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Advancing Green Distribution Practices on Performance of Manufacturing Firms in Kenya

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Abstract

Purpose: This study examines the adoption of green distribution practices in Kenya's manufacturing sector, focusing on transportation efficiency, warehousing sustainability, packaging practices, information technology integration, supplier collaboration, and regulatory compliance.

Methodology: A mixed-method approach was employed, combining stratified sampling, regression diagnostics, chi-square tests, and qualitative content analysis.

Findings: Results reveal persistent inefficiencies in transportation, limited renewable energy adoption in warehousing, inconsistent packaging practices, weak supplier collaboration, and partial compliance with regulatory frameworks. Statistically significant relationships were observed between transportation efficiency, warehousing sustainability, IT integration, regulatory compliance, and firm performance.

Unique Contribution to Theory, Policy and Practice: Managerial implications highlight the need for embedding sustainability clauses in procurement contracts, integrating green KPIs into dashboards, and investing in renewable logistics. Policy recommendations include targeted incentives, industry-wide packaging standards, and stronger enforcement mechanisms. The study contributes to procurement and supply chain scholarship by contextualizing green distribution within emerging economies and offering actionable insights for sustainable procurement.

Keywords: *Green Distribution, Sustainable Procurement, Transportation Efficiency, Warehousing Sustainability, IT Integration, Supplier Collaboration, Regulatory Compliance*

Introduction

The global transition toward sustainability has positioned procurement and supply chain management at the center of environmental responsibility. Green distribution, defined as the integration of environmentally conscious practices into logistics and delivery systems, represents a critical link between procurement strategies and operational execution (Carter & Rogers, 2008). In emerging economies, the challenge of balancing economic growth with environmental stewardship is particularly acute. Kenya's manufacturing sector contributes significantly to national GDP, yet it faces persistent inefficiencies in transportation, high carbon emissions, limited renewable energy adoption in warehousing, and inconsistent packaging practices (Government of Kenya, 2025). These challenges undermine both environmental sustainability and operational efficiency, creating a pressing need for procurement-driven interventions.

Problem Statement

Despite the growing global emphasis on sustainability, Kenya's manufacturing sector continues to grapple with inefficiencies in distribution systems. Transportation remains heavily reliant on fossil fuels, warehousing facilities show minimal renewable energy adoption, packaging practices lack consistency, supplier collaboration is weak, and regulatory compliance is partial at best. These shortcomings not only increase environmental degradation but also erode firm competitiveness. The absence of integrated procurement strategies that embed sustainability clauses into contracts further exacerbates the problem. This study therefore seeks to bridge the gap by investigating how procurement decisions can drive green distribution practices, enhance firm performance, and align with institutional sustainability mandates.

2. Literature Review

2.1 Transportation Efficiency

Transportation efficiency is central to green distribution, as logistics networks are major contributors to carbon emissions. Studies in developed economies emphasize fleet electrification, route optimization, and modal shifts to rail or water transport as strategies for reducing environmental impact (Seuring & Müller, 2008). Procurement decisions influence transportation sustainability by embedding efficiency requirements into supplier contracts. In emerging economies, however, reliance on fossil fuel vehicles remains dominant, with limited investment in alternative fuels (World Bank, 2024).

2.*2 Warehousing Sustainability*

Warehousing sustainability involves integrating renewable energy sources and energy efficient technologies into storage facilities. Research highlights the role of solar panels, smart lighting, and automated energy audits in reducing warehousing footprints (Carter & Rogers, 2008). Procurement officers can drive sustainability by requiring suppliers to adopt energy efficient warehousing

practices. In Kenya, renewable adoption in warehousing remains minimal, reflecting capital constraints and weak enforcement mechanisms (Government of Kenya, 2025).

2.3 Packaging Practices

Packaging practices are a visible aspect of green distribution, with biodegradable and recyclable materials reducing environmental harm. Studies show that procurement contracts embedding sustainable packaging clauses can significantly influence supplier behavior (Zhu & Sarkis, 2004). However, adoption is inconsistent in emerging economies, where cost considerations often outweigh environmental priorities. This highlights the need for industry wide standards to harmonize packaging practices.

2.4 Information Technology Integration

Information technology (IT) integration enhances logistics transparency and efficiency. Digital tracking systems, blockchain, and AI driven optimization models are increasingly used to monitor fleet emissions, route accuracy, and supplier compliance (Seuring & Müller, 2008). From a Resource Based View (RBV) perspective, IT systems represent unique organizational capabilities that can yield competitive advantage. In Kenya, large firms are more likely to adopt IT solutions, while SMEs face barriers due to cost and technical expertise (World Bank, 2024).

2.5 Supplier Collaboration

Supplier collaboration is essential for embedding sustainability into distribution practices. Procurement officers can strengthen collaboration by including sustainability clauses in contracts and creating platforms for knowledge sharing. Institutional Theory suggests that normative pressures from industry associations and international standards can drive supplier compliance (Carter & Rogers, 2008). However, evidence from Kenya indicates weak collaboration, with suppliers often prioritizing cost over sustainability (Government of Kenya, 2025).

2.6 Regulatory Compliance

Regulatory compliance reflects the influence of institutional pressures on green distribution. Governments and international bodies establish sustainability regulations, but enforcement remains uneven. Studies highlight that compliance is often driven by external pressures rather than internal commitment (Zhu & Sarkis, 2004). In Kenya, regulatory frameworks exist but lack robust monitoring and enforcement, leading to partial compliance across firms (Government of Kenya, 2025).

1.3. Objective of the stufy

i. Determine the effect of Green Distribution on the performance of Manufacturing Firms in Kenya,

1.4 Research Hypotheses

H_2: There was no significant effect of Green Distribution on the performance of manufacturing firms in Kenya.

LITERATURE REVIEW

2.1 Resource Based View

The Resource-Based View (RBV) theory, initially advanced by Edith Penrose in 1959, conceptualizes the firm as a bundle of tangible and intangible resources that can be strategically deployed to achieve superior performance and sustainable competitive advantage. The theory later gained prominence through the works of scholars such as Jay Barney, who emphasized that organizations achieve long-term competitiveness when they possess valuable, rare, inimitable, and non-substitutable (VRIN) resources (Barney *et al*., 2011). The Resource-Based View argues that firm growth and performance are largely influenced by the ability of organizations to acquire, develop, combine, and effectively utilize internal resources and capabilities. According to Das and Teng (2000), RBV emphasizes optimization and strategic deployment of organizational resources in order to improve operational efficiency, innovation, and organizational performance.

The theory further posits that firms gain competitive advantage when their internal resources and capabilities cannot easily be replicated by competitors. Such resources may include organizational knowledge, technological capability, managerial expertise, environmental sustainability systems, organizational culture, supplier relationships, and operational processes (Acedo et al., 2006). RBV therefore shifts strategic focus from external market conditions to internal organizational capabilities as the primary source of superior performance.

In the context of this study, the Resource-Based View provides a strong theoretical foundation for explaining how Green Supply Chain Management Practices (GSCMP) enhance the performance of manufacturing firms in Kenya. Green supply chain practices such as green purchasing, green distribution, and reverse logistics represent strategic organizational capabilities that enable firms to improve operational efficiency, environmental sustainability, customer satisfaction, and competitive advantage (Odock et al., 2024; Mutulu, 2023; Odoyo, 2023). These environmentally sustainable practices constitute valuable and difficult-to-imitate organizational resources that can differentiate firms from competitors.

For instance, green purchasing enables firms to establish environmentally sustainable supplier relationships, reduce procurement-related environmental risks, and improve resource utilization efficiency. Green distribution enhances logistics efficiency through environmentally sustainable transportation systems, efficient warehousing, and optimized routing systems, thereby reducing operational costs and improving customer service delivery. Similarly, reverse logistics strengthens resource recovery, recycling, refurbishment, and waste minimization practices, allowing firms to

recover value from returned products and improve environmental sustainability performance (KNBS, 2025; Kenya Association of Manufacturers [KAM], 2025).

Despite its relevance, the Resource-Based View has attracted several criticisms. Scholars argue that the theory places excessive emphasis on internal organizational resources while underestimating the influence of external environmental factors such as market dynamics, regulatory changes, technological disruptions, and global competition (Barney *et al*., 2011). Additionally, RBV faces challenges in empirical measurement because it is often difficult to identify, quantify, and evaluate intangible organizational resources and capabilities. The theory has also been criticized for its limited ability to explain rapidly changing and networked business environments where resources extend beyond individual firms into broader supply chain and inter-organizational networks.

In relation to Green Supply Chain Management Practices, RBV may not adequately explain how external stakeholders, environmental regulations, supply chain partnerships, and global sustainability pressures influence organizational performance. Modern supply chains operate within highly interconnected and dynamic environments where competitive advantage increasingly depends on collaboration, innovation, and external stakeholder engagement rather than solely on internal resources. Nevertheless, despite these limitations, the Resource-Based View remains highly relevant to this study because it provides a useful framework for understanding how manufacturing firms in Kenya can strategically deploy Green Supply Chain Management Practices and Corporate Environmental Responsibility initiatives as organizational resources to improve both financial and non-financial performance.

2.2 Empirical Literature

Green Distribution and Firm Performance

A study by Luca *et al* (2024) on green warehousing practices, consents that Warehouses significantly contribute to the environmental impact of supply chains, prompting a growing interest in green warehouse practices and the concept of sustainable warehousing. These initiatives aim to mitigate the environmental impacts associated with warehouse operations. This is despite the fact that the literature still lacks empirical studies assessing the impact of such practices.

According to Pavithraa & Priyadharshini (2025), an effective distribution system not only enhances operational performance but also strengthens the company's market presence and customer relationships and satisfaction. This is because manufacturing processes are in the rise and integrating digital and traditional distribution strategies is vital for maintaining competitiveness in the manufacturing industry. Manufacturing through effective distribution channels ensures that products reach consumers in the most efficient and cost-effective way.

Green distribution focuses on environmentally friendly practices in the movement of goods, including eco-efficient transportation, packaging, and warehousing. Empirical studies show that

green distribution contributes to both operational efficiency and environmental sustainability. Wagan *et al* (2025) analyzed 632 organizations across sectors in China and confirmed that green innovation in distribution channels significantly improved operational efficiency and environmental commitment, thereby enhancing firm competitiveness.

Warehouses are vital components of supply chains and distribution as they buffer material flow to consolidate products for streamlined delivery, and provide value-added timely services to customers which enhances customer satisfaction. Green distribution has led to non-negligible environmental impact compelling practitioners concerned with sustainable goals to focus more on the sustainability of warehouses prompting companies to adopt Green Warehousing practices to minimize environmental impact and maintaining the highest social standards in terms firm performance (Sara *et al*., 2024).

An empirical inquiry by Roy and Mohanty (2023) focused on the nexus between green distribution operations and its influence on supply chain related sustenance. Green distribution operations were delineated using reverse logistics, green packaging, transportation, innovation, warehousing and environmental management. On the other hand, FP was represented by social, economic and environmental aspects. The proposed model was verified via primary data gathered using a structured questionnaire from 324 Indian Distribution service providers and estimated using Structural Equation Modeling (SEM) approach.

A study on Transportation Research Interdisciplinary Perspectives by Marhadi *et al* (2025) suggests that, the automotive sector is particularly affected due to the rising popularity of electric vehicles as an eco-friendly mode of transportation, thus the adoption of electric vehicles is considered essential to addressing environmental challenges because of its potential to reduce greenhouse gas emissions and mitigate climate change. Consumer perceptions on the adoption of EVs are central to understanding the barriers, particularly across different age-based segments. Generational gap exerts a strong influence on consumer behavior, as values, preferences, and attitudes are shaped by historical experiences, social context, and technological exposure.

Despite the growing importance of this issue, existing research has primarily examined consumer attitudes toward EVs and autonomous vehicles, with limited attention to the comprehensive factors shaping willingness to adopt EVs, however quality attributes in terms of customer satisfaction, has not yet been established. Key findings show generational variation in “must-be” attributes by the different generations. Attractive attributes such as vehicle design and brand reputation held differing generational appeal. Notably, Baby Boomers were least concerned with charging time, while Generation Z prioritized environmental sustainability and rejected resale value as a decision factor. These differences call for further investigation on adoption of EV as a transportation consideration.

Wakoli and Wachiuri (2025) on a study focusing on Supply Chain Scalability and Performance of distribution Firms in Nairobi City County, Kenya established that warehouse design has a positive

and significant effect on performance of distribution firms in Nairobi City County, Kenya. In addition, the study concluded that supplier network has a positive and significant effect on performance of distribution firms in Nairobi City County, Kenya. Based on the findings, the study recommends that the management of distribution firms in Nairobi City County, Kenya, should invest in eco- warehouse infrastructure and transformation that allows for quick adaptation to changes in inventory volume, product types, and delivery schedules.

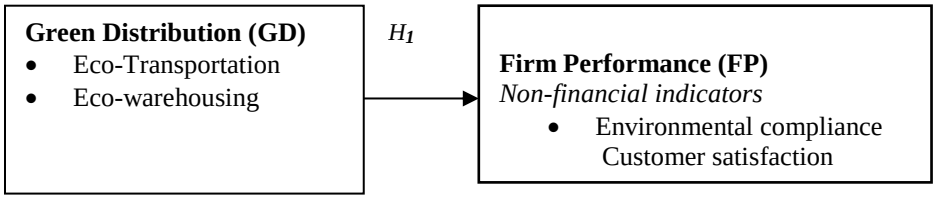
Odock and Mwangi (2024) investigated logistics firms in Kenya and established that green logistics practices—including distribution—positively influenced firm performance, with environmental performance mediating the relationship. These findings suggest that green distribution not only reduces environmental footprints but also strengthens customer satisfaction and market positioning, though challenges such as infrastructural limitations and regulatory enforcement remain barriers in developing economies.

A study by Kamoni *et al* (2024), showed that in Kenya, warehouse management has led many business organizations to invest their resources installing warehouse management systems with the aim of minimizing operational costs, and enhance service delivery to customers. Good performance of distribution systems plays a crucial role in the improved performance an organization, as it directly impacts customer satisfaction. In distribution, the speed of operations, particularly from order picking to delivery, is essential for ensuring high-quality customer service and satisfaction.

Optimizing distribution channel performance is integral to operational success and customer satisfaction in the manufacturing sector, thus the need for businesses to integrate digital and traditional distribution approaches and consumer behavior in their management decisions. An organization with timely product delivery and strategic geographic planning are also critical for improving service quality and firm performance. Organizations that continuously evaluate and adapt their distribution models will be better positioned to achieve sustainable growth and maintain a competitive advantage in an evolving marketplace.

2.3 Conceptual Framework

A conceptual framework refers to a diagrammatic and narrative representation of the relationship between study variables based on existing theories and empirical literature. It provides a systematic structure that guides the researcher in explaining how the independent variable is expected to influence the dependent variable, (Kothari, 2004). According to Creswell and Creswell (2018), a conceptual framework assists in clarifying the direction of relationships among variables and provides the foundation for hypothesis development and data analysis. In this study, the conceptual framework is anchored on the Resource-Based View Theory, The framework conceptualizes green distribution Practices affect the performance of Manufacturing Firms



Independent variables **Dependent variable**

The conceptual framework shows dimensions related to green distribution. The conceptual framework illustrates the expected relationship between Green Distribution (GD) and Firm Performance (FP). Green Distribution (independent variable) represents environmentally responsible distribution practices, specifically eco-transportation and eco-warehousing. Firm Performance (dependent variable) is measured using non-financial indicators, particularly environmental compliance and customer satisfaction. The framework proposes that adoption of green distribution practices influences firm performance. Eco-transportation and eco-warehousing can reduce environmental impacts, improve compliance with environmental requirements, and potentially enhance customer satisfaction.

RESEARCH DESIGN AND METHODOLOGY

This study was guided by the positivist research philosophy. Positivism is founded on the assumption that reality is objective, measurable, and independent of the researcher, and that knowledge can be generated through empirical observation and statistical analysis (Saunders *et al*., 2019).. Since the current study seeks to examine the relationship between green distribution and Firm performance among manufacturing Firms in Kenya, the positivist philosophy was considered appropriate because the various variables could be objectively measured and statistically analyzed. This study adopted a descriptive cross-sectional survey research design. A descriptive research design is appropriate because it seeks to systematically describe characteristics, behaviors, relationships, or phenomena as they exist within a target population without manipulating study variables (Saunders *et al*., 2019). The study employed a cross-sectional approach as data was collected from respondents at a single point in time. The target population consisted of all the 1,163 manufacturing firms in Kenya registered by Kenya Association of Manufacturers (KAM) based on 2025 report from which a sample size of 298 manufacturing Firms in Kenya was identified by application of Yamane formula (1998). The study used primary data in this study through a questionnaire, which was administered to the targeted procurement officers of manufacturing Firms in Kenya. The collected data underwent cleaning, sorting, and coding prior to analysis with the Statistical Package for Social Sciences (SPSS) software. To facilitate additional research, inferential statistics including chi square tests and ordinal regression analysis will be employed to test hypotheses and investigate the links between green supply distribution practices and firm performance. The criteria for rejecting or failing to reject the null hypothesis will be informed by the p- The hypotheses testing will be performed at 95% confidence level and

$p < 0.05$ will lead into rejection of null hypothesis while a $p > 0.05$ will result into failure to reject the null hypothesis. The study adopted the following model to show the relations between the independent variable and the dependent variable; FP=β_0+β_1, _ GD+ e , Where: β_0= constant; β_1 coefficient; GD= green distribution and Ɛ =Error term.

RESULTS AND DISCUSSIONS

4.1.1. Response on Green Distribution

The frequency distribution on the green distribution management practices was presented in Table 1.

Table 1 Green Distribution Responses

Green Distribution Responses	5	4	3	2	1
1.Our Firm distributes products together, rather than in smaller batches to ensure full vehicle loads for efficiency	54.3	30.5	8.1	5.8	1.3
2. Our Firm employs transport modes that use less energy or use energy more efficiently.	39.9	34.1	17.5	6.3	2.2
3.Our Firm uses Use logistics firms that abide to environmentally friendly principles or have EMS certification	41.7	39.9	11.7	6.7	0.0
4.Our Firm uses a good information system and innovative management for efficient loading, scheduling and routing	64.6	17.0	15.2	3.1	0.0
5. Our Firm uses of warehousing facilities that have been certified as environmentally efficient.	46.6	30.5	12.6	7.2	3.1

Table 1 presents respondents' perceptions regarding Green Distribution practices adopted by manufacturing firms in Kenya. The findings indicate that most firms implemented environmentally sustainable distribution practices to a great extent, particularly in transport efficiency, logistics management, routing systems, and environmentally compliant warehousing. The findings show that 54.3% of the respondents indicated that their firms distributed products together rather than in smaller batches to ensure full vehicle loads for efficiency to a very great extent, while 30.5% indicated great extent. Only 7.1% indicated little extent or no extent. These findings imply that most firms highly embraced load consolidation practices in order to minimize transportation costs, improve fuel efficiency, and reduce environmental impact associated with product distribution.

Regarding the use of transport modes that consume less energy or use energy more efficiently, 39.9% of the respondents indicated very great extent while 34.1% indicated great extent. However, 17.5% indicated moderate extent and 8.5% indicated little extent or no extent. The findings suggest that many firms had adopted energy-efficient transportation systems to a considerable extent as

part of efforts to reduce emissions and improve environmental sustainability within distribution operations. The results further indicate that 41.7% of the respondents stated that their firms used logistics firms that complied with environmentally friendly principles or possessed Environmental Management System (EMS) certification to a very great extent, while 39.9% indicated great extent. No respondents indicated no extent.

This implies that manufacturing firms increasingly collaborated with environmentally responsible logistics service providers in order to strengthen sustainable supply chain practices and environmental compliance. On whether firms used good information systems and innovative management for efficient loading, scheduling, and routing, 64.6% of the respondents indicated very great extent while 17.0% indicated great extent. Only 3.1% indicated little extent and none indicated no extent. This represented the highest level of positive responses among the green distribution indicators and suggests that firms highly utilized information technology and innovative logistics systems to improve operational efficiency, reduce wastage, and optimize transportation processes.

Similarly, 46.6% of the respondents indicated very great extent while 30.5% indicated great extent that their firms used warehousing facilities certified as environmentally efficient. However, 10.3% indicated little extent or no extent. The findings of this study indicate that manufacturing firms in Kenya have adopted green distribution practices to a considerable extent, particularly in load consolidation, energy efficient transport, environmentally compliant logistics partnerships, information driven routing systems, and certified warehousing. These results are consistent with several empirical studies both locally and internationally. The strong emphasis on load consolidation to ensure full vehicle loads agree with Zhu and Sarkis (2004), who found that Chinese manufacturing firms reduced transportation costs and emissions by consolidating shipments. Similarly, Kumar et al. (2023) reported that load optimization is a critical green logistics strategy in emerging economies.

4.2. Response on Firm Performance

A survey on the distribution of non-financial performance was conducted and the results were presented in Table 2

Table 2 Firm Performance

Environmental Compliance of the Firms	**5**	**4**	**3**	**2**	**1**
1.Our Firm is engaging in environmental beautification	45.3	28.7	21.1	4.0	0.9
2.Our Firm has elaborated environmental rehabilitation programs	30.9	36.8	22.9	5.8	3.6
3.Our Firm support tree planting initiatives	40.8	37.2	15.2	4.9	1.8
4.Our Firm has developed environmental awareness among its employees	49.3	31.4	9.9	7.2	2.2
5.Our Firm is not engaged in natural resource depletion activities	44.4	31.4	10.8	4.5	8.5

Customer Satisfaction	5	4	3	2	1
1.Number of customer complaints have reduced	35.9	41.3	13.0	4.0	5.8
2.Level of customer retention is high	45.3	33.2	15.2	3.6	2.7
3.Level of customer satisfaction survey index is high	36.8	40.8	15.7	5.4	1.3
4.Number of customers referred to the company by other customers has increased	44.4	30.9	17.5	4.0	3.1
5.Number of customer suggestions have increased	44.4	40.4	6.7	5.4	3.1

Table 2 presents respondents' perceptions regarding firm performance based on two key dimensions, namely environmental compliance and customer satisfaction. The findings indicate that manufacturing firms in Kenya had achieved firm performance outcomes to a great extent through environmental sustainability initiatives and customer-oriented practices.

Regarding environmental compliance, Table 3.13 shows that 45.3% of the respondents indicated that their firms engaged in environmental beautification to a very great extent, while 28.7% indicated great extent. However, 21.1% indicated moderate extent and 4.9% indicated little extent or no extent. These findings imply that many firms actively participated in environmental conservation and beautification activities as part of their environmental sustainability efforts. Regarding environmental rehabilitation programs, 30.9% of the respondents indicated very great extent while 36.8% indicated great extent that their firms had elaborate environmental rehabilitation programs. Further, 22.9% indicated moderate extent while 9.4% indicated little extent or no extent. The findings suggest that a majority of firms had implemented environmental

rehabilitation initiatives to a considerable extent in order to restore and conserve the environment affected by industrial operations.

The results further indicate that 40.8% of the respondents stated that their firms supported tree planting initiatives to a very great extent, while 37.2% indicated great extent. Only 6.7% indicated little extent or no extent. This implies that most manufacturing firms substantially participated in tree planting activities as part of environmental conservation and corporate sustainability programs. On whether firms had developed environmental awareness among employees, 49.3% of the respondents indicated very great extent while 31.4% indicated great extent. However, 9.9% indicated moderate extent and 9.4% indicated little extent or no extent. These findings suggest that many firms highly prioritized employee environmental awareness programs in order to strengthen environmental responsibility and sustainable workplace practices.

Similarly, 44.4% of the respondents indicated very great extent while 31.4% indicated great extent that their firms were not engaged in natural resource depletion activities. However, 13.0% indicated little extent or no extent. The findings imply that most firms had adopted environmentally responsible operational practices aimed at minimizing environmental degradation and promoting sustainable utilization of natural resources.

On customer satisfaction, the findings further show that 35.9% of the respondents indicated that the number of customer complaints had reduced to a very great extent, while 41.3% indicated great extent. However, 13.0% indicated moderate extent and 9.8% indicated little extent or no extent. These findings imply that many firms had improved customer service quality and operational efficiency, resulting in reduced customer complaints. Regarding customer retention levels, 45.3% of the respondents indicated very great extent while 33.2% indicated great extent that the level of customer retention in their firms was high. Only 6.3% indicated little extent or no extent. The findings suggest that many manufacturing firms had successfully maintained long-term customer relationships through improved product quality, service delivery, and customer satisfaction initiatives.

The results further indicate that 36.8% of the respondents stated that the level of customer satisfaction survey index was high to a very great extent, while 40.8% indicated great extent. However, 15.7% indicated moderate extent and 6.7% indicated little extent or no extent. This implies that most firms achieved high customer satisfaction levels through effective operational and environmental management practices. On whether the number of customers referred to the company by other customers had increased, 44.4% of the respondents indicated very great extent while 30.9% indicated great extent. However, 17.5% indicated moderate extent and 7.1% indicated little extent or no extent. These findings suggest that customer referrals had increased substantially among many firms due to positive customer experiences and improved organizational reputation.

Similarly, 44.4% of the respondents indicated very great extent while 40.4% indicated great extent that the number of customer suggestions had increased. Only 8.5% indicated little extent or no

extent. The findings imply that many firms had enhanced customer engagement and communication mechanisms, encouraging customers to actively provide feedback and suggestions regarding products and services.

The findings in Table 2 confirm that manufacturing firms in Kenya have achieved firm performance outcomes to a great extent through environmental compliance and customer satisfaction, reflecting the sector's growing integration of sustainability into operations. Firms actively engage in environmental beautification, rehabilitation programs, tree planting, employee awareness, and avoidance of resource depletion, which aligns with Wanjiku & Mwangangi (2023) who found that green procurement improved efficiency and customer satisfaction, and Muturi & Were (2022) who demonstrated that sustainable logistics enhanced competitiveness.

4.3. Chi Square Tests

The study sought to test the *Chi-square* value between green distribution and firm performance. This was used to test the null hypothesis that green distribution does not have a significant effect to firm performance. The results were presented in Table 3.

Table 3 Chi-square Tests between Green Distribution and Firm Performance

	Value	***df***	***Asymp. Sig. (2-sided)***
Pearson Chi-Square	393.100[a]	348	.048
Likelihood Ratio	282.621	348	.996
Linear-by-Linear Association	8.254	1	.004
N of Valid Cases	223		

Table 3 presents the Chi-Square test results examining the association between Green Distribution practices and Firm Performance among manufacturing firms in Kenya. The test was conducted to determine whether a statistically significant relationship existed between the two variables. The findings indicate that the Pearson Chi-square statistic was 393.100 with 348 degrees of freedom and a significance value (*p-value*) of 0.048. Since the p-value was less than the threshold of 0.05, the results indicate that there was a statistically significant association between Green Distribution practices and Firm Performance. This implies that adoption of green distribution practices significantly influenced the performance of manufacturing firms in Kenya.

The Linear-by-Linear Association statistic was 8.254 with a significance value of 0.004. Since the p-value was below 0.05, the findings indicate that there was a significant positive linear relationship between Green Distribution and Firm Performance. This suggests that increased implementation of environmentally sustainable distribution practices was associated with improved organizational performance.

The Likelihood Ratio statistic was 282.621 with a significance value of 0.996. Although the likelihood ratio test did not indicate statistical significance, the Pearson Chi-Square statistic remains the principal statistic for interpretation in contingency table analysis. Consequently, the study relied primarily on the Pearson Chi-square results in determining the association between the variables. The analysis was based on 223 valid cases, indicating that all the responses used in the analysis were complete and suitable for statistical testing.

Hence, the findings demonstrate that Green Distribution practices had a statistically significant relationship with Firm Performance among manufacturing firms in Kenya. The results imply that firms that adopted environmentally sustainable distribution practices such as efficient transport systems, environmentally certified logistics providers, optimized routing systems, energy-efficient transportation modes, and environmentally efficient warehousing were more likely to achieve improved firm performance outcomes.

The study for Green Distribution and Warehousing studies reinforces the importance of eco-efficient logistics and infrastructure. Luca (2024) noted warehouses as major contributors to environmental impact, while Pavithraa and Priyadharshini (2025) emphasized the integration of digital and traditional distribution strategies for competitiveness. Wagan (2025) confirmed in China that green innovation in distribution channels improved efficiency and environmental commitment. Sara (2024) highlighted the role of green warehousing in minimizing environmental impact, and Roy and Mohanty (2023) in India linked green distribution practices to social, economic, and environmental performance. In Kenya, Wakoli and Wachiuri (2025) found eco-warehouse design significantly enhanced distribution firm performance, while Odock and Mwangi (2024) showed green logistics practices mediated firm performance through environmental outcomes. Kamoni (2024) further demonstrated that warehouse management systems reduced operational costs and improved customer satisfaction. Marhadi (2025) added a consumer behavior dimension, showing generational differences in attitudes toward electric vehicles as part of green distribution strategies.

4.4 Summary of Chi-square Results and Hypothesis Testing

A summary of the *Chi-square* values, degrees of freedom, *p-values* and the interpretations between the variables was represented in Table 4

Table 4 Summary of Chi Square Results and Hypothesis Tests

Green Supply Management Practices	Dependent Variable	Chi-Square Value	df	p-value	Conclusion
Green Distribution	Firm Performance	393.100	348	0.048	Significant Effect; *H2* rejected

Table 4 presents a summary of the Chi-square test results examining the relationship between Green Supply Chain Management Practices and Firm Performance among manufacturing firms in Kenya. The table specifically summarizes the Chi-Square values, degrees of freedom, p-values, and decisions regarding the study hypotheses.

H_1: The results further show that Green Distribution recorded a Pearson Chi-square value of 393.100 with 348 degrees of freedom and a p-value of 0.048. Since the *p-value* was below 0.05, the relationship between Green Distribution and Firm Performance was statistically significant. Therefore, the null hypothesis stating that Green Distribution has no significant effect on Firm Performance was rejected. The findings suggest that adoption of environmentally sustainable distribution practices significantly enhanced organizational performance.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1.1 Green Distribution Practices

The findings further revealed that firms had implemented Green Distribution practices to a great extent. Majority of respondents (54.3%) indicated to a very great extent that their firms distributed products together rather than in smaller batches to ensure full vehicle loads for efficiency, while 30.5% indicated great extent. Similarly, 64.6% indicated to a very great extent that their firms used good information systems and innovative management for efficient loading, scheduling, and routing. Further, 41.7% reported to a very great extent that their firms used logistics firms that complied with environmentally friendly principles or possessed EMS certification. The results imply that manufacturing firms highly embraced environmentally sustainable transportation, logistics, and warehousing systems.

5.1.2. Firm Performance

The findings indicated that firms achieved environmental compliance performance to a great extent. Specifically, 49.3% of respondents indicated to a very great extent that their firms had developed environmental awareness among employees, while 31.4% indicated great extent. Further, 44.4% reported to a very great extent that their firms were not engaged in natural resource depletion activities, while 40.8% indicated to a very great extent that their firms supported tree planting initiatives. These findings suggest that manufacturing firms actively embraced environmental sustainability and conservation initiatives. The findings also established that firms achieved customer satisfaction performance to a great extent. Majority of respondents indicated that customer complaints had reduced, with 41.3% indicating great extent and 35.9% indicating very great extent. Similarly, 45.3% indicated to a very great extent that customer retention levels were high, while 44.4% reported to a very great extent that customer referrals had increased. Further, 44.4% indicated to a very great extent that customer suggestions had increased, implying enhanced customer engagement and satisfaction. The findings therefore suggest that Green Supply

Chain Management Practices positively contributed towards improved customer satisfaction and overall firm performance.

5.2 Conclusions

Effect of Green Distribution on Firm Performance

Results from Chi square test *(value= 393.1, p-value = 0.048)* indicated that there was a significant relationship between green distribution and non- financial performance. The ordinal regression model estimates resulted to a positive significant coefficient of green distribution *(β=0.383, p-Value= 0.047*). This shows that green distribution had a direct significant effect to non- financial performance. Therefore, distribution of products together, employment of transport modes, use of logistics firms that abide to environmentally friendly principles, use of good information system and use of warehousing facilities that have been certified, causes a significant increase to the firm's performance. These findings suggest that green distribution strategies are essential determinants in the performance of manufacturing firms in Kenya.

5.3 Recommendations

The study established that green distribution had a statistically significant positive effect on firm performance (*β = 0.383, p = 0.047*). The findings further revealed that 64.6% of respondents indicated to a very great extent that their firms used effective information systems and innovative management for efficient loading, scheduling, and routing, while 54.3% reported to a very great extent that products were distributed together to ensure full vehicle loads. Based on these findings, the study recommends that manufacturing firms should prioritize investment in environmentally sustainable distribution systems and logistics technologies. Firms should adopt efficient transport scheduling and routing systems in order to reduce fuel consumption, transportation costs, and environmental pollution.

Manufacturing firms should also collaborate with environmentally certified logistics providers since 41.7% of respondents indicated that their firms already practiced this to a very great extent. In addition, firms should invest in environmentally efficient warehousing facilities and energy-saving transportation technologies to enhance operational efficiency and environmental sustainability.

Policy Recommendations

Policy makers (Government) should provide incentives such as tax reliefs, subsidies, and technical support to firms investing in environmentally sustainable logistics systems, energy-efficient transportation technologies, and environmentally certified warehousing facilities.

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