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REVERSE LOGISTICS PRACTICES AND PERFORMANCE OF FOOD AND BEVERAGE MANUFACTURING FIRMS IN NAIROBI CITY COUNTY, KENYA

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ABSTRACT

The food and beverage manufacturing industry plays a vital role in promoting food security, value addition, employment creation, and economic growth. However, the sector continues to face increasing challenges associated with waste generation, disposal of end-of-life products, and environmental sustainability. Reverse logistics has emerged as an important strategy for improving resource utilization and enhancing organizational performance through sustainable waste management practices. This study examined the effect of reverse logistics practices on the performance of food and beverage manufacturing firms in Nairobi City County, Kenya, with particular focus on recycling practices and disposal management. Specifically, the study assessed the effect of recycling practices and disposal management on firm performance. The study was anchored on the Closed-Loop Supply Chain Theory and Transaction Cost Economics Theory. The study adopted a descriptive research design. The unit of analysis comprised food and beverage manufacturing firms operating in Nairobi City County, while the unit of observation consisted of heads of supply chain, logistics, and procurement departments. A sample of 144 respondents was selected using stratified random sampling. Both primary and secondary data were collected. Primary data were obtained using semi-structured questionnaires, whereas secondary data were sourced from company reports and relevant industry publications. Qualitative data were analyzed using thematic analysis, while quantitative data were analyzed using descriptive and inferential statistics with the aid of Statistical Package for the Social Sciences (SPSS) Version 28. The findings revealed that recycling practices have a positive and statistically significant effect on the performance of food and beverage manufacturing firms. Similarly, disposal management was found to have a positive and significant influence on firm performance. The study concludes that effective implementation of recycling and environmentally responsible disposal management practices enhances operational efficiency, environmental sustainability, and overall organizational performance. The study recommends that food and beverage manufacturing firms strengthen recycling initiatives by investing in waste segregation, material recovery, and resource reuse systems. In addition, firms should adopt environmentally sustainable disposal management practices that minimize landfill disposal, promote compliance with environmental regulations, and improve long-term organizational performance.

Keywords: Reverse logistics, recycling practices, disposal management, firm performance, food and beverage manufacturing firms, Nairobi City County, Kenya.

INTRODUCTION

Manufacturing is a vital pillar of Kenya's economy, with significant contributions to employment, gross domestic product (GDP) growth, and industrialization. The sector enhances economic diversification, supports trade, and strengthens the nation's overall development (Mutuku & Moronge, 2020). Within this framework, the food and beverage manufacturing industry play a crucial role in ensuring food security, fostering value addition, and enhancing local and international trade. However, with the expansion of the manufacturing sector, challenges related to waste management, defective goods, and sustainability concerns emerge. Reverse logistics provides a strategic solution to these challenges by managing the return of goods, recycling, remanufacturing, and disposal processes (Letunovska et al., 2023). It has become an essential aspect of modern business operations as firms strive to reduce waste, comply with environmental regulations, and optimize resource utilization. In light of this, integrating reverse logistics into Kenya's manufacturing sector is not only necessary for regulatory compliance but also a key driver of sustainable economic growth and competitive advantage.

Reverse logistics encompasses a set of practices aimed at managing products, materials, and waste after they have been delivered to customers. It includes product returns, remanufacturing, recycling, refurbishment, and proper disposal of defective or obsolete items (Mishra et al., 2023). These practices help businesses recover value from returned goods while reducing environmental impact. Recycling involves collecting, processing, and repurposing materials such as packaging, plastics, to reduce waste and lower production costs (Lamma, 2021). Recycling converts waste materials into new materials. Disposal management ensures that waste and non-recyclable materials are disposed of in compliance with environmental regulations, reducing the risk of pollution and other harmful effects (Mutuku & Moronge, 2020). These reverse logistics practices are critical for sustainability and cost efficiency, enabling firms to recover value, minimize environmental impact, and comply with regulatory standards.

Reverse logistics has attracted significant attention in the recent years following the increasing demand for environmental conservation, efficiency in resource utilization, and regulatory pressures. It forms a significant aspect of sustainable supply chain management practices. According to Letunovska et al. (2023), reverse logistics is the process in the supply chain where a product is returned from the final destination or point of sale to the manufacturer for recycling, reuse, recovery, or disposal. In other words, reverse logistics embraces green supply chain management practices through the 3Rs (reduce, reuse, and recycle), which embrace environmental issues within the supply chain management. Effective reverse logistics practices present an organization with aspects of cost savings, reputational image, and enhanced corporate social responsibility (Nthiwa et al., 2024). Effective reverse logistics practices can help firms improve efficiency, reduce costs, and enhance their overall environmental performance while maintaining competitiveness in the market. Reverse logistics practices ensure activities, such as recycling, remanufacturing and disposal of products returned post-sale or post-consumption possible, which adds onto the possible benefits of cost savings for materials used for productions.

Statement of the Problem

Manufacturing firms play a crucial role in national development and contribute significantly to Gross Domestic Product (GDP), often accounting for around 10% or more in many economies (Muthoni & Mose, 2020). However, manufacturing firms have been experiencing challenges in their performance, including high production costs, fluctuating market demand, and stiff competition, leading to the closure of some companies (Ngetich & Wanyoike, 2022). Reverse logistics, which involves the process of managing the return of goods, recycling, and waste reduction, has been identified as a critical strategy to address these challenges. By improving

the efficiency of supply chains and minimizing waste, reverse logistics has the potential to reduce operational costs and enhance overall firm performance. In response, food and beverage manufacturing firms have increasingly adopted reverse logistics practices to enhance performance, improve efficiency, and minimize waste in their supply chains (Mutuku & Moronge, 2020). The food and beverage (F and B) manufacturing sector is particularly significant in this regard, as it faces unique challenges such as perishable goods, high waste generation, and a growing demand for sustainable practices. Nonetheless, despite the adoption of various reverse logistics practices, performance still remains a challenge, with some firms reporting losses and others experiencing slow growth.

In Nairobi County, the food and beverage manufacturing sub-sector experienced a significant decline in growth, falling from 4.7% in 2021 and 2.7% in 2022 to 1.7% in 2023 (Balala & Kising'u, 2024). According to Mutuku and Moronge (2020), reverse logistics accounts for 3% to 4% of a company's total logistics costs and an efficient reverse logistics system can save up to 10% of a company's annual logistics bill, with 20% of these savings in labor costs and 80% in lowered freight costs and reduced pipeline inventory. According to World Bank Group (2021), only 45 percent of the waste generated in Nairobi City County is recycled, reused, or transformed in another form to be used for other economic or ecological purposes, which is far from the target of 80 percent set by the National Environment Management Authority. The low rate of recycling and reuse reflects inefficiencies in reverse logistics systems, where materials are not effectively returned or managed for reuse. Furthermore, inadequate disposal management contribute to increased waste, putting pressure on the environment and hindering economic sustainability.

Various studies have examined reverse logistics and its impact on firm performance. For instance, Kuno and Arani (2024) studied the effect of reverse logistics on the performance of plastic bottling firms in Mombasa County, while Gikonyo and Ngugi (2022) explored reverse logistics management in building and construction manufacturing firms in Kenya. Contextually, these studies were limited to specific sectors, and their findings cannot be generalized to food and beverage firms, which have unique operational processes, supply chains, and product characteristics. Methodologically, the studies relied solely on structured questionnaires, providing only quantitative data. In contrast, this study employs a semi-structured questionnaire to capture both quantitative and qualitative insights, offering a more comprehensive understanding of reverse logistics practices. Conceptually, the influence of reverse logistics on performance metrics such as operational efficiency, supply chain sustainability, and customer satisfaction within Nairobi's food and beverage manufacturing sector remains largely unexplored, highlighting a critical knowledge gap. Addressing this gap is essential to inform policy, improve practice, and guide further research. Therefore, this study examined the effect of reverse logistics practices on the performance of food and beverage manufacturing firms in Nairobi City County.

General Objective of the Study

The general objective was to assess the effect of reverse logistics practices and the performance of food and beverage manufacturing firms in Nairobi City County, Kenya.

Specific Objectives of the Study

1. To assess the effect of recycling practices on the performance of food and beverage manufacturing firms in Nairobi City County.
2. To examine the effect of disposal management on the performance of food and beverage manufacturing firms in Nairobi City County.

LITERATURE REVIEW

Theoretical Review

Closed-Loop Supply Chain (CLSC) Theory

The CLSC theory was developed by Guide and Van Wassenhove (2009), which puts forward maximization of creating value in the entire life cycle of a product through value recovery. According to Ramanathan et al. (2023), the theory originated from reverse logistics planning and it integrates forward and reverse logistics to create a closed-loop system where products can be returned, remanufactured, re-used, or recycled to reduce waste and improve resource utilization. The important element of CLSC theory is on how it makes for a sustainable business model, where firms consider the entire product life cycle from production to disposal, which promotes sustainability. Effective management of closed-loop supply chains can lead to significant cost savings and improved environmental outcomes (Ramanathan et al., 2023). The CLSC theory helps manufacturing firms to achieve sustainability goals by designing the products to make it easy for reuse, recycling, and remanufacturing.

The CLSC theory puts forward assumptions that help with its understanding. A closed loop supply chain focuses on practices that intend to capture additional value from initially sold products. The aspect that CLSC integrates both forward and reverse supply chains helps in resource use optimization as well as minimizing waste, which fosters better coordination and efficiency (Ramanathan et al., 2023). It fosters product recovery and reuse, making returned products as resources rather than waste. The economic viability of closed-loop practices presents a better view into their application. According to Mishra et al. (2023), the cost savings through waste management costs or expenses helps a firm to achieve economic benefits, while also making them invest in sustainability as part of business strategy by reducing waste. CLSC helps companies to reuse their production waste for creating new products, making a sustainable approach for resource preservation.

The study used CLSC as a theoretical basis for emphasize the importance of product life cycle management where reverse logistics recover value from end-of-life products. The theory gives an emphasis to sustainability through maximizing value creation, which includes recycling, and disposal management with the intention of environmental sustainability (Mishra et al., 2023). In this way, the theory can be used to explain all the reverse logistics practices considered in this study as the key concepts of the theory embrace the variables. Adesoga et al. (2024) indicate that reverse logistics led to significant cost savings through reclaiming value from returned products, reducing waste, optimize resource utilization, which improve operational efficiency and reduce environmental impact. In the context of reverse logistics, CLSC theory emphasizes the importance of recycling, and disposing products to achieve environmental sustainability, operational efficiency, and cost-effectiveness.

Stakeholder Theory (ST)

ST was developed by Freeman (1984), where he posited that an organization has to consider interests of different stakeholders when making business decisions. In this consideration, ST helps organizations to view how their actions affect the people or groups with interests in their firm. Viewing sustainability in the lenses of ST as a great deal to what caters for the interests of those stakeholders and that anything that is done by the organization has to be inherently good as it meets the stakeholders' wellbeing (Freeman et al., 2021). ST gives a clear concern for people with interests, such as customers, suppliers, regulators, employees, and government agencies. According to Freeman et al. (2021), it encourages the acknowledgement of the internal and external stakeholders to promote understanding in their needs, demands, and wants. Understanding stakeholders' needs and demands helps in maximizing value creation.

ST is built on several foundational assumptions that guide its principles and application in business. It states that stakeholders should focus on value creation by emphasizing the need to balancing the interests of various stakeholders for long-term sustainability (Freeman et al., 2021). It means that for the business to be successful it should create value for all the stakeholders. In line with reverse logistics practices, a firm does not have to create value not only for the organization, but for all stakeholders involved, where customers benefit through return processes and community through reduced environmental effect. Freeman et al. (2021) give a clear perspective that ethical and social responsibility forms integral part of ST for being accountable to stakeholders. It means organizations engage in practices that are fair to all stakeholders.

The study used ST to support perspectives on the importance of understanding the needs of customers, regulatory bodies, suppliers, and community on the reverse logistics practices. Customers may pressurize firms into sustainable practices and corporate citizenship expectations to influence the adoption of reverse logistics initiatives (Asamoah et al., 2024). In this way, stakeholder demands for sustainability drive firms to implement effective reverse logistics strategies, such as recycling and responsible disposal management. With regulatory bodies as stakeholders, the regulatory pressures firms into sustainable practices, which can be enforced through enforcing environmental laws and waste management policies (Letunovska et al., 2023). In line with regulations, reverse logistics practices align with legal requirements, such as waste disposal to avoid legal issues. By engaging and addressing stakeholders' concerns in the development and adoption of reverse logistics practices, firms embrace the demands to promote sustainable practices.

Conceptual Framework

The conceptual framework for this study is based on the interaction between reverse logistics strategies and the performance of food and beverage manufacturing firms in Nairobi City County, Kenya.

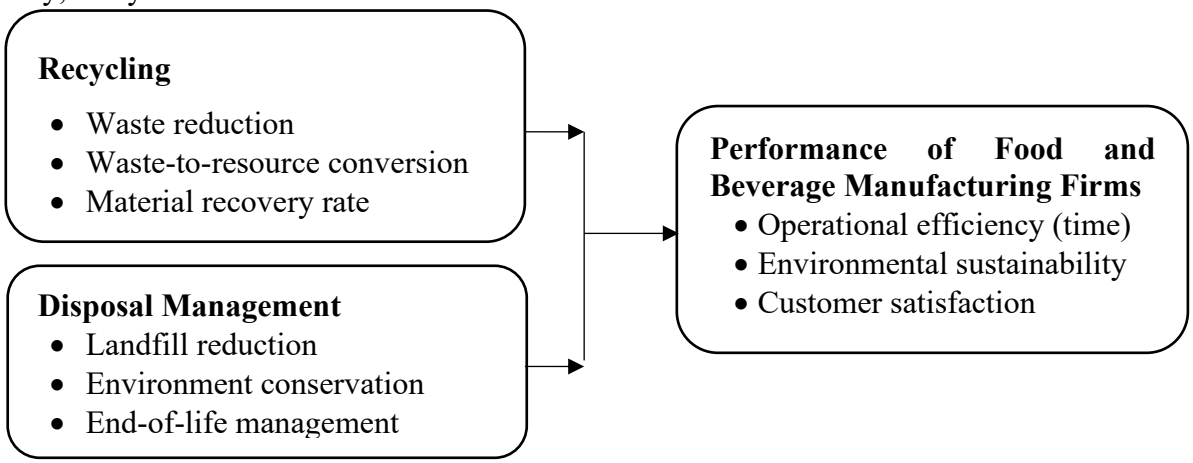

Figure 2.1: Conceptual Framework

Recycling

Recycling is a key reverse logistics practice that involves recovering and converting waste materials into reusable products, thereby reducing resource consumption and minimizing environmental impact (Lamma, 2021). It supports sustainable supply chain management by reducing waste generation, conserving natural resources, and improving resource utilization. Recycling enables manufacturing firms to recover value from discarded materials while enhancing operational efficiency and environmental sustainability (Iqbal et al., 2020).

The study conceptualized recycling using three dimensions: waste reduction, waste-to-resource conversion, and material recovery. Waste reduction minimizes environmental pollution through the reprocessing of used materials, while waste-to-resource conversion transforms waste into valuable inputs for production, supporting circular economy principles (Hsien et al., 2020; Elroi et al., 2023). Material recovery focuses on retrieving recyclable materials for reintegration into production processes, reducing dependence on virgin raw materials and lowering production costs (Mutiso & Gatari, 2023).

Overall, effective recycling practices improve operational efficiency, reduce waste management costs, promote environmental conservation, and strengthen organizational competitiveness. By integrating recycling into production processes, manufacturing firms can enhance both sustainability and long-term performance (Kopsidas & Giakoumatos, 2021).

Disposal Management

Disposal management represents the final stage of reverse logistics, involving the safe and environmentally responsible handling of products or materials that cannot be reused, recycled, or recovered (Mutuku & Moronge, 2020). Effective disposal management minimizes environmental pollution, ensures compliance with environmental regulations, and contributes to sustainable supply chain operations (Nthiwa et al., 2024).

This study measured disposal management through landfill reduction, environmental conservation, and end-of-life management. Landfill reduction emphasizes diverting waste to sustainable alternatives such as composting and energy recovery, while environmental conservation focuses on adopting environmentally friendly disposal methods that reduce pollution and support corporate sustainability initiatives (Iqbal et al., 2020). End-of-life management ensures obsolete products are handled responsibly through safe disposal or recovery of valuable materials, consistent with circular economy principles (Mutuku & Moronge, 2020).

Effective disposal management enables firms to reduce waste disposal costs, improve environmental performance, enhance regulatory compliance, and strengthen corporate reputation. Consequently, responsible disposal practices contribute to improved operational efficiency and overall organizational performance (Mio et al., 2022).

Performance of Firms

Firm performance refers to an organization's ability to achieve its strategic objectives while maintaining operational efficiency, environmental sustainability, and customer satisfaction. Guided by the Sustainability Balanced Scorecard (SBSC), performance extends beyond financial outcomes to incorporate environmental and operational dimensions that support long-term competitiveness (Mio et al., 2022).

In this study, firm performance was assessed using three indicators: operational efficiency, environmental sustainability, and customer satisfaction. Operational efficiency reflects effective utilization of organizational resources to reduce costs and improve productivity (Handoyo et al., 2023). Environmental sustainability captures the firm's ability to minimize environmental impacts through responsible resource use and waste management, while customer satisfaction reflects the extent to which firms meet customer expectations and build long-term loyalty through quality products and sustainable business practices (Javed et al., 2021).

Overall, improvements in operational efficiency, environmental sustainability, and customer satisfaction enhance organizational competitiveness and long-term performance. These dimensions provide a comprehensive measure of firm performance within the context of reverse logistics practices.

Empirical Literature Review

Recycling and Performance of Food and Beverage Manufacturing Firms

Recycling has been widely recognized as a strategic reverse logistics practice that enhances organizational performance by promoting efficient resource utilization, reducing waste, and supporting environmental sustainability. Empirical studies consistently show that firms implementing recycling initiatives achieve improved operational efficiency, lower production costs, and enhanced regulatory compliance. Recycling also contributes to sustainable production by reducing dependence on virgin raw materials while strengthening corporate reputation and competitiveness (Yu et al., 2022; Udodiugwu, 2024).

Studies conducted within the food and beverage manufacturing sector similarly demonstrate that recycling positively influences firm performance. Mutuku and Moronge (2020), Dacha et al. (2023), and Leah and Eric (2022) found that recycling practices improve resource utilization, reduce waste disposal costs, increase operational efficiency, and enhance environmental sustainability. These studies further indicate that firms adopting structured recycling programs benefit from improved brand image, customer loyalty, and long-term profitability, highlighting recycling as an important driver of organizational performance.

Disposal Management and Performance of Food and Beverage Manufacturing Firms

Disposal management has been identified as an important reverse logistics practice that supports firm performance through responsible waste handling, regulatory compliance, and environmental conservation. Empirical evidence from South Asia and Nigeria indicates that effective disposal management reduces operational costs, improves productivity, enhances environmental compliance, and strengthens organizational performance by minimizing waste accumulation and environmental risks (Akram et al., 2022; Nwokeogu et al., 2024).

Within the Kenyan context, studies have consistently reported a positive relationship between disposal management and firm performance. Simiyu and Osoro (2024), Omar et al. (2023), and Panya and Marendi (2021) found that effective disposal management enhances operational efficiency, lowers waste management costs, improves environmental sustainability, strengthens regulatory compliance, and enhances corporate reputation. Collectively, these studies suggest that firms implementing structured disposal management systems achieve better organizational performance while supporting sustainable business operations.

RESEARCH METHODOLOGY

The study adopted a descriptive research design to examine the influence of reverse logistics practices on the performance of food and beverage manufacturing firms in Nairobi City County, Kenya. A descriptive design was considered appropriate because it enables researchers to systematically describe phenomena and examine relationships among variables without manipulating the study environment (Dubey & Kothari, 2022). The target population comprised 76 food and beverage manufacturing firms registered by the Kenya Association of Manufacturers (KAM), with heads of supply chain, logistics, and procurement departments serving as the unit of observation, resulting in a target population of 228 respondents.

A stratified random sampling technique was employed to ensure proportional representation of the three functional departments involved in reverse logistics. Using Yamane's (1967) formula, a sample size of 144 respondents was determined and distributed equally among supply chain, logistics, and procurement departments. Stratified random sampling enhances representativeness by ensuring that all relevant subgroups are adequately included in the study sample (Dubey & Kothari, 2022).

The study utilized both primary and secondary data. Primary data were collected using semi-structured questionnaires comprising closed-ended Likert scale items and open-ended

questions, while secondary data were obtained from company reports, industry publications, and government databases. The questionnaire covered respondent demographics, the four dimensions of reverse logistics practices (recycling, and disposal management), and organizational performance. Data collection was conducted after obtaining the necessary approvals from the university, NACOSTI, and the participating firms. Questionnaires were administered using the drop-and-pick-later method, while confidentiality and anonymity were maintained throughout the research process. Quantitative data were analyzed using SPSS version 28 through descriptive statistics (frequencies, means, and standard deviations) and inferential statistics, including Pearson correlation and multiple regression analysis. A multivariate regression model was applied to determine the effect of recycling, and disposal management on the performance of food and beverage manufacturing firms.

RESEARCH FINDINGS AND DISCUSSIONS

The researcher issued 144 questionnaires out of which 131 were completely filled and returned, giving a response rate of 90.97%. According to Aithal and Aithal (2020), a 75% response rate is typically sufficient for data analysis, drawing conclusions, and making recommendations. Therefore, the 90.97% response rate attained in this study was well above the acceptable threshold, ensuring the reliability and credibility of the findings.

Descriptive Statistics

Recycling

The first objective of the study was to assess the effect of recycling practices on the performance of food and beverage manufacturing firms in Nairobi City County. The respondents were requested to indicate the extent on which they agree with various statements regarding recycling. The results were as shown in Table 1.

Table 1: Aspects of Recycling

	Mean	Std. Dev.
Our company actively implements strategies to minimize water use in production operations.	3.985	.984
Our production facilities of our operations focus on transforming waste multiple times for use.	4.038	.923
Our organization spends capital on water-efficient equipment to decrease wastage levels.	3.924	.847
The company measures water consumption to locate areas for reduction purposes.	4.183	.742
The treatment facilities at our operations properly clean wastewater for possible reuse scenarios.	3.969	.744
We actively invest in technologies that enhance waste-to-resource conversion.	4.191	.860
The waste-to-resource conversion process has improved our operational efficiency.	4.191	.860
Our firm collaborates with external partners to optimize waste-to-resource conversion.	4.176	.980
Employees are trained on best practices for converting waste into reusable resources.	4.427	.832
Our company tracks and measures the percentage of materials recovered from waste.	4.351	.822
We have policies in place to ensure high material recovery rates.	4.229	.760
The material recovery rate in our firm has significantly reduced raw material costs.	4.275	.833
Our company's recycling efforts contribute to a sustainable supply chain.	4.336	.730
Advanced recycling methods have improved our firm's material recovery rate.	4.183	.742

According to the study findings, the respondents agreed with a mean of 4.183 (SD=0.742) that their company measures water consumption to locate areas for reduction purposes. In addition, respondents agreed with a mean of 4.038 (SD=0.923) that the production facilities of their operations focus on transforming waste multiple times for use. These findings align with Yu, Umar, and Rehman (2022) observations that production facilities increasingly emphasize transforming waste multiple times for reuse. With a mean of 3.985 (SD=0.984), respondents agreed that their company actively implements strategies to minimize water use in production operations. The respondents also agreed with a mean of 3.969 (SD=0.744) that the treatment facilities at their operations properly clean wastewater for possible reuse scenarios. With a mean of 3.924 (SD=0.847), the respondents agreed that their organization spends capital on water-efficient equipment to decrease wastage levels.

In addition, respondents agreed with a mean of 4.275 (SD=0.814) that their company has an established process for converting waste into reusable materials. With a mean of 4.191 (SD=0.860), the respondents agreed that they actively invest in technologies that enhance waste-to-resource conversion. The respondents also agreed with a mean of 4.427 (SD=0.832) that employees are trained on best practices for converting waste into reusable resources. Similarly, with a mean of 4.191 (SD=0.860), the respondents agreed that the waste-to-resource conversion process has improved their operational efficiency. Furthermore, with a mean of 4.176 (SD=0.980), respondents agreed that their firm collaborates with external partners to optimize waste-to-resource conversion. These findings concur with Udodiugwu (2024) observations that firms engaging in external partnerships are more effective in optimizing the conversion of waste into valuable resources.

The respondents agreed with a mean of 4.351 (SD=0.822) that their company tracks and measures the percentage of materials recovered from waste. The respondents also agreed with a mean of 4.336 (SD=0.730) that their company's recycling efforts contribute to a sustainable supply chain. These findings are in line with Wubet (2022) observations that corporate recycling initiatives play a significant role in enhancing supply chain sustainability. With a mean of 4.275 (SD=0.833), the respondents agreed that the material recovery rate in their firm has significantly reduced raw material costs. In addition, respondents agreed with a mean of 4.229 (SD=0.760) that their company has policies in place to ensure high material recovery rates. With a mean of 4.183 (SD=0.742), the respondents agreed that advanced recycling methods have improved their firm's material recovery rate.

The respondents were also asked how else recycling affects the performance of food and beverage manufacturing firms in Nairobi County. From the findings, they noted that Recycling plays a significant role in enhancing the performance of food and beverage manufacturing firms in Nairobi County by contributing to cost savings, improved operational efficiency, and sustainability. Recycling also supports compliance with environmental regulations, which helps avoid penalties and promotes a positive corporate image. These findings conform to Mutuku and Moronge (2020) observations that compliance with environmental regulations not only helps firms avoid penalties but also enhances their corporate image. Additionally, firms that adopt sustainable practices often experience increased consumer trust and loyalty, as more customers prioritize eco-friendly products. Moreover, the efficient use of resources in recycling initiatives leads to less environmental impact, fostering a greener supply chain that aligns with global sustainability trends and attracts environmentally conscious investors.

Disposal Management

The second objective of the study was to examine the role of disposal management in enhancing the performance of food and beverage manufacturing firms in Nairobi City County. The respondents were requested to indicate their level of agreement with various statements related to disposal management. The results were as illustrated in Table 2.

Table 2: Aspects of Disposal Management

	Mean	Std. Deviation
Our company has effective measures to cut down waste and packaging waste sent to landfills.	4.252	.778
We monitor food waste disposal patterns in order to report quantities that end up in landfills.	4.137	.839
Our landfill waste disposal practices comply with all food safety and environmental regulations.	4.099	.983
Our company connects with waste management firms to enhance burial waste procedures.	4.160	.991
The company has a strategy for directing organic waste away from landfills to more sustainable alternatives.	4.099	.999
The company actively implements strategies to reduce the negative environment impact associated with food and beverage waste.	3.977	.401
Our organization selects environmentally friendly packaging materials which degrade or can be recycled	4.160	.991
Our organization established programs which minimize waste of water and energy through its processes.	4.313	.869
Our organization applies technological investments to develop efficient conservation systems.	4.198	.915
Employees are equally trained on handling waste sustainably	4.145	.842
Our firm has a clear policy for managing expired or unsellable food and beverage products.	4.053	.931
We prioritize redistribution of surplus food through donations or alternative uses before disposal.	4.099	.968
Organic waste from food and beverage production is effectively repurposed	4.252	.817
The company has established guidelines for the safe and sustainable disposal of beverage containers.	4.366	.834
We work with certified recycling facilities to properly dispose of food and beverage packaging waste.	4.099	.802

From the results, the respondents agreed with a mean of 4.252 (SD=0.778) that their company has effective measures to cut down waste and packaging waste sent to landfills. In addition, the respondents agreed with a mean of 4.160 (SD=0.991) that the company connects with waste management firms to enhance burial waste procedures. The respondents also agreed with a mean of 4.137 (SD=0.839) that they monitor food waste disposal patterns in order to report quantities that end up in landfills. With a mean of 4.099 (SD=0.983), respondents agreed that their landfill waste disposal practices comply with all food safety and environmental regulations. The respondents further agreed with a mean of 4.099 (SD=0.999) that the company has a strategy for directing organic waste away from landfills to more sustainable alternatives (e.g., composting, anaerobic digestion).

Additionally, the respondents agreed with a mean of 4.313 (SD=0.869) that their organization established programs which minimize production and disposal waste of water and energy through its processes. With a mean of 4.198 (SD=0.915), the respondents agreed that their organization applies technological investments to develop efficient conservation and waste reduction systems. Furthermore, the respondents agreed with a mean of 4.160 (SD=0.991) that their organization selects environmentally friendly packaging materials which degrade or can be recycled. The respondents further agreed with a mean of 4.145 (SD=0.842) that employees are equally trained on handling waste sustainably and practice conservation methods. Moreover, the respondents agreed with a mean of 3.977 (SD=0.401) that the company actively

implements strategies to reduce the negative environmental impact associated with food and beverage waste.

In addition, the respondents also agreed with a mean of 4.252 (SD=0.817) that organic waste from food and beverage production is effectively repurposed (e.g., animal feed, composting, bioenergy). Also, the respondents agreed with a mean of 4.099 (SD=0.968) that they prioritize redistribution of surplus food through donations or alternative uses before disposal. Similarly, the respondents agreed with a mean of 4.099 (SD=0.931) that their firm has a clear policy for managing expired or unsellable food and beverage products. Respondents also agreed with a mean of 4.099 (SD=0.802) that they work with certified recycling facilities to properly dispose of food and beverage packaging waste. With a mean of 4.053 (SD=0.931), the respondents agreed that the company has established guidelines for the safe and sustainable disposal of beverage containers and packaging.

The respondents were further asked to indicate how else disposal management affects the performance of food and beverage manufacturing firms in Nairobi County. The respondents noted that effective disposal management helps reduce waste-related costs, ensuring that resources are utilized more efficiently. Additionally, they highlighted that proper waste management enhances compliance with environmental regulations, avoiding potential fines or legal issues. It was also noted that environmentally responsible disposal practices improve the firm's public image, attracting customers who prioritize sustainability. Furthermore, respondents mentioned that efficient disposal systems contribute to a safer working environment, reducing health risks and enhancing employee productivity.

The findings align with Akram et al. (2022) observations that companies implementing structured waste reduction measures and collaborating with waste management partners effectively minimize landfill contributions and promote sustainable disposal methods. These findings also concur with Nwokeogu, Okafor, and Okafor (2024) observations that compliance with environmental and food safety regulations, coupled with strategies such as composting and anaerobic digestion, significantly improves landfill waste management. The findings agree with Ampofo (2020) observations that technological investment and employee training in waste handling are critical to fostering sustainable production practices and reducing the environmental impact of industrial operations. These findings further conform to Simiyu and Osoro (2024) observations that environmentally friendly packaging and food waste repurposing—such as through bioenergy and composting—enhance organizational sustainability. The findings also align with Omar, Kituku, and Kithinji (2023) observations that redistribution of surplus food, partnerships with certified recyclers, and clear policies for managing unsellable products are essential for efficient and responsible waste management in the food and beverage sector.

Performance of Firms

The dependent variable of the study was the performance of food and beverage manufacturing firms in Nairobi City County. The respondents were asked to indicate extent to which they agree with various statements on performance of these firms. The results were as depicted in Table 3.

Table 3: Aspects of Firms

	Mean	Std. Deviation
Our company achieves effective production process optimization to decrease costs along with waste reduction.	4.099	.968
The company depends on modern technology to optimize its production process.	4.023	.948
Production targets are achieved without delay by the organization.	4.244	.851
Our firm efficiently handles all resources including raw materials along with energy resources to achieve maximum productivity.	4.046	.885
The organization provides extensive training to its staff which leads to higher operational performance	4.107	.897
The company actively implements sustainable practices to minimize environmental impact.	4.206	.848
Energy and water conservation measures are effectively integrated into production processes.	4.115	.958
Waste management strategies, including reduction initiatives, are well-established.	4.153	.940
The company prioritizes the use of eco-friendly packaging materials.	4.214	.903
Regular environmental audits are conducted to ensure continuous improvement.	4.099	.952
Every product we deliver satisfies all customer requirements for quality.	4.130	.964
The organization makes continuous efforts to collect customer input which allows product enhancement.	4.168	.929
Our customers identify the product container as practical while also recognizing its environmentally-friendly nature	4.115	.891
Our food and beverage industry brand hold an outstanding reputation as a reliable corporation.	4.229	.828
If customers file complaints our organizational team manages these reports with speed.	4.084	.903

With a mean of 4.244 (SD=0.851), the respondents agreed that production targets are achieved without delay by the organization. Similarly, with a mean of 4.107 (SD=0.897), the respondents agreed that the organization provides extensive training to its staff which leads to higher operational performance. The respondents also agreed, with a mean of 4.099 (SD=0.968), that their company achieves effective production process optimization to decrease costs along with waste reduction. Further, with a mean of 4.046 (SD=0.885), the respondents agreed that their firm efficiently handles all resources including raw materials along with labor power and energy resources to achieve maximum productivity. With a mean of 4.023 (SD=0.948), the respondents agreed that the company depends on modern technology to optimize its production process.

Moreover, the respondents agreed with a mean of 4.214 (SD=0.903) that the company prioritizes the use of eco-friendly and sustainable packaging materials. Similarly, with a mean of 4.206 (SD=0.848), the respondents agreed that the company actively implements sustainable practices to minimize environmental impact. Further, with a mean of 4.153 (SD=0.940), the respondents agreed that waste management strategies, including recycling and reduction initiatives, are well-established. With a mean of 4.115 (SD=0.958), the respondents agreed that energy and water conservation measures are effectively integrated into production processes. Further, with a mean of 4.099 (SD=0.952), the respondents agreed that regular environmental audits and assessments are conducted to ensure continuous improvement.

Furthermore, the respondents agreed with a mean of 4.229 (SD=0.828) that their food and beverage industry brand holds an outstanding reputation as a reliable corporation. The respondents also agreed, with a mean of 4.168 (SD=0.929), that the organization makes continuous efforts to collect customer input which allows product enhancement and service improvement. Similarly, with a mean of 4.130 (SD=0.964), the respondents agreed that every product delivered satisfies all customer requirements for both safety and quality. The respondents also agreed, with a mean of 4.115 (SD=0.891), that their customers identify the product container as practical while also recognizing its environmentally-friendly nature and its helpful user experience.. With a mean of 4.084 (SD=0.903), the respondents agreed that if customers file complaints, their organizational team manages these reports with speed and delivers prompt resolutions to each problem.

Correlation Analysis

The Pearson product-moment correlation coefficient was used to assess the strength of the relationships between the independent variables (recycling, and disposal management) and the dependent variable (performance of food and beverage manufacturing firms in Nairobi City County). The results are presented in Table 4.

Table 4: Correlation Analysis

		Performance of Firms	Recycling	Disposal Management
Performance of Firms	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	131		
Recycling	Pearson Correlation	.854**	1	
	Sig. (2-tailed)	.000		
	N	131	131	
Disposal Management	Pearson Correlation	.742**	.282**	1
	Sig. (2-tailed)	.000	.000	
	N	131	131	131

The study found a positive and significant relationship between recycling and the performance of food and beverage manufacturing firms in Nairobi County ($r = 0.854$, $p < 0.000$). As the p-value is below the 0.05 significance threshold, the relationship is considered statistically significant. These findings align with Leah and Eric (2022) observations that recycling practices significantly and positively impacted the performance of local food and beverage companies.

The study also found a positive and significant relationship between disposal management and the performance of food and beverage manufacturing firms in Nairobi County ($r = 0.742$, $p < 0.000$). Since the p-value falls below the 0.05 significance threshold, the relationship is deemed statistically significant. These findings are in agreement with Panya and Marendi (2021) observations that waste disposal strategies directly and substantially impacted the organizational performance of FMCG companies.

Regression Analysis

A multivariate regression analysis was conducted to assess the relationships between the independent variables (recycling, and disposal management) and the dependent variable (performance of food and beverage manufacturing firms in Nairobi City County).

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.811[a]	.658	.594	.06079

a. Predictors: (Constant), Disposal Management, Recycling,

As depicted in Table 5, the R-squared value for the model was 0.658. This indicates that 65.8% of the variance in the performance of food and beverage manufacturing firms in Nairobi County was explained by the independent variables-recycling, and disposal management.

Table 6: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	68.211	2	17.053	102.25	.000[b]
	Residual	21.013	128	0.167		
	Total	89.224	130			

a. Dependent Variable: Performance of Firms

b. Predictors: (Constant), Disposal Management, Recycling,

ANOVA was performed in this research to determine whether the model adequately fit the data. As illustrated in Table 6, the calculated F-value was 102.25, which is significantly higher than the critical F-value of 2.46 from the F-distribution table. In addition, the p-value was 0.000, which is below the 0.05 significance level. Therefore, the model was considered a good fit for the data, indicating that recycling, and disposal management collectively have a statistically significant effect on the performance of food and beverage manufacturing firms in Nairobi County.

Table 7: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.314	0.102		3.078	0.009
	Recycling	0.631	0.147	0.635	4.293	0.000
	Disposal Management	0.362	0.100	0.377	3.620	0.000

a. Dependent Variable: Performance of Firms

Regression equation for the unstandardized coefficients was:

$Y = 0.314 + 0.631X_1 + 0.362X2$

The study found that recycling has a positive and significant effect on the performance of food and beverage manufacturing firms in Nairobi County ($\beta_1 = 0.631$, p-value = 0.000). Since the p-value (0.000) is below the 0.05 significance level, the relationship is considered statistically significant. This suggests that a unit increase in recycling practices leads to a 0.631 unit improvement in firm performance. These findings align with Mutuku and Moronge (2020) observations that the companies' performance is positively impacted by efficient recycling management. Furthermore, the findings are consistent with Wubet (2022), who noted that recycling and operational performance was positively correlated.

Moreover, the study found that disposal management has a positive and significant effect on the performance of food and beverage manufacturing firms in Nairobi County ($\beta4=0.362$, p-value=0.000). Given that the p-value (0.000) is below the 0.05 significance level, the relationship is regarded as significant. This implies that improvements in disposal management practices result in a 0.362 increase in performance. These findings are in agreement with Simiyu and Osoro (2024) observations that disposal management practices positively and substantially impacted the performance of FMCG firms in Nairobi City County, Kenya. The findings also agree with Ampofo (2020) who observed that poor waste disposal practices in these schools had a negative impact on students, faculty, and school administration, putting their health at serious danger.

Conclusions

The study concludes that recycling has a positive and significant effect on the performance of food and beverage manufacturing firms in Nairobi County. Specifically, the findings indicate that waste reduction, waste-to-resource conversion and material recovery rate affects the performance of food and beverage manufacturing firms in Nairobi County. This means that an improvement in recycling (waste reduction, waste-to-resource conversion and material recovery rate) results to an improvement in the performance of food and beverage manufacturing firms in Nairobi County.

Moreover, the study concludes that disposal management has a positive and significant impact on the performance of food and beverage manufacturing firms in Nairobi County. Specifically, the findings reveal that landfill reduction, environment conservation and end-of-life management affects firm performance. This means that improving disposal management (landfill reduction, environment conservation and end-of-life management) results to a significant and positive effect on the performance of food and beverage manufacturing firms in Nairobi County.

Recommendations

In regard to the study's findings related to recycling practices and the performance of food and beverage manufacturing firms in Nairobi County, the study recommends a multi-faceted approach to enhance sustainability outcomes. Companies should prioritize water conservation by measuring consumption, investing in water-efficient equipment, and treating wastewater for reuse. Additionally, production facilities should adopt technologies that enable multiple cycles of waste transformation, thereby reducing environmental impact. Organizations must also strengthen employee training on best practices for waste-to-resource conversion and collaborate with external partners to optimize these efforts. Leadership should enforce policies that support high material recovery rates while investing in advanced recycling techniques that reduce dependency on raw materials and support cost-efficiency. Further, accurate tracking of recovered materials should be maintained to monitor progress and inform continuous improvement.

Based on the study's findings related to waste management and performance of food and beverage manufacturing firms in Nairobi County, several key recommendations were made to improve the organization's waste management strategies. Firms should continue to enhance collaboration with waste management partners to ensure the effective disposal and recycling of waste, with a focus on sustainable practices. In addition, employees should be empowered through further training programs on sustainable waste handling, enabling them to actively contribute to waste reduction efforts. The organization should also invest in advanced technologies for waste reduction, water conservation, and energy efficiency to minimize environmental impact. Furthermore, companies should strengthen efforts to repurpose organic waste into valuable resources, such as animal feed or bioenergy. Firms should also prioritize the redistribution of surplus food before disposal, aligning with environmental sustainability goals. Moreover, the company should ensure that policies and guidelines for safe and sustainable waste disposal are up-to-date, providing clear direction for handling expired or unsellable products and packaging.

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