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REVERSE LOGISTICS AND PERFORMANCE OF FOOD AND BEVERAGE MANUFACTURING FIRMS IN KENYA

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ABSTRACT

This study examined the influence of reverse logistics practice on performance of food and beverage manufacturing firms in Kenya. The study was guided by complexity theory. This research adopted positivism research philosophy. The research design was explanatory survey research design. The target population for the study constituted 217 food and beverage manufacturing firms and Slovin's formula was used to sample 141 firms. The study used structured questionnaires to collect relevant to the study. The hypotheses were then tested using multiple linear regression and hierarchical linear modeling. The results affirmed that reverse logistics practice have a significant negative influence on the performance of food and beverage manufacturing firms in Kenya. Therefore, managers and practitioners in the food and beverage manufacturing industry should consider reverse logistics strategies and green warehousing in the sector to facilitate a harmonious balance between environmental responsibility and the sustained growth and success of food and beverage manufacturing firms in Kenya.

Keywords: *Reverse Logistics, Firm Performance, Food and Beverage Manufacturing*

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INTRODUCTION

Firm performance is the epicenter of any enterprise and organizations are solely able to expand and move forward through performance (Ahn, 2020). In the same fashion, Krupskyi and Kuzmytska (2020) postulate that a business' survival is to achieve goals and objectives. Bonaventura et al., (2018) asserts that one of the fundamental prerequisites for abiding company survival and effectiveness is firm profitability. Firm performance is critical for venture capitalists, collaborators as well as the economy as a whole. According to Jin and Xu. (2022), the return on investments for venture capitalists is immeasurable, and an optimally performing enterprise can bring in vast and sustainable revenue for their investments. Based on Faizal (2015), companies nowadays are endlessly seeking ways to achieve optimum firm performance and maintain a competitive edge through the successful disposition of resources and business processes and one of these practices is reverse logistics.

To increase business performance, companies need good systematic green supply management. The idea of green logistics supply chain management refers to a group of management performance that merge issues of the environment into supply chain management to make sure fostering of the environment ability and environmental regulations of the whole supply chain. Reverse logistics is a logistics function concentrating on the backward flow of products from customers to suppliers. It is a crucial component of green supply chain management (GSCM) as it can help to reduce the waste generated by handling and disposition of returned and used products through engaging a range of disposition options (Ahi & Searcy, 2013). Product returns can occur for a number of reasons and at different places in the supply chain including manufacturing, distribution and customer-related returns (Kim & Schoenherr, 2018). Product disposition involves activities associated with making a decision about what to do with used or returned products and this process is a key part of reverse logistics (Fang & Zhang, 2018). Reuse, repair, remanufacturing, recycling and disposal have been defined as the common disposition options of reverse logistics. Well-managed reverse logistics programs can lead to sustainable development and create a competitive advantage through increased profits, cost reduction and improvement in customer satisfaction (Somuyiwa & Adebayo, 2014). According to Sarkis (2012), the link between supply chain management and environmental protection also needs to be considered from the opposite perspective. Whereas design for environment techniques is dependent on the availability of materials and technical capabilities of the supply chain, product take-up requires well-honed logistics operations. Managing the reverse flow of products is an important ability for any company since the product lifecycle offers a valuable source of insight about the changing needs of marketing and logistics over the life of a product (Rashid, Asif, Krajnik & Nicolescu, 2013). Recycling is a technique that is used to reduce the solid waste stream volume, though the reverse logistics channels used seem to have received minimal attention (Agrawal *et al.,* 2015). The priority for top leading manufacturers is efficiency, accuracy and timeliness in reverse supply chain.

Cohen and Roussel (2013) assert that with all the attention that has been put into the forward action of the supply chain, there is a consideration by the manufacturers on how supply chain can work in reverse to regain products at their life cycle end and recover them through supply chain disposal, decomposition or recycling of key components. In reverse logistics, one considers strategic factors including environmental concerns, legislative concerns, overall quality customer service and cost (Agrawal *et al.,* 2015).

Most organizations have gradually changed their policies with more strategic emphasis being put on reverse logistics. Reverse logistics has played a major and critical role in general corporate business and has been strategically examined within a wider supply chain strategy (Shaik, 2015). The more the customers are influential the more the multi-channel retailers increase and have an impact on the movement of resources throughout the industry's supply chain and mainly on the reverse flows. Reverse logistics activities need sufficient knowledge management in returning products in order to solve issues that occur in these processes. In this logic, it is necessary for all organizations to be able to create new knowledge to decrease the high

uncertainties that come with reverse logistics activities, giving it greater flexibility to expand its capacity to respond to the continuous changes that occur in these activities (Abdulrahman, Gunasekaran & Subramanian, 2014).

Statement of the Problem

The performance food and beverage manufacturing sector plays a critical role in economic development and creation of employment globally, regionally and in Kenya (Thuita et al., 2023). Manufacturing sector is a crucial tool for Kenya to achieve her long-term economic strategy, the Vision 2030 and the Big Four Agenda for the Jubilee Government, (KAM, 2023). However, in Kenya, the sector has been facing significant challenges in the last 15 years with significant drop in its contribution to GDP hence the premature de-industrialization phenomenon. This is evidenced by constant reduction in the manufacturing firms (KNBS, 2017). Kenya Bureau of Statistics (2019) report indicated that the growth rate of the food and beverage manufacturing sector was 4.2 % in 2019 which arose from 3.7 percent in the year 2018. A growth rate of an average of 3.9 % is very low given that the Kenya Vision 2030 envisages that the food and beverage manufacturing sector will grow at the rate of 10 percent annually. Food and beverage manufacturing stands tall as a key pillar in the Big Four development agenda by the National Government in Kenya (KAM, 2023). Additionally, as per World Bank (2018), the manufacturing industry recorded a significant decline in growth from 2.7% to 0.2%. This decrease in growth has prompted a rise in imports which has necessitated to a reduction in market share for food and beverage manufacturing firms in Kenya (Apurva & Conte, 2016).

Food and beverage Manufacturers could gain broad benefits from reverse logistics practices (EU, 2018). Nzuma and Ndeto (2023) affirm that managers are motivated by the potential benefits associated with reverse logistics which is key for managerial adoption of green logistics practices and the appropriate allocation of resources. However, research on reverse practices has attracted little attention especially on their effect on organizational performance. Several local studies have been conducted to show the link between reverse logistics and firm performance. However, these studies did not cover all aspects of reverse logistics and it effect on performance of food and beverage manufacturing firms in Kenya.

Objective of the Study

The objective of this study was to determine the influence of reverse logistics on performance of food and beverage manufacturing firms in Kenya. The study tested the following research hypotheses;

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

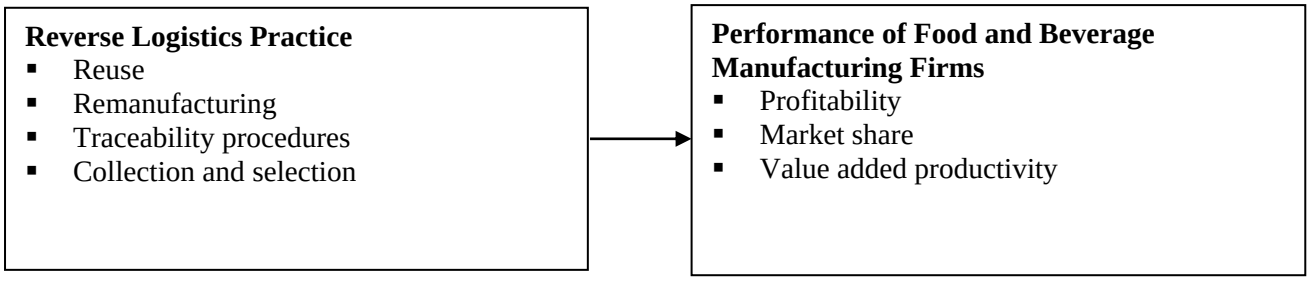
LITERATURE REVIEW

Theoretical Framework

The study was anchored on reverse logistics practice. The idea of organized complexity is core to complexity theory (CT). In this theory, the complexity of the returns-related processes makes it challenging for firms to quickly respond to changing market conditions and fluctuating return flows. A focused effort is necessary to keep reverse logistics programs responsive to such changes and competitive pressures. Reverse logistics responsiveness, defined as the firm's ability to respond to changing returns-related customer requirements, has the potential to enhance the competitive positioning of the firm (Genchev, Landry, Daugherty & Roath, 2010). In this study one effect of complexity theory for reverse logistics is that in some events the complexity of the returns-related procedures makes it difficult for firms to respond rapidly to the changing market needs and decreasing return flows. It is important to have an engrossed determination so as to keep reverse logistics programs reactive to such competitive pressure and changes. The adaptation aspect of complex systems may also relate to reverse logistics and performance of food and beverage manufacturing firms (Akhi, 2020). This theory therefore aptly explains reverse logistics variable in the subject study.

Conceptual Framework

Figure 1 shows diagrammatical presentation of the hypothesized relationship between independent variable (reverse logistics) and firm performance of food and beverage firms.



Independent Variable **Dependent Variable**

Figure 1: Conceptual Framework

Empirical Review and Hypothesis Development

While there are numerous studies examining the relationship between reverse logistics and other green logistics practices and performance outcomes, the findings are not decisive as they differ across several industries. While Younis, Sundarakani and Vel (2016) found a significant positive relationship between reverse logistics and social performance, Geng, Mansouri and Aktas (2017) found no relationship between the two. Contrastingly, Geng *et al.* (2017) and Diabat, Khodaverdi and Olfat (2013) found a positive relationship between reverse logistics and environmental performance, while Younis *et al.* (2016) found no such relationship. Wu, Liao, Tseng and Chiu (2015) indicated that the recovery and recycling system had the most significant effect on economic performance, while Schoenherr (2012) found that recycling does not have any significant effect on economic performance.

Reverse logistics can make a noteworthy contribution to improving the sustainability performance of firms through its impact on cost savings, increased revenue from sales of recovered and remanufactured products (Khor, Udin, Ramayah & Hazen, 2016), enhanced customer satisfaction by acting in a socially and environmentally responsible manner, improved customer loyalty by paying more attention to faulty products and its positive effect on climate change and global warming by taking back products and reducing their carbon footprint (Lee *et al.,* 2012). Efficient and sustainable reverse logistics can create competitive advantage through cost savings in procurement, inventory carrying, distribution and transportation (Banihashemi, Fei & Chen, 2019), positive impact on environmental performance and improving corporate image. In order to guarantee sustainable reverse logistics, firms have to incessantly monitor and evaluate their reverse logistics performance (Agrawal & Singh, 2019).

However, only a few studies have considered sustainability issues from the reverse logistics perspective and examined their probable interrelations. It would be useful to examine the relationship between reverse logistics and sustainable development (Govindan, Soleimani & Kannan, 2015; Govindan & Soleimani, 2017). In addition, the social aspects of sustainability, especially their application to reverse logistics, are less explored and there is a necessity for research (Vahabzadeh & Yusuff, 2015; Geng *et al.,* 2017). Implementing reverse logistics has been shown to have substantial impacts on organizations' environmental and economic performance (Mangla, Govindan & Luthra, 2016).

Wanjiku (2019) investigated the influence of reverse logistics on the performance of the food and beverage industry in Kenya. Banihashemi *et al.,* (2019) explored the implementation of reverse logistics in the supermarket business using observations and semi-structured interviews and found that the supermarkets

gained both environmental and economic advantages. Khor *et al.,* (2016) also reported reverse logistics advantages in environmental and economic outcomes in their study of Chinese manufacturing firms with a further study in Taiwan, demonstrating reverse logistics' positive effect on environmental and economic performance (Huang & Yang, 2014).

In order to stimulate research associated with social sustainability and reverse logistics in the literature, Sarkis *et al.* (2011) developed a profile of reverse logistics for social sustainability by denoting the same to practical examples from industries to identify the potential social benefits of reverse logistics. The study developed four categories: internal human resources being practices associated with employment stability, health and safety; external population referring to human, productive and community capital; stakeholder participation represented by information provision and stakeholder influence issues; and macro social issues comprising socio-economic and socio-environmental performance. In another study, Hussain, Rigoni and Orij (2018) proposed an integrated model according to the triple-bottom-line performance indicators to measure the corporate social responsibility of reverse logistics. Thus, the study hypothesized that:

$H_{0:}$ Reverse logistics has no significant influence on performance of food and beverage manufacturing firms in Kenya.

METHODOLOGY

This study adopted a positivist philosophy because the data gathered was majorly quantitative and sought to measure correlations between variables. Thus, the research design adopted for this study was explanatory survey research design. The target population for this study constituted of 217 food and beverage manufacturing firms in Kenya (Kenya Association of Manufacturers (2019). Slovin's formula was used for determination of sample size of 141. This study applied stratified random sampling. Purposive sampling procedure was used to identify sample units that participated in the study. The method was used for selecting Procurement Managers in the food and beverage manufacturing firms since they can be identified by designation.

A structured questionnaire with closed and open-ended questions with a 5-point Likert scale was used to collect the primary data. The instrument's validity was measured through the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity (Abd ElHafeez et al, 2022). The component factor analysis with promax rotation was conducted in variables to extract factors from each construct. According to Hair et al., (2015) all items loading below 0.50 were deleted and those with more than a 0.50 loading factor were retained. As a result, the items were well loaded into their various underlying variable structure of dimensions. Reliability test was done using Cronbach's alpha reliability coefficient which exceeded the recommended threshold value of 0.70 for Cronbach's alpha coefficients demonstrating good internal consistency and were retained for further analyses. The instruments were considered reliable as their reliability coefficients were above the recommended 0.7 threshold (Fraenkel & Wallen, 2000).

Table 1: Reliability and Validity of the Research Instrument

	Component loadings
Reverse Logistic (KMO=0.739, Cumulative % = 73.508, Cronbach's Alpha =0.731)	
My company reuses recycled containers and other appropriate material.	0.850
My company recovers waste materials from logistics processes and used-up materials.	0.896
My company has a system to return the equipment used in logistics to suppliers.	0.624
My organization recovers all logistics tools that are harmful to environment.	0.784
There are documented policies, processes and procedures that relate to reuse of materials	0.690
My organization purchases recycled products when offered in the market as opposed to new products.	0.740
My company encourages distributors and customers to return used products for possible reuse.	0.752
My company instructs customers to reuse packaging materials and products.	0.784
Firm Performance (KMO=0.717, Cumulative % = 69.09, Cronbach's Alpha =0.923)	
My company has achieved and maintained a high market share within the sector.	0.760
My company has experienced high growth in sales in the intervening period.	0.522
My company has been able to grow its after-tax return on assets.	0.850
Profit after taxes has exponentially grown in my company in the period under review.	0.846
My company has successfully grown its financial liquidity.	0.813
With green logistics practices, my company has grown its value-added productivity.	0.813
The public image of my company has substantially improved.	0.742
Adoption of green logistics practices has enhanced the customer loyalty in my company.	0.671

Rotation Method: Varimax with Kaiser Normalization.

Data Analysis and Model specification

To test hypothesis, Single and hierarchical regression analysis was carried out to establish the relationship between the independent and dependent variables. The regression model applied for this study was;

$Y = \beta_0 + \beta_1 x_1 + \varepsilon_1$ ..... Model 1

Where; Y = Performance of Food and Beverage Manufacturing Firms in Kenya

β_0 = Constant, β_1 = Coefficient of estimates, X_1 = Reverse logistics, ε_1 = Error term

FINDINGS AND DISCUSSION

This section presented the data analysis as well as the findings of the study based on the study hypotheses. The data was summarized and presented using tables. The total response rate for usable questionnaires was 94.3%.

Sample Characteristics

The sample characteristics indicate a balanced gender distribution among respondents from food and beverage manufacturing firms, with 46.6% being female and 53.4% male. The age group of 31-40 years was predominant, suggesting a significant workforce presence in their thirties. The Head of Department was the most common job position, held by 43.6% of respondents, indicating a notable representation of individuals in leadership roles. A majority (44.4%) of respondents possess an undergraduate degree, reflecting a common educational requirement in the industry. Additionally, 43.6% have 6-10 years of experience in green logistics practices, indicating a substantial level of expertise in implementing sustainable logistics strategies within the sector.

Descriptive Results

Findings in table 2 data presented the findings of a survey on the reverse logistics practices of food and beverages manufacturing firms

Table 2: Descriptive Statistics for Reverse Logistic

	Mean	Std. Dev.
My company reuses recycled containers and other appropriate material.	4.790	0.591
My company recovers waste materials from logistics processes and used-up materials.	4.759	0.605
My company has a system to return the equipment used in logistics to suppliers.	4.278	0.742
My organization recovers all logistics tools that are harmful to environment.	4.203	0.705
There are documented policies, processes and procedures that relate to reuse of materials in my company.	4.241	0.790
My organization purchases recycled products when offered in the market as opposed to new products.	4.376	0.692
My company encourages distributors and customers to return used products for possible reuse.	4.301	0.696
My company instructs customers to reuse packaging materials and products where possible.	4.421	0.741
Reverse Logistics	**4.487**	**0.342**

The reverse logistics survey of food and beverage manufacturing firms reveals a generally high awareness of the significance of reverse logistics, with proactive implementation efforts. The majority of surveyed firms engage in practices such as reusing recycled containers and materials, recovering waste materials, and returning logistics equipment to suppliers. Moreover, they exhibit environmentally conscious actions like recovering harmful logistics tools, having documented policies for material reuse, purchasing recycled products, encouraging product return for reuse, and instructing customers on packaging reuse. The overall mean score of 4.487 indicates a proactive stance towards reverse logistics, yet there is room for improvement, as shown by the notable standard deviation of 0.342, signifying variation in firms' responses. The findings emphasize the commitment of these firms to sustainability, aligning with previous research by Tan & Guo (2019) and Kim & Schoenherr (2018). This positive trend in adopting reverse logistics is crucial for environmental protection and cost reduction associated with waste disposal.

The findings in Table 3 provided are related to the perception of respondents regarding various aspects of firm performance. The data includes the mean scores, standard deviations, and the distribution of responses across different rating options, ranging from "Strongly Disagree" (SD) to "Strongly Agree" (SA).

Table 3: Descriptive Statistics for Firm Performance

	Mean	Std. Deviation
My company has achieved and maintained a high market share within the sector.	4.511	1.070
My company has experienced high growth in sales in the intervening period.	4.368	0.965
My company has been able to grow its after-tax return on assets.	4.211	1.023
Profit after taxes has exponentially grown in my company in the period under review.	4.165	0.923
My company has successfully grown its financial liquidity.	4.226	1.077
With green logistics practices, my company has grown its value-added productivity.	4.083	0.985
The public image of my company has substantially improved.	4.248	1.003
Adoption of green logistics practices has enhanced the customer loyalty in my company.	4.301	1.015
Firm Performance	**4.263**	**0.936**

The means scores in Table 4 shows that generally have a positive perception of their company's performance across different dimensions. The mean scores for all items are above the midpoint of the scale (which is 3), indicating that, on average, respondents tend to agree or strongly agree with the statements. The standard deviations provide insights into the level of agreement or disagreement among the respondents. Overall, the mean score for firm performance across all items is 4.263, indicating a positive perception of performance among the respondents. The standard deviation of 0.936 suggests a moderate level of agreement among the respondents regarding firm performance. It is important to note that these findings represent the subjective perceptions of the respondents and may not necessarily reflect objective performance measures. However, they provide valuable insights into how employees or stakeholders perceive the company's performance across various dimensions

Assumptions of Regression Model Testing

To identify normal distribution in the study, Kolmogorov-Smirnov and Shapiro Wilks Tests were used (Shapiro and Wilk, 1968). The results of the Test of Normality using Kolmogorov-Smirnov and Shapiro-Wilk tests indicated that the data under consideration follows a normal distribution. In this study, it was important to test for linearity since statistical models require an assumption of linearity of data before adopting methods like linear regression. The normal P-P plot in figure indicated that data conformed to linearity. Results of the ANOVA test for linearity indicated a significant linearity for all variables. Durbin-Watson Statistic was used to check for the presence of autocorrelation of residuals. The results indicated that there was no autocorrelation between the variables since all the values of Durbin-Watson statistic fall within the range of between 1 and 2 thresholds as recommended by Gujarat (2009). This study employed the variance inflation factor (VIF) and tolerance to evaluate Multicollinearity. The VIF values were all less than the threshold of 10, which indicated that the independent variable was not highly correlated with each other.

Correlation Analysis

Table 4 presented the outcomes of a correlation analysis aimed at investigating the relationships between dependent and independent variable within the studied context.

Table 4: Correlation between the Dependent and Independent Variables

	Firm Performance	**Reverse Logistic**
firm performance	1	
reverse logistic	-.350**	1

The correlation coefficient between reverse logistic and firm performance was -0.350 ($p < 0.01$), indicating a statistically significant negative correlation. This suggested that as reverse logistic increases, firm performance tends to decrease.

Hypotheses Testing

Regression analysis; model summary, ANOVA for goodness of fit and coefficients of estimates, was done. The research outcomes are effectively encapsulated in Table 5.

Table 5: Simple and hierarchical regression models

	Model 1			
	Unstandardized Coefficients		Standardized Coefficients	
	B	Std. Error	Beta	Sig.
(Constant)	5.778	0.362		0.000
Reverse Logistics	-0.358	0.084	-0.350	0.000
Model summary				
R	0.35			
R Square	0.123			
Adjusted R Square	0.116			
Std. Error of the Estimate	0.872			
Change Statistics				
R Square Change	0.123			
F Change	18.326			
df1	1			
df2	131			
Sig. F Change	0.000			

a Dependent Variable: **Firm Performance**

Hypothesis H_0 states that reverse logistics has no significant influence on the performance of food and beverage manufacturing firms in Kenya. The results in Mode 1 show that the coefficient for reverse logistics is -0.358 with a standard error of 0.084 and the corresponding significance level (Sig.) is 0.000. Since the significance level (p value) was less than the conventional threshold of 0.05, H_0 was rejected. Therefore, the results suggest that for every one-unit increase in reverse logistics practices, there is a significant negative influence on the performance of food and beverage manufacturing firms in Kenya. This finding aligns with previous research by Younis, Sundarakani, and Vel (2016), who identified a significant positive relationship between reverse logistics and social performance, supporting the notion that reverse logistics impacts performance positively. However, this contrasts with the findings of Geng, Mansouri, and Aktas (2017), who found no significant relationship between reverse logistics and social performance. This suggests that while social aspects can be influenced by reverse logistics, the relationship may not be universally consistent. Moreover, the significance of reverse logistics for environmental performance is highlighted by Geng et al. (2017) and Diabat, Khodaverdi, and Olfat (2013), but a lack of such relationship is indicated by Younis et al. (2016), underlining the complex interplay between reverse logistics and environmental outcomes. Interestingly, Banihashemi et al. (2019) and Khor et al. (2016) corroborate the positive impact of reverse logistics on environmental and economic outcomes, reflecting the wide-ranging consequences of its implementation. Notably, Sarkis et al. (2011) advocate for further exploration of the social sustainability dimension within reverse logistics, emphasizing the need to assess the broader social benefits of such practices.

The optimal regression models for effect of reverse logistic on firm performance of food and beverage manufacturing firms in Kenya was as follows:

$Y = 5.778 - 0.350\text{RL}$

Where;

Y = performance of food and beverage manufacturing firms

RL = reverse logistics

Ɛ = error term

CONCLUSION AND RECOMMENDATION

The descriptive results from the reverse logistics survey among food and beverage manufacturing firms revealed a positive trend in the adoption of environmentally responsible practices. The majority of surveyed firms actively engage in reusing recycled materials, recovering waste, and returning equipment, showcasing a commitment to sustainable logistics. Documented policies, a preference for recycled products, and efforts to encourage product returns further emphasize environmental responsibility. The overall mean score of 4.487 indicates a favorable disposition toward reverse logistics, suggesting these firms are actively pursuing environmentally friendly practices. However, the correlation coefficient between reverse logistics and firm performance showed a statistically significant negative correlation, indicating that as reverse logistics increases, firm performance tends to decrease. Regression results affirmed that reverse logistics practices have a significant negative influence on the performance of food and beverage manufacturing firms in Kenya.

In conclusion, the findings highlight a noteworthy concern regarding the impact of reverse logistics on the performance of food and beverage manufacturing firms. Despite the commendable efforts such as reusing recycled materials, recovering waste, and implementing environmentally conscious policies and processes, the evidence suggests a detrimental effect on overall performance. This underscores a potential gap in current practices, indicating that the existing measures may not be adequately effective in positively influencing the performance of these firms. Further exploration and strategic adjustments may be necessary to address this challenge and optimize the balance between environmental responsibility and operational performance within the food and beverage manufacturing sector.

On recommendations, the study underscores a significant concern regarding the adverse impact of reverse logistics on the overall performance of food and beverage manufacturing firms, despite commendable efforts in adopting environmentally conscious practices. The findings signal a potential gap in the effectiveness of existing measures, revealing a need for further exploration and strategic adjustments to optimize the delicate balance between environmental responsibility and operational performance within the sector. To address this challenge, managers and practitioners in the food and beverage manufacturing industry should consider a holistic reassessment of their reverse logistics strategies, placing a renewed focus on innovative and sustainable solutions that align with the sector's unique dynamics. This may involve investing in advanced technologies for more efficient waste recovery, exploring alternative materials with lower environmental impact, and enhancing collaboration with suppliers and distributors to streamline the reverse logistics process. Additionally, fostering a culture of continuous improvement and environmental innovation within organizations is crucial to staying ahead of industry challenges. Managers should prioritize employee training and engagement programs to instill a sustainability mindset throughout the workforce. Collaborative industry initiatives, knowledge-sharing platforms, and partnerships with research institutions can further support the development and adoption of best practices in reverse logistics.

Theoretical Implications

This study makes a substantial contribution to Complexity Theory in the field of supply chain management by supporting the role of this theoretical framework in unraveling the intricacies of reverse logistics within the food and beverage manufacturing sector. The findings align with the foundational principles of Complexity Theory, emphasizing the interconnected and dynamic nature of reverse logistics processes in the supply chain. Through empirical evidence, the study showcases how various components of reverse logistics, such as reusing recycled materials and recovering waste, are interrelated and form a complex system within the organizational context of supply chain management. This not only affirms the relevance of Complexity Theory in the field of supply chain management but also provides practical insights into the complex dynamics that characterize sustainable practices in reverse logistics.

Policy and Practice Implications

The study underscores a significant concern regarding the adverse impact of reverse logistics on the overall performance of food and beverage manufacturing firms, despite commendable efforts in adopting environmentally conscious practices. The findings signal a potential gap in the effectiveness of existing measures, revealing a need for further exploration and strategic adjustments to optimize the delicate balance between environmental responsibility and operational performance within the sector. To address this challenge, managers and practitioners in the food and beverage manufacturing industry should consider a holistic reassessment of their reverse logistics strategies, placing a renewed focus on innovative and sustainable solutions that align with the sector's unique dynamics. This may involve investing in advanced technologies for more efficient waste recovery, exploring alternative materials with lower environmental impact, and enhancing collaboration with suppliers and distributors to streamline the reverse logistics process. Additionally, fostering a culture of continuous improvement and environmental innovation within organizations is crucial to staying ahead of industry challenges. Managers should prioritize employee training and engagement programs to instill a sustainability mindset throughout the workforce. Collaborative industry initiatives, knowledge-sharing platforms, and partnerships with research institutions can further support the development and adoption of best practices in reverse logistics.

Limitation of the Study and Further Studies

The study has significantly contributed to our understanding of the impact of reverse logistics practices on performance. However, several limitations suggest areas for future exploration. First, the study focused on one specific green logistics practice, and future research could broaden the scope to include additional practices for a more comprehensive analysis. Second, the study was confined to the food and beverage manufacturing sector, and thus, replication across various manufacturing sectors would enhance the generalizability of findings.

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