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SUPPLY CHAIN OPTIMIZATION AND PERFORMANCE OF FOOD AND BEVERAGE MANUFACTURING FIRMS IN KIAMBU COUNTY, KENYA

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Abstract

Manufacturing firms rely on supply chain optimization to improve operations and reduce costs. This study examines the relationship between supply chain optimization and the performance of food and beverage manufacturing firms. The study will be guided by lean theory which expects organizations to maximize customer value while minimizing wastage, agility theory weighing on an organizations capability to respond to market demands. Purchasing portfolio theory guiding the purchase of items with a forecast on profit margin and supply risk, transaction cost analysis theory which manufacturers employ to minimize frictional costs embedded in supply chain transactions, and complex adaptive system theory which describe systems composed of interconnected agents that continuously sense, lean and adopt to changes in their environment. Specifically, the study seeks to determine the relationship between cost optimization, inventory maximization, lead time adjustment, and supply chain integration to performance of manufacturing firms. The study will use an explanatory research design. The study will target all food and beverage manufacturing firms operating in Kiambu County, which number 76 firms according to the Kenya Association of Manufacturers (KAM). A semi-structured questionnaire will be used to collect quantitative and qualitative data from supply chain personnel within these firms. A pilot study will be conducted on selected food and beverage manufacturing firms within Nairobi County to establish the reliability and validity of the research instrument. Data will be analyzed using descriptive statistics, including means and standard deviations, and inferential statistics in correlation and regression analysis using SPSS 29.

Key Words: Digital banking channels; mobile banking services; agency banking services; financial performance; investment companies; Nairobi Securities Exchange; Kenya

1. Introduction

Supply Chain Management (SCM) has evolved into a strategic function that coordinates activities across suppliers, manufacturers, distributors, retailers, and customers. Its core aim is to improve the efficiency of material, financial, and information flows across the entire supply chain network (Ivanov & Dolgui, 2020). As global markets become competitive, manufacturing firms must optimize their supply chains beyond the organizational level and respond to market conditions and service delivery. The modern SCM ensures inter-organization collaboration and end-to-end value chain optimization (Queiroz et al., 2022).

Supply chain optimization describes the deliberate efforts on supply chain processes through resource utilization and technology adoption (Firmo, 2024). It integrates artificial intelligence, blockchain, automation, predictive analytics, and IoT to increase visibility and streamline operational performance across the supply chain. The use of advanced technologies enables firms to reduce waste and timely delivery of products to customers (Bag et al., 2021).

In Sweden, the manufacturing sector exemplifies how lean and agile principles are fused with digitalization. Swedish multinationals like Volvo and Electrolux have pioneered data-driven supply chains characterized by high integration and sustainability. Volvo's "Demand-Driven Supply Chain" model utilizes real-time data from connected vehicles to predict maintenance part demands, reducing inventory holding costs by approximately 25% while improving part availability to 98% (Ericsson & Lundberg, 2022).

The home of Industries, Germany, manufacturers maintain global competitiveness despite labor costs approximately 40% higher than in emerging economies, primarily through automation and smart supply networks (Sharma & Modgil, 2020). Siemens consolidated its supplier base by over 30% to focus on strategic partnerships, achieving a 12% reduction in procurement costs and a significant improvement in component quality and innovation input (Siemens AG, 2023). BMW's "Partnering for Innovation" supplier integration program reduced production lead times by 20% while decreasing inventory levels through just-in-sequence delivery systems (Bosch Group, 2022).

In Japan, the legacy of the Toyota Production System (TPS) continues to evolve. Toyota has integrated IoT sensors across its global production and supplier network, creating a "living" supply chain that can self-diagnose bottlenecks and predict equipment failures. This digital jidoka (automation with a human touch) approach has reduced unplanned downtime by 35% and improved overall equipment effectiveness (OEE) (Toyota Motor Corporation, 2023).

Manufacturing firms in Sub-Saharan Africa face higher logistics costs compared to developed economies. There are poor road conditions and inefficient transportation systems (Adusei & Awunyo-Vitor, 2021). The road freight rates in East Africa exceed those in Asia because of infrastructure deficiencies and empty return journeys. Electricity costs in Sub-Saharan Africa are substantially higher than competitive manufacturing economies. Frequent power interruptions force most manufacturers to operate backup generators at higher costs than grid electricity. The manufacturing firms contributes to Sub-Saharan African GDP and employs 8.2 million people across the sectors (African Development Bank, 2022).

South African automotive manufacturers implemented supplier development programs that reduced defect rates and improved quality performance (Adeinat & Ventura, 2022). The food processing companies adopting just-in-time inventory practices reduced raw material inventory holding periods. Ethiopian manufacturers in industrial parks achieved cost reductions in centralized and proximity to suppliers. Nigerian consumer goods manufacturers implementing warehouse management systems improved inventory accuracy and reduced order processing times. The African Continental Free Trade Area eliminated tariffs on most traded goods. The

manufacturers source raw materials regionally with reduced lead times and lower costs compared to overseas imports.

In Kenya, supply chain optimization practices are evolving as manufacturing firms navigate a complex landscape characterized by infrastructural constraints, regulatory challenges, and competitive market pressures. Kenyan manufacturers face electricity tariffs that are approximately 30% higher than those in Tanzania and Ethiopia, with frequent power interruptions forcing reliance on expensive backup generators, thereby increasing operational costs by an estimated 15-20% annually (Muiruri, 2021).

Transport and logistics present another significant hurdle. Transport costs from Mombasa Port to Nairobi average $1,800 per container—significantly higher than equivalent distances in competitive economies—while extended cargo dwell times at the port tie up working capital through substantial demurrage charges (KNBS, 2023). Raw material procurement lead times average 75 days for imported inputs and 12 days for locally sourced materials, creating cash flow constraints and production planning difficulties (Njagi & Kombo, 2022).

Kenya's manufacturing sector occupies a pivotal role in the nation's economic development aspirations, particularly within the framework of Vision 2030, which aims to transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens through a clean and secure environment. The food and beverage sector represents one of the largest and most dynamic manufacturing sub-sectors in Kenya, characterized by a mix of large multinational corporations, regional giants, and numerous small and medium-sized enterprises (SMEs). This sub-sector has shown relative resilience, with consistent growth driven by population expansion, urbanization, and rising disposable incomes. A significant strength lies in its high degree of local raw material sourcing, particularly for dairy, grains, and tea, which supports the agricultural sector and provides some insulation from international supply shocks (KNBS, 2023). Ongoing optimization efforts focus on cold chain logistics, packaging innovation, and brand development for both local and export markets.

2. Literature Review

2.1 Lean Theory

The Lean Theory was propounded and popularized by James P. Womack, Daniel T. Jones, and Daniel Roos following their seminal study of the Toyota Production System (TPS) in the 1990s (Womack, Jones, & Roos, 1990). The theory posits that the primary goal of any organization should be to maximize customer value while systematically minimizing waste (muda) in all its forms—including overproduction, waiting, unnecessary transport, over-processing, excess inventory, unnecessary motion, and defects. It advocates for a continuous improvement (kaizen) culture and a streamlined, pull-based flow of materials and information (Liker, 2004). In this study, Lean Theory primarily supports the variable of Cost Optimization. The theory's core principle of waste elimination directly aligns with the study's aim to examine how strategic cost-reduction initiatives impact the financial and operational performance of food and beverage manufacturing firms.

To manufacturing firms, productivity and profitability are the most important variables (Desai, 2008) as they help to measure the efficiency of production as well as the ratio of product output to production target. Leanness as a theory helps organizations to deliver goods and services faster and at lower costs to customers in the target markets in a streamlined procedure having eliminated wastes (Nave, 2002). It is also defined by Womack and Jones (1996) as a way of specifying value, developing value-creation strategies in an achievable sequence, following those activities with minimum disruption and performing them with the highest degree of efficiency.

2.3 Conceptual Framework

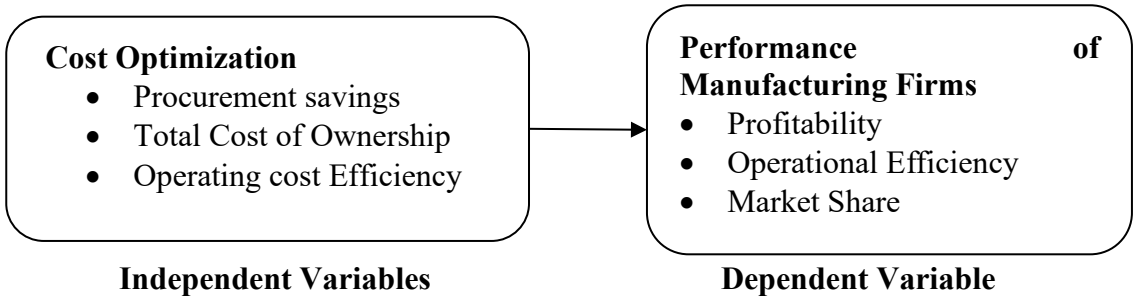


Figure 1: Conceptual Framework

3. Research Design and Methodology

The research adopted an explanatory research design. An explanatory research design seeks to establish the nature of the relationship between variables and explain why and how those relationships exist (Saunders et al., 2007). The target population for this study was 76 food and beverage manufacturing firms operating in Kiambu County (KAM, 2022). Two stage sampling was used by the study. Cluster random sampling was used to select 20 food and beverage manufacturing firms from the 76 in Kiambu county with the aid of Nassiuma Formula (2000). Purposive sampling was used in second stage to select two participants from the participating manufacturing firms. The sample size of the study was 40 respondents from 20 food and beverage manufacturing firms in Kiambu County, Kenya.

4. Results

4.1 Descriptive Analysis

Table 1: Cost Optimization

Statement	Mean	Std Deviation
Our firm clearly identified its needs and expectations from the supply market.	4.107	0.892
Our firm involves procurement professionals to bargain for a win-win approach.	4.250	0.775
Managers make a joint decision on the contract cost.	3.964	1.002
Our firm seeks advice from the procurement department on global sourcing.	4.071	0.823
Our firm has reached out to other local manufacturers for equity partnerships.	3.696	0.984
Procurement decisions are based on accurate and timely data.	4.143	0.862
The firm implements strategies to minimize procurement costs.	4.196	0.801
Procurement policies are regularly reviewed to ensure cost-effectiveness.	4.054	0.913
There is a focus on long-term supplier relationships to reduce costs.	4.018	0.903
Aggregate	**4.055**	**0.884**

The study examined nine statements under cost optimization. The results showed that the statement “Our firm involves procurement professionals to bargain for a win-win approach” recorded the highest mean of 4.250 with a standard deviation of 0.775, indicating strong

agreement among respondents. The statement "The firm implements strategies to minimize procurement costs" followed closely with a mean of 4.196 and a standard deviation of 0.801.

The statement "Procurement decisions are based on accurate and timely data" had a mean of 4.143 and a standard deviation of 0.862, while "Our firm clearly identified its needs and expectations from the supply market" recorded a mean of 4.107 with a standard deviation of 0.892. "Procurement policies are regularly reviewed to ensure cost-effectiveness" scored a mean of 4.054 and a standard deviation of 0.913.

"There is a focus on long-term supplier relationships to reduce costs" had a mean of 4.018 and a standard deviation of 0.906, whereas "Our firm seeks advice from the procurement department on global sourcing" recorded a mean of 4.071 with a standard deviation of 0.823. "Managers make a joint decision on the contract cost" recorded a mean of 3.964 with a standard deviation of 1.002. The lowest score was for the statement "Our firm has reached out to other local manufacturers for equity partnerships", which had a mean of 3.696 and a standard deviation of 0.984.

4.2 Correlation Analysis

The correlation between supply chain optimization and the performance of food and beverage manufacturing firms in Kenya, was examined using the Pearson product-moment correlation coefficient. There was positive correlation between the dependent and the set of independent ($r > .3$, $p < .001$ in all cases). The strength of the relationship between the independent variable [Cost optimization], and the dependent variable (performance of food and beverage manufacturing firms) was strong. This was shown by cost optimization ($r = 0.805$, large).

Table 2: Correlation Matrix

Study Variable		Cost Optimization
Cost Optimization	Pearsons Correlation	805
	Sig. (2-tailed)	.000
	N	24

**. Correlation is Significant at the 0.01 level (2-tailed)

4.3 Model Summary

Model 1 revealed that supply chain optimization and performance of manufacturing firms have a positive significant association (R = 0.805, R2 = 0.648). As the outcome, model 1's coefficient of determination (R^2) was 0.648, suggesting that the independent variables [cost optimization] is able to account for 64.8% of the variability in performance of food and beverage manufacturing firms in Kiambu County.

Table 3: Model Summary

Model	R	R^2	Adjusted R^2	*SE* of the Estimate
1	.805	.648	.647	.10412

a. Predictors: (Constant), Cost optimization,

4.4 Analysis of Variance

The ANOVA was used to determine whether the model was a good fit for the data. F calculated was 33.14 while the F critical was 2.499. The p value was 0.002. therefore, the model can be used to predict the influence of cost optimization, inventory maximization, lead time adjustment and supply chain integration on the performance of food and beverage manufacturing firms in Kiambu, County.

Table 4: Analysis of Variance

Model	Sum of Square	Df	Mean Square	F	Sig.
1. Regression	87.235	4	21.808	33.14	.002[a]
Residual	47.301	42	.658		
Total	134636	46			

a. Predictors: (constant), cost optimization,

4.5 Regression Coefficient

Table 5: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficient		
	B	Std Error	Beta	T	Sig
(Constant)	0.254	0.068		3.735	0.000
Cost optimization	0.311	0.081	0.312	3.840	0.003

a. Dependent Variable: Performance of Food and Beverage Manufacturing firms in Kiambu, County.

Regression results demonstrated that the independent variables have a statistically significant positive effect on the performance of food and beverage manufacturing firms in Kiambu, County, Kenya. Cost optimization had a positive significant effect on firm performance (β= 0.312, B= 0.311, t=3.840, p=0.003) implying there was an increase in 0.311 in firm performance with other variables constant.

5. Conclusion

The study found that procurement cost optimization remains a cornerstone of efficient supply chain management among food and beverage manufacturing firms. Procurement professionals play a decisive role in purchasing decisions. Firms benefit when needs are identified clearly and expenses are minimized through deliberate strategy. The approach has improved performance through stronger operational efficiency and higher profitability.

6. Recommendations

Procurement professionals should lead supplier negotiations in every firm. Managers should record the target price and the agreed price for each contract so that savings can be measured. Joint decisions by managers on contract cost received mixed agreement. A cost committee of finance and procurement managers should approve major contracts together.

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