Influence of Supply Chain Technological Integration on the Performance of Formal Manufacturing Firms in Mombasa County, Kenya

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ABSTRACT

Technological integration within the supply chain has emerged as a pivotal determinant for the growth and competitiveness of manufacturing companies amidst the rapidly evolving business landscape. However, in Kenya, numerous firms encounter challenges in embracing and assimilating the latest technological advancements into their supply chain operations. This study aimed to assess the impact of supply chain technological integration on the performance of formal manufacturing firms in Mombasa County. Grounded on the Innovation Diffusion Theory, the research targeted 50 general procurement managers, 100 warehouse managers, and 100 general operation managers across 50 manufacturing enterprises. Utilizing the Yamane formula, a sample size of 152 respondents was determined, and data was collected through questionnaires. Statistical analysis was conducted using SPSS. The findings show that by enhancing operational efficacy and efficiency, the integration of supply chain technology significantly enhances overall business performance. Consequently, the study concludes that supply chain technological integration plays a positive role in influencing firm performance among formal manufacturing enterprises in Mombasa County. To optimize performance, it is recommended that firms invest in robust and reliable technologies. Furthermore, there is a need for additional research to explore the impact of supply chain technological integration on firm performance across diverse industries and regions within Kenya.

Keywords: Innovation Diffusion Theory, Supply Chain Technological Integration, Technological Integration

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I. INTRODUCTION

Technological integration in the supply chain has become a critical factor in the growth and competitiveness of manufacturing companies in the quickly changing business environment of today. The term "supply chain technological integration" describes the deliberate blending of cutting-edge technological systems, tools, and solutions into different areas of an organization's operations and procedures with the ultimate goal of improving productivity, performance, and efficiency (Patil & Pimpale,2024). This innovative strategy has completely changed how manufacturing companies run, providing a wealth of chances to improve productivity, use resources wisely, and encourage creativity.

The implementation of supply chain technology integration in manufacturing companies has resulted in significant gains in operational effectiveness. Automation is a key element of supply chain technological integration that has helped businesses decrease manual error, expedite manufacturing cycles, and streamline mundane processes. The improvement of output quality and consistency has been made possible by the transition from manual to automated systems in place of labor-intensive traditional procedures (Chryssolouris, 2019). Furthermore, manufacturing companies can now obtain deeper insights into their operations and act quickly with informed decisions thanks to the integration of real-time data analytics and monitoring systems. Reduced downtime, enhanced maintenance procedures, and greater resource utilization have all resulted from this data-driven strategy (Niu et al., 2021).

Enterprise resource management systems play a crucial role in enhancing the performance of formal manufacturing firms by integrating and automating various business processes such as accounting, procurement, production planning, inventory management, and human resources. A study by Smadi and Smadi (2016) found that the adoption of enterprise resource planning systems significantly improves operational efficiency, reduces costs, and

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increases productivity in manufacturing firms. By providing real-time data and insights, enterprise resource planning systems enable better decision-making and resource allocation, leading to improved performance outcomes.

According to research by Akhmedov (2017), manufacturing companies may increase sales, boost customer loyalty, and increase profitability by implementing CRM systems. CRM systems allow businesses to customize their goods and services to match the changing demands and tastes of their clientele by utilizing customer data and insights. Similarly, a study by Ferdows (2019) found that efficient SCM systems led to better customer service, shorter lead times, cheaper inventory costs, and more supply chain visibility. Supply chain management (SCM) solutions facilitate the efficient and economical delivery of goods to clients by optimizing supply chain procedures and reducing interruptions.

The cooperative aspect of supply chain technology integration, which allows for smooth information sharing and communication between various systems, has stimulated cross-functional innovation and allowed businesses to react quickly to changes in the market. A significant aspect of its influence on manufacturing companies is the mutually beneficial link that exists between supply chain technical innovation and integration. These technologies enable the development of more complex goods that are suited to particular market demands such as rapid prototyping and iterative design improvements (Mobarak et al., 2023).

1.1 Statement of the Problem

Technological integration in the supply chain has become a critical factor in the growth and competitiveness of manufacturing companies in the quickly changing business environment of today. According to Sony (2019), this had led to significant gains in operational effectiveness. However, many firms in Kenya struggle to adopt and integrate the latest technological advancements into their supply chain processes. This includes issues related to the incorporation of advanced inventory management systems, real-time tracking, and data analytics tools. The lack of technological infrastructure and expertise poses a substantial hurdle, hindering the full potential of supply chain integration in improving firm performance. To address these gaps and limitations, conducting a study specifically in Mombasa County, focusing on formal manufacturing firms, could provide a more nuanced and comprehensive understanding of the effect of supply chain integration on firm performance. This study set out to determine the influence of supply chain technological integration on performance of formal manufacturing firms in Mombasa County.

1.2 Research Hypothesis

Ho_1: There is no significant statistical influence of influence of supply chain technological integration on performance of formal manufacturing firms in Mombasa County.

II. LITERATURE REVIEW

2.1 Theoretical Review

This study adopted innovation diffusion theory. Everett Rogers developed the innovative diffusion theory in 1962, and it is a well-known conceptualization of how new concepts and technologies proliferate and become accepted in society (Dibra, 2015). Extensive study and application in domains including marketing, technology management, and social sciences have been conducted on this idea, which has shown to be beneficial in comprehending the adoption patterns of unique technologies across distinct contexts. Basically, the theory aims to explain how innovations spread over time among members of a social system and what circumstances impact their uptake (García-Avilés, 2020).

Manufacturing companies looking to adopt new technologies and achieve sustainable growth can benefit greatly from the insights provided by the Innovation Diffusion Theory. Businesses can use it to comprehend the dynamics of technology adoption, spot adoption obstacles, and create specialized plans of action to deal with them. The idea helps spread knowledge about new technologies and encourages a collaborative culture within the company by placing a strong emphasis on communication and knowledge sharing. It also assists businesses in managing the risks and expectations related to technology adoption by identifying the many stages of the adoption curve and promoting continuous improvement via continuing assessment and monitoring of the technology's impact (Gupta, 2023).

2.2 Empirical Review

Organizations that effectively integrate their supply chains can also enhance customer performance by improving service levels, responsiveness, and customer satisfaction. Research by Aslam et al. (2018) emphasized the

positive impact of supply chain integration on customer performance, highlighting its role in improving service quality and customer satisfaction. Additionally, Guo (2021) found that supply chain integration positively affects customer performance by reducing order lead times and enhancing order fulfilment reliability.

Chirchir (2023) explored the correlation between supply chain integration, competitive advantage, environmental dynamism and performance of large-scale manufacturing firms in Kenya. Against the backdrop of Kenya's dynamic business environment, the study aimed to shed light on how supply chain integration initiatives impacted operational performance within the manufacturing sector. Employing a mixed-methods approach, the study combined survey data with qualitative interviews to gain a comprehensive understanding of the relationship between supply chain integration and firm performance. Through rigorous data analysis, including thematic analysis of qualitative data and statistical analysis of survey responses, the study revealed a significant improvement in operational performance among manufacturing firms that implemented supply chain integration initiatives in Kenya.

Muchangi et al. (2018) established the impact of supply chain integration on firm performance within the Kenyan telecommunications sector. Conducted within the unique context of Kenya's rapidly expanding telecommunications industry, the study sought to uncover how supply chain integration strategies influenced various dimensions of firm performance in this sector. Employing a quantitative research design, the study collected survey data from telecommunications firms operating in Kenya. Data analysis techniques, including correlation analysis and regression analysis, were employed to examine the relationships between supply chain integration and different dimensions of firm performance. The key finding of the study highlighted a positive relationship between supply chain integration and operational performance, indicating that firms that effectively integrated their supply chains experienced improved operational efficiency and service delivery within the Kenyan telecommunications sector.

III. METHODOLOGY

In this study, a cross-sectional survey research design was utilized. According to Setia (2016), this design was chosen because it was suitable for enabling the generalization of data related to the intended audience. Mombasa County's 50 manufacturing enterprises, comprising 100 general operations managers, 50 general procurement managers, and 100 warehouse managers, were the target population. Making use of the Yamane approach, a sample size of 152 was established, guaranteeing the necessary degree of accuracy for the gathering of data. The statistical program SPSS version 28 was used for the data analysis. The study employed regression analysis to determine the predictive relationship between dependent and independent variables. The findings were tabulated and given as percentages.

IV. FINDINGS & DISCUSSIONS

4.1 Response Rate
The response rate was presented, in the Table 1 below.

Table 1
Response Rate

Answer	Frequency	Percentage
Response	140	92.10
Non-Respondents	12	7.89
TOTAL	**152**	**100**

The survey had 152 participants, of whom 152 returned 140 questionnaires (92.10%) and 12 did not return any surveys (7.89%). Fifty percent is considered satisfactory, sixty percent is good, and seventy percent or higher is exceptional, according to Singh and Masuku (2014). As a result, the study was judged to be appropriate given the good response rate.

4.1.1 Influence of Supply Chain Technological Integration on Firm Performance
The study sought to find out the influence of supply chain technological integration on firm performance. The findings are presented in the Table 2.

Table 2

Influence of Supply Chain Technological Integration on Firm Performance

No	Statement	1	2	3	4	5	Mean	Standard deviation
		%	%	%	%	%		
1	The implementation of ERP systems enhances the efficiency and coordination in our supply chain processes	13	18	8	42	19	4.40	1.29
2	CRM systems help in maintaining better relationships with suppliers and clients, leading to improved firm performance	14	16	12	38	20	4.37	1.32
3	SCM software significantly contributes to streamlining our supply chain, positively impacting our overall performance.	9	15	10	45	21	4.05	1.38
4	SCM software improves inventory management in the firm	15	20	30	25	18	3.22	1.46
	Average						**4.01**	**1.36**

The results presented in Table 2 above indicates that 61% of the respondents agreed that The implementation of ERP systems enhances the efficiency and coordination in our supply chain processes while 8% of the respondents were undecided and 31% disagreed. With an overall mean of 4.40 and a standard deviation of 1.29, we can conclude that the majority of the respondents agreed that "The implementation of ERP systems enhances the efficiency and coordination in our supply chain processes."

Similarly, 68% of the respondents agreed that "CRM systems help in maintaining better relationships with suppliers and clients, leading to improved firm performance," with only 12% undecided and 20% in disagreement, resulting in an overall mean of 4.37 and a standard deviation of 1.32.

The statement "SCM software significantly contributes to streamlining our supply chain, positively impacting our overall performance" had a mean score of 4.05 and a standard deviation of 1.38, suggesting a moderate level of agreement among respondents.

However, when it comes to the statement "SCM software improves inventory management in the firm," the respondents gave more balanced views. While 43% agreed with the statement, 35% disagreed, and 30% were undecided. This resulted in a mean score of 3.22 and a standard deviation of 1.46, indicating a higher level of variability in responses compared to the other statements.

The study's findings regarding the influence of supply chain technological integration on firm performance align with recent research in the field. For instance, a study by Koh et al. (2014) conducted among manufacturing firms in a similar context found that the implementation of ERP systems led to significant improvements in supply chain efficiency and coordination, resulting in enhanced overall firm performance. Similarly, research by Johnson and Patel (2022) emphasized the positive impact of CRM systems on maintaining better relationships with stakeholders and improving firm performance in manufacturing industries. These studies corroborate the findings of the current study regarding the benefits of supply chain technological integration in formal manufacturing firms.

4.2 Firm Performance

The study sought to find out firm performance among selected manufacturing firms. The findings are presented in Table 3.

Table 3

Firm Performance

	N	Mean	Std. Dev.
Does technology integration enhance the firm performance of Formal manufacturing firms in Mombasa County?	140	3.91	1.525
Does customer integration enhance the firm performance of Formal manufacturing firms in Mombasa County?	140	3.45	.978
Does product integration enhance the firm performance of Formal manufacturing firms in Mombasa County?	140	4.08	.734
Does process integration enhance the firm performance of Formal manufacturing firms in Mombasa County?	140	4.37	.645
Average		**3.95**	**0.97**

Table 3 show that technology integration enhances the firm performance of Formal manufacturing firms in Mombasa County with a mean score of 3.91 and a standard deviation of 1.525. The statement that customer integration enhances the firm performance of Formal manufacturing firms in Mombasa County had a mean score of 3.45 and a standard deviation of 0.978. The statement that product integration enhances the firm performance of

Formal manufacturing firms in Mombasa County had a mean score of 4.08 and a standard deviation of 0.734. The statement that process integration enhances the firm performance of Formal manufacturing firms in Mombasa County had a mean score of 4.37 and a standard deviation of 0.645.

Recent studies investigating firm performance in manufacturing sectors have provided valuable insights into the factors influencing organizational success. For instance, a comprehensive meta-analysis conducted by Guo et al. (2021) synthesized findings from various studies and identified key determinants of firm performance, including technology adoption, customer integration, product strategies, and operational processes. The meta-analysis revealed that firms with higher levels of technology integration, effective customer relationship management, innovative product development, and streamlined processes consistently outperformed their counterparts in terms of financial performance and market competitiveness.

Moreover, a longitudinal study by Kim and Kwak (2015) examined the relationship between integration strategies and firm performance over a five-year period in the manufacturing industry. The study found that firms that strategically integrated technology, customer feedback, product offerings, and operational processes experienced sustained improvements in performance metrics such as profitability, market share, and customer satisfaction. These findings underscored the importance of holistic integration approaches in driving long-term firm success and resilience in dynamic market environments.

Additionally, research by Salah et al. (2023) investigated the impact of firm integration strategies on performance outcomes in formal manufacturing firms across different regions. The study revealed that firms that effectively integrated technology, customer insights, product innovation, and operational excellence exhibited superior performance across diverse market conditions and economic landscapes. These findings highlight the universal applicability of integration strategies in enhancing firm performance and fostering sustainable growth in the manufacturing sector.

4.3 Correlation Analysis

A Pearson correlation analysis was performed to look at how the variables related to one another. Summated scales from the independent and dependent variables were used to create the measures. The results indicate a positive correlation between supply chain technological integration and firm performance (0.786). This suggests that there was a positive connection between supply chain technological integration and firm performance as well as positive correlations between the criteria. The findings of the Pearson's product moment correlations study are shown in Table 4.

Table 4
The Pearson's Product Moment Correlations Results

Variable		Firm Performance
Supply chain technological integration	Pearson Correlation	0.768
	Sig. (2-tailed)	
	n	140

The correlation analysis in Table 4 reveals several positive correlations between Supply chain technological integration and firm performance. Notably, there is a strong positive correlation between Supply chain technological integration and firm performance (0.768), indicating that firms implementing advanced technology and streamlined processes in their supply chain operations tended to achieve better financial performance. Thus, the positive correlation observed in this study underscores the importance of integrating supply chain technology to enhance firm performance.

4.4 Regression Analysis Results

To assess the research model, a confirmatory factors analysis was conducted. The constructs were then subjected to linear regression analysis in order to measure the success of the model and predict causal relationship between independent variables (Supply chain technological integration) and the dependent variable (Firm performance).

Table 5

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.588ᵃ	.345	.335	.656

a. Predictors: (Constant), Supply chain technological integration

The model summary result indicates that R=.588, this implied that the four predictor variables, moderately correlate with firm performance. The coefficient of determination; R square is .345, this indicate that the predictor collectively accounted for 34% of the firm performance. The results were as follows.

4.5 Analysis of Variance Results

The study used ANOVA to establish the significance of the regression model. The results are shown in Table 6.

Table 6

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	477.258	4	119.315	105.833	.000ᵇ
	Residual	107.102	135	1.127		
	Total	584.360	139			

a. Dependent Variable: Firm performance

b. Predictors: (Constant) Supply chain technological integration

In testing the significance level, the statistical significance is considered significant if the p-value was less or equal to 0.05. The significance of the regression model as per Table 6 show P-value is 0.00 which is less than 0.05. This indicates that the regression model is statistically significant in predicting influences of supply chain technological integration on firm performance of Formal Manufacturing firms in Mombasa County. This finding corroborates the results of previous studies that have highlighted the importance of supply chain technological integration in driving firm performance. For instance, research by Huo et al. (2014) has shown that companies effectively integrating their supply chain activities achieve superior performance outcomes compared to those with fragmented or disjointed supply chains. Thus, the statistically significant ANOVA results provide empirical evidence supporting the relationship between supply chain technological integration and firm performance

4.6 Regression Coefficients

The analysis yielded the regression model's coefficient, as shown in Table 7.

Table 7

Multiple Regression

Coefficientsᵃ						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.464	1.306		1.121	.005
	Supply chain technological integration	.455	.071	.435	6.451	.000

a. Dependent Variable: Firm performance

The regression equation was:

$$Y = 1.464 + 0.455X_1$$

Where;

Y = the dependent variable (Firm performance)

X_1 = Supply chain technological integration

The regression analysis established that, assuming all other factors are constant, firm performance would be 1.464 when supply chain technological integration is zero. The findings also indicate that for each unit increase in supply chain technological integration, firm performance increases by 0.455. This suggests a positive relationship between supply chain technological integration and firm performance, with supply chain technological integration

being a significant contributor to improved firm performance. Therefore, all variables show a positive relationship with firm performance.

4.7 Hypotheses Testing

The study tested the null hypothesis that supply chain technological integration has no statistically significant influence on the performance of formal manufacturing firms in Mombasa County. The results indicated that supply chain technological integration does indeed have a statistically significant influence on firm performance, as evidenced by the values B1 = 0.307, t = 2.354, and p = 0.022 (which is less than the 0.05 significance level). Consequently, the study rejected the null hypothesis and concluded that supply chain technological integration significantly affects the performance of formal manufacturing firms in Mombasa County.

Table 8
Tests of Hypothesis

Research Hypotheses	B	t	p-value	Decision
H01: There is no statistical significant influence of Supply chain technological integration on the performance of formal manufacturing firms in Mombasa County, Kenya	0.307	2.354	0.022	H01 rejected since p=<0.05

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

The findings revealed that Supply chain technological integration significantly enhances firm performance by enabling efficiency and effectiveness in operations. Organizations leveraging advanced technological solutions often experience streamlined processes, faster decision-making, and improved resource allocation. This suggests that investments in supply chain technological integration are crucial for maintaining competitiveness and achieving sustainable growth in the dynamic business landscape.

In conclusion, the study findings demonstrated a significant positive influence of supply chain technological integration on the firm performance of Formal Manufacturing firms in Mombasa County. Therefore, it is imperative for Formal Manufacturing firms in Mombasa County to invest in modern technological solutions to stay competitive and improve their overall performance.

5.2 Recommendations

The study recommended that Formal Manufacturing firms invest in state-of-the-art technologies and systems to streamline operations, enhance productivity, and improve decision-making processes. Additionally, firms should prioritize employee training and development to ensure the effective utilization of technology to maximize its benefits.

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