.768$, $SD=0.529$). Further, the respondents agreed that in their organization, recyclable packaging meets the sustainability expectations of international buyers ($M=3.751$, $SD=0.834$).

From the results, the respondents agreed that in their organization, customers prefer floriculture products with sustainable packaging, improving their sector's reputation ($M=3.733$, $SD=0.515$). In addition, the respondents agreed that in their organization, reusing packaging materials reduces operational costs and supports sustainability ($M=3.711$, $SD=0.901$). Further, the respondents agreed that in their organization, adopting sustainable packaging practices has improved the performance of the floriculture export sector ($M=3.703$, $SD=0.815$).

Table 1: Sustainable Packaging and Organization Performance

	Mean	Std. Deviation
In our organization, using eco-friendly packaging materials boosts the marketability of Kenyan flowers internationally.	3.810	0.736
In our organization, the cost of eco-friendly packaging materials affects the profitability of floriculture exports.	3.768	0.529
In our organization, recyclable packaging meets the sustainability expectations of international buyers.	3.751	0.834
In our organization, customers prefer floriculture products with sustainable packaging, improving our sector's reputation.	3.733	0.515
In our organization, reusing packaging materials reduces operational costs and supports sustainability.	3.711	0.901
In our organization, adopting sustainable packaging practices has improved the performance of the floriculture export sector.	3.703	0.815
Aggregate	3.746	0.722

Route Optimization and Organization Performance

The second specific objective of the study was to establish the effect of route optimization on performance of the floriculture export sector in Kenya. The respondents were requested to indicate their level of agreement on various statements related to route optimization and performance of the floriculture export sector in Kenya. The results were as shown Table 2.

From the results, the respondents agreed that their organization uses real-time data to adjust routes dynamically for improved efficiency (M=3.881, SD= 0.611). In addition, the respondents agreed that they implement technology that helps optimize delivery routes based on traffic and weather conditions (M=3.863, SD= 0.838). Further, the respondents agreed their routing system allows for flexibility in adjusting to last-minute changes or unforeseen events (M=3.838, SD= 0.740).

From the results, the respondents agreed that the route optimization process allows them to respond quickly to shifts in customer demands or unexpected delays (M=3.827, SD= 0.619). In addition, the respondents agreed that they continuously monitor and adjust their routes to ensure maximum fuel efficiency (M=3.741, SD= 0.904). Further, the respondents agreed that the use of optimized routes helps decrease their carbon footprint and improve sustainability in their logistics (M=3.729, SD= 0.803).

Table 4. 1: Route Optimization and Organization Performance

	Mean	Std. Deviation
Our organization uses real-time data to adjust routes dynamically for improved efficiency.	3.881	0.611
We implement technology that helps optimize delivery routes based on traffic and weather conditions	3.863	0.838
Our routing system allows for flexibility in adjusting to last-minute changes or unforeseen events.	3.838	0.740
The route optimization process allows us to respond quickly to shifts in customer demands or unexpected delays	3.827	0.619
We continuously monitor and adjust our routes to ensure maximum fuel efficiency.	3.741	0.904
The use of optimized routes helps decrease our carbon footprint and improve sustainability in our logistics.	3.729	0.803
Aggregate	3.813	0.753

Organization Performance

The respondents were requested to indicate their level of agreement on various statements related to performance of the floriculture export sector in Kenya. The results were as shown Table 3.

From the results, the respondents agreed that their organization consistently increases its market share in the past year ($M=3.894$, $SD=0.865$). In addition, the respondents agreed that they are positioned as one of the leading competitors in their industry ($M=3.864$, $SD=0.798$). Further, the respondents agreed that their organization consistently meets or exceeds profitability goals ($M=3.847$, $SD=0.763$).

From the results, the respondents agreed that they see a steady increase in net profits over the last few quarters ($M=3.815$, $SD=0.718$). In addition, the respondents agreed that they actively collect and use customer feedback to improve their offerings ($M=3.785$, $SD=0.813$). Further, the respondents agreed that their organization has a strong reputation for delivering excellent customer service ($M=3.760$, $SD=0.598$).

Table 3: Organization Performance

	Mean	Std. Deviation
Our organization consistently increases its market share in the past year	3.894	0.865
We are positioned as one of the leading competitors in our industry	3.864	0.798
Our organization consistently meets or exceeds profitability goals	3.847	0.763
We see a steady increase in net profits over the last few quarters	3.815	0.718
We actively collect and use customer feedback to improve our offerings	3.785	0.813
Our organization has a strong reputation for delivering excellent customer service.	3.760	0.598
Aggregate	3.820	0.759

Correlation Analysis

This research adopted Pearson correlation analysis determine how the dependent variable (performance of the floriculture export sector in Kenya) relates with the independent variables (sustainable packaging, route optimization).

Table 4: Correlation Coefficients

		Organization Performance	Sustainable Packaging	Route Optimization
Organization Performance	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	95		
Sustainable Packaging	Pearson Correlation	.841*	1	
	Sig. (2-tailed)	.001		
	N	95	95	
Route Optimization	Pearson Correlation	.866**	.173	1
	Sig. (2-tailed)	.000	.033	
	N	95	95	95

From the results, there was a very strong relationship between sustainable packaging and performance of the floriculture export sector in Kenya ($r = 0.841$, $p \text{ value} = 0.001$). The relationship was significant since the $p \text{ value } 0.001$ was less than 0.05 (significant level). The findings are in line with the findings of Ingabire and Irechukwu (2022) who indicated that there is a very strong relationship between sustainable packaging and organization performance.

Moreover, there was a very strong relationship between route optimization and performance of the floriculture export sector in Kenya ($r = 0.866$, p value $=0.000$). The relationship was significant since the p value 0.000 was less than 0.05 (significant level). The findings are in line with the findings of Adebayo and Aworemi (2021) who indicated that there is a very strong relationship between route optimization and organization performance.

Regression Analysis

Multivariate regression analysis was used to assess the relationship between independent variables (sustainable packaging, route optimization) and the dependent variable (performance of the floriculture export sector in Kenya).

Table 5: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.265	0.070		3.786	0.000
sustainable packaging	0.367	0.095	0.366	3.863	0.001
route optimization	0.378	0.098	0.379	3.857	0.000

a Dependent Variable: performance of the floriculture export sector in Kenya

The regression model was as follows:

$$Y = 0.265 + 0.367X_1 + 0.378X_2 + \varepsilon$$

According to the results, sustainable packaging has a significant effect on performance of the floriculture export sector in Kenya ($\beta_1=0.367$, p value $= 0.001$). The relationship was considered significant since the p value 0.001 was less than the significant level of 0.05 . The findings are in line with the findings of Ingabire and Irechukwu (2022) who indicated that there is a very strong relationship between sustainable packaging and organization performance

The results also revealed that route optimization has a significant effect on performance of the floriculture export sector in Kenya ($\beta_1=0.378$, p value $= 0.000$). The relationship was considered significant since the p value 0.000 was less than the significant level of 0.05 . The findings are in line with the findings of Adebayo and Aworemi (2021) who indicated that there is a very strong relationship between route optimization and organization performance

Conclusions

The study concludes that sustainable packaging has a positive and significant effect on performance of the floriculture export sector in Kenya. Findings revealed that eco-friendly materials, recyclability and reusability affects performance of the floriculture export sector in Kenya

In addition, the study concludes that route optimization has a positive and significant effect on performance of the floriculture export sector in Kenya. Findings revealed that dynamic routing, flexibility and fuel efficiency affects performance of the floriculture export sector in Kenya

Recommendations

The study recommends that floriculture export sector in Kenya should adopt biodegradable and compostable packaging materials made from locally available agricultural waste, such as maize husks or sugarcane bagasse. This approach not only reduces environmental impact and aligns with increasing global demand for eco-friendly products but also enhances the brand image of Kenyan flowers in international markets.

In addition, the study recommends that floriculture export sector in Kenya should integrate real-time GPS and data analytics systems to streamline transportation from farms to export hubs and airports. By using intelligent route planning technologies, exporters can reduce delays, minimize fuel consumption, and ensure that flowers reach their destinations faster and in optimal condition.

Suggestions for Further Studies

This study was limited to the effect of sustainable logistics practices on performance of the floriculture export sector in Kenya hence the study findings cannot be generalized to organization performance in other organizations in Kenya. The study therefore suggests further studies on the effect of sustainable logistics practices and organization performance in other organizations in Kenya.

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