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**Reverse Logistics and Performance of Plastic Bottling Firms in Mombasa County,
Kenya**


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Abstract

Purpose: The purpose of this study was to determine the relationship between reverse logistics and the performance of plastic bottling firms in Mombasa County, Kenya.

Methodology: Cross-sectional research design was employed in the study. The study considered all 27 plastic bottling firms registered by Mombasa County Department of Trade. Stratified random sampling techniques was used to select sample size and Slovin's formula was adopted to get the sample size for the study. Primary data was collected by use of structured questionnaires. Collected data was analyzed by employing descriptive and inferential statistics as the data analysis techniques. Descriptive statistics gives the profile of the respondents, that is, the frequencies and their percentages; whereas inferential statistics adopts a hierarchical, moderated, multiple regression analysis model in order to determine the effect of the explanatory variable. Statistical Package for Social Science was used as the data analysis tool. Data was presented in frequency and descriptive tables.

Findings: The study established that there is a correlation of 0.748 between reverse logistics and performance of plastic bottling firms in Mombasa County. Reverse logistics accounted for 56.0% of the variation in the performance of plastic bottling firms in Mombasa County.

Unique Contribution to Theory, Practice and Policy: Systems theory was adopted and validated. By incorporating linking the entire supply chain, Systems theory could assist plastic bottling firms in developing a seamless sustainable reverse logistics. The study revealed that successfully implementing reverse logistics; minimize unnecessary costs, protect the environment and increase firm returns.

Keywords: *Reverse Logistics, Plastic Bottling Firms, Performance*

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INTRODUCTION

Reverse logistics is a technique that reduces trash disposal by recovering and reusing things to lessen their negative environmental consequences (Kleindorfer, 2016). Reverse logistics can only be successfully implemented, though, if forward and backward material and information movements are integrated. Reverse logistics procedures vary from sector to sector (Hawks, 2016). The market for plastic bottles and containers was valued at \$39.03 billion globally in 2019 and is projected to grow at a compound annual growth rate (CAGR) of 4.2% from 2020 to \$50.19 billion by 2025. Over the past ten years, the idea of reverse logistics has gained traction, leading several industrial companies to examine and implement the strategy (Eltayeb, Zailani, & Ramayah, 2017). According to a Deloitte (2019) survey, reverse logistics accounts for a sizeable portion of a company's cost structure. On average, it accounts for 0.5% of a product's sales value, or \$200 billion USD annually in costs incurred in the United States. Compared to the cost of goods sold, an average of 7 to 10% is directly or indirectly attributable to reverse logistics. The idea of reverse logistics enables businesses to gather damaged and old goods from consumers for recycling, refilling, and refurbishing (Hazen, 2016).

Increased consumption and mass manufacturing have led to a demand for raw materials, endangering the availability of vital raw material sources and contributing to the growing number of landfills (Van Wassenhove & Bessiou, 2017). Due to this phenomena, plastic bottling firms need to develop and implement reverse logistics strategies that can effectively and efficiently handle problems that arise throughout the procurement process (Tseng & Hung, 2016).

In Kenya, the plastic bottling industry forms one integral part of the county's environmental and economic setup. Massively producing and consuming plastic bottle products have brought socio-economic and ecological challenges. Despite the plastic industry importing 20,000 tonnes of polyethylene terephthalate products annually and still growing, the industry is only able to achieve recovery rate of around 5 percent of the plastic bottles consumed (NEMA, 2018). KNBS (2017) indicated that 65% of manufacturing firms in Kenya often focus on forward logistics and as a result, they tend to overlook the importance of reverse logistics activities and its potential of improving the firm's performance.

The concept of reverse logistics is not novel in Kenya, however, nearly all plastic bottling firms have failed to adopt the practice thus missing on cost savings. The raw material procurement costs have increased due to changes in global markets and exchange rates a problem which could be solved through recycling, reuse and remanufacturing. If plastic bottling firms in Mombasa can leverage on reverse logistics systems as it can significantly contribute to achieving sustainable business results by increasing revenue, increasing recoverable and recycled goods, saving costs, considering social and environmental issues, and ensuring customer satisfaction (Khan, Ma, Akbar, Islam, Ali & Noor, 2024). This has necessitated need to research on reverse logistics and its effect on procurement performance

Statement of the Problem

Reverse logistics plays a pivotal role in cost reduction through effective recycling and refurbishment translating to improved firm performance (Lau & Wang, 2016). Chopra and Meindl (2017) reiterate that reverse logistics leads to supply chain costs reduction and improved process efficiencies which creates competitive advantage for the firm. Conceptually,

many research works have demonstrated that reverse logistics is important to enhance performance (Lambert & Burduroglu, 2016; Tibben-Lembke & Rogers, 2017; De Brito, 2016).

In this context, Kenya's output from the plastics bottlers industry rebounded near the end of the decade, with growth rates of 6% in 2018 and a staggering 16% in 2019–2020. However, the sector has only grown slowly since the release of COVID-19 in 2020 (KAM, 2022). Due to supply chain rigidity, an inability to control operating expenses, and a poor capacity to react to outside pressures and market shifts, a large number of businesses have either shut down or moved their operations abroad (Mogaka & Odari, 2021). This request for research on the impact of reverse logistics on the long-term viability of plastic bottling companies.

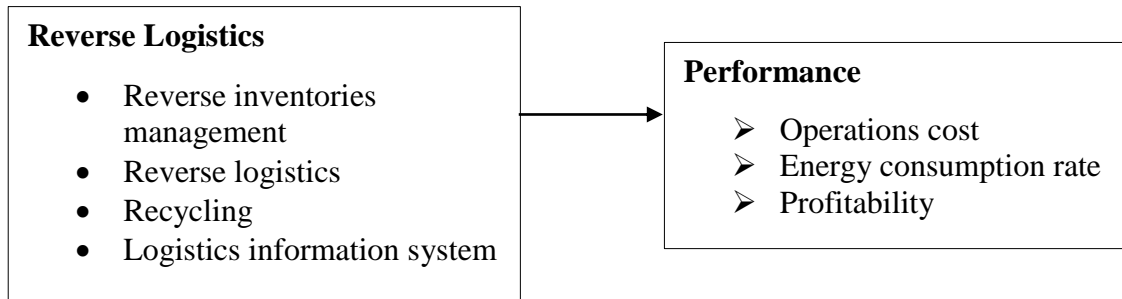
Numerous research studies on reverse logistics and performance have been conducted. The purpose of Wanjiku and Mwangangi's (2019) study was to determine how Kenya's food and beverage industry performs in relation to reverse logistics. A research on reverse logistics and the performance of Kenyan companies that manufacture food and beverages was conducted by Mutuku and Moronge (2020). In a research on the impact of reverse logistics procedures on the competitiveness of plastic packaging companies, Omwenga (2019) shown that standardized reverse logistics might provide a business with a competitive edge. Similarly, Wambaya, Oketchi, Namusonge, and Sakwa (2018) looked at the impact of reverse logistics on the Kenya Medical Supplies Agency's procurement performance and found a strong correlation. The previous one concentrated on public procurement, which is distinct from private company procurement. However, despite many studies having been focused on reverse logistics and performance, very few have narrowed down to reverse logistics in the context of plastic bottling firms performance a gap which the study sought to fill.

LITERATURE REVIEW

The study was guided by the systems theory which was postulated by Dunlop in 1958 and the theory has a perspective of an organization as complex set of dynamically intertwined and interconnected elements, including its inputs, processes, outputs, feedback loops and the environment in which it operates. The foundation of systems theory is that all the components of an organisation are inter-related, and that changing one variable might impact many others (Maignan, Hillebrand, & McAlister, 2012).

According to Lozano and Valles (2013), system theory views organisational structure as the established pattern of relationships among the parts of the organisation, of particular importance are the patterns in relationships and duties. These include themes of; integration (the way activities are coordinated), differentiation (the way tasks are divided), authority (the structure of the hierarchical relationships), and administrative (the formalized policies, procedures, and controls that guide the organization) (Maignan, Hillebrand, & McAlister, 2012). This theory therefore is relevant to this study in the sense that reverse logistics information systems can integrate all the core processes of the firm to derive distinctive competence.

The study used the following framework;



Independent Variables

Dependent Variable

Figure 1: Conceptual Framework

METHODOLOGY

The study used cross-sectional research design. The study considered all 27 plastic bottling firms registered by Mombasa County Department of Trade. Stratified random sampling techniques was used to select sample size and Slovin's formula was adopted to get the sample size for the study. Primary data was collected by use of structured questionnaires. Collected data was analyzed by employing descriptive and inferential statistics as the data analysis techniques. Descriptive statistics gives the profile of the respondents, that is, the frequencies and their percentages; whereas inferential statistics adopts a hierarchical, moderated, multiple regression analysis model in order to determine the effect of the explanatory variable. Statistical Package for Social Science was used as the data analysis tool.

RESULTS AND DISCUSSIONS

Descriptive Statistics of Reverse Logistics

The respondents were asked to rate their agreement with the reverse logistics claim made about the performance of plastic bottling firms. From Table 1, majority of respondents with a mean of 4.46 and a standard deviation of 0.552 agreed the statement that the plastic bottling firm has inventory model to manage returns. Majority of respondents, with a mean of 4.60, concurred with the assertion that the company owns fleet of transportation modes to manage reverse transport needs, with a standard deviation of .813 indicating that the results were highly varied.

The results indicated that few firms have established plastic bottles collection points which are convenient to customers with a mean of 3.16 and a standard deviation of .977 which shows that the results were very varied. Also, respondents were indifferent to the statement that the firm has policies guiding on used bottle conversion processes as indicated by a mean of 3.44 with a standard deviation of 0.850.

The results also show that the majority of respondents disagreed with the assertion that information sharing between the final consumers and the company is effective, with a mean of 2.44 and a standard deviation of 0.895. Respondents agreed to the statement that the designated returns collection points are sparsely distributed as indicated by a mean of 3.83 with a standard deviation of 0.857. This indicates that the results were varied. Based on the results and the average of the responses, majority of plastic bottling firms in Mombasa County have been practicing reverse logistics.

Table 1: Reverse Logistics

Reverse Logistics	SD %	D %	N %	A %	SA %	Mean	Std. Deviation
The plastic bottling firm has inventory model to manage returns	0	1	47	80	8	4.46	0.552
The company owns fleet of transportation modes to manage reverse transport needs	0	6	35	89	6	4.60	0.813
Firms have established plastic bottles collection points which are convenient to customers	0	11	41	74	10	3.16	0.977
The information sharing between the final consumers and the company is effective	12	89	10	25	0	2.44	0.895
The designated returns collection points are sparsely distributed	5	53	66	12	0	3.83	.857
The firm has policies guiding on used bottle conversion processes	18	37	72	9	0	3.44	.479

Effect of Reverse Logistics on the Performance of Plastic Bottling Firms in Mombasa County

For this particular purpose, the hypothesis to be tested was:

H₀: Reverse logistics has no significant effect on performance of plastic bottling firms in Mombasa County.

Table 2 displays the results of the analysis of the relationship between reverse logistics and the performance of plastic bottling firms in Mombasa County. There exists a positive relationship between reverse logistics and the performance of plastic bottling firms in Mombasa County with a correlation coefficient of 0.748.

Table 2: Regression Model Summary of Reverse Logistics and the Performance of Plastic Bottling Firms

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.748a	.560	.521	.72915

a. Predictors: (Constant), Reverse logistics

From Table 3, the sum of squares for Regression is 637.038, indicating the amount of variation in the dependent variable explained by the predictors in the model. The sum of squares for Residual is 499.135 which represents the unexplained variation or the residual error. The significance value in this table is .000^b, suggesting a very low p-value. This indicates strong evidence to reject the null hypothesis and conclude that the regression model is statistically significant.

Table 3: ANOVA Summary for Regression Model of Reverse Logistics and Performance of Plastic Bottling Firms

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	637.038	1	637.038	171.06	.000 ^b
	Residual	499.135	134	3.724		
	Total	1136.173	135			

a. Dependent Variable: Performance

b. Predictors: (Constant), Reverse logistics

CONSLUSIONS AND RECOMMENDATIONS

Conclusions

The study concludes that reverse logistics has a positive and significant effect on the performance of plastic bottling firms. The plastic bottling firms possess automated and digitized inventory processes and that they have invested in inventory model to manage returns. Plastic bottling firms also indicated to have enough capability and capacity to manage reverse logistics. Also the returns are collected and transported back frequently and the companies own fleet of transportation modes to manage reverse transport needs. It is concluded the plastic bottling firms have developed policies to guide on used bottle conversion processes and these firms have established plastic bottles collection points which are convenient to customers.

Recommendations

In summary, the management of plastic bottling firms have put measures and structures in place to ensure maximum empty returns as they were found to lead to procurement costs savings. To enhance efficiency, the plastic bottling firms have digitized and where necessary automated inventory processes for ease of management. The study suggests that the plastic bottling firms management should consider outsourcing the function of returns collection to third parties who are informal hence less costly. This would enable the firms to concentrate their resources and efforts on the conversion process. The returned bottles should be collected back to the firm frequently and the companies should opt for own fleet of transportation so as to ensure efficiency in the process of returns transportation. In addition, the firms should observe high standards during sorting of used bottles for recycle. This would minimize rejects in the systems and save on procurement costs. The study recommends that the plastic bottling firms should establish visible plastic bottles collection points which are convenient to customers.

The study contributes to theory in practice by providing practical guidance to the plastic bottling firms to get insights on the contribution of reverse logistics on performance. This knowledge on reverse logistics would help these companies to adopt effectively reverse logistics practices so as to mitigate the problems the industry experiences by lowering the production costs and managing waste hence creating loyal customer base and complying with environmental laws and regulations. In addition, the study contributes to the policy makers to develop encouraging policies which would stimulate adoption of reverse logistics beyond plastic bottling firms hence promote the practice in the country where its uptake is low.

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