

Supply Chain Digitization and Procurement Performance Of Farmers' Cooperative Societies in Kiambu County, Kenya

Simon Chepkwony

Student, School of Business and Entrepreneurship
Jomo Kenyatta University of Agriculture and Technology, Kenya

Duncan Nyaberi

Lecturer, School of Business and Entrepreneurship
Jomo Kenyatta University of Agriculture and Technology, Kenya

Abstract: Supply chain digitization within the supply chain agility optimizes the procurement processes which drives better performance in terms of value delivery. However, farmers' cooperative societies in Kenya are yet to maintain stable procurement performance. Therefore, the current study assessed the effect of supply chain digitization on the procurement performance of farmers' cooperative societies in Kiambu County. The study was anchored on complex adaptive systems theory. The descriptive research design was employed. The present study's target population was the 35 farmers' cooperative societies in Kiambu County. These cooperative societies were the unit of analysis. The unit of observation was the 201 procurement committee members and the 35 general managers. Stratified random sampling was applied to obtain sample of 93 respondents. Questionnaires were utilized in data collection. Descriptive and inferential statistical methods were employed in data analysis. Under descriptive analysis, means, percentages and standard deviations were used while inferential analysis employed Pearson's correlation and multiple regression analysis. Statistical Packages for Social Sciences (SPSS) will aided data analysis. Tables were used in presenting the findings. Descriptive findings established that supply chain digitization affect the procurement performance. The correlation analysis revealed a significant relationship ($r=0.707^{**}$, $p=0.000$), between supply chain digitization and procurement performance. Consequently, supply chain digitization plays a crucial role in influencing the procurement performance of farmers' cooperative societies. Regression analysis further indicated that 49.9% of the variation in procurement performance was attributed to supply chain digitization, underscoring its significant effect. It is recommended that farmers' cooperative societies should prioritize standardizing information-sharing processes among members to enhance coordination and decision-making. Additionally, fostering partnerships with relevant stakeholders can create synergies that support the adoption of digital tools, leading to improved procurement performance.

I. Introduction

Supply chain digitization in the context of supply chain agility encompasses the integration of digital technologies and data-driven processes to enhance the efficiency, responsiveness, and flexibility of supply chain operations (Alabdali & Salam, 2022). Digitizing supply chains significantly enhances process integration and brings delivery platforms into a unified system, which is essential for boosting operational efficiency and ensuring seamless coordination across various supply chain functions. As such, companies can better integrate different stages of the supply chain, thereby reducing delays and minimizing errors (Du, Hu, & Vakil, 2021). Additionally, the unification of delivery platforms enables a more streamlined and coordinated product distribution approach. This improvement leads to higher customer satisfaction and strengthens the company's competitive position in the market (Monczka et al., 2020). This holistic approach to digitization not only improves overall supply chain performance but also increases agility and responsiveness in an ever-changing business environment.

Supply chains of farmers' cooperative societies in Kenya encounter coordination challenges and increased operational costs (Mogere, 2021). They continue to grapple with sourcing inefficiencies and elevated procurement expenses. Moreover, the cooperative societies operate in the face of transportation hurdles and slow adoption of digitized

processes. Ultimately, these inefficiencies impede the cooperatives' procurement performance and the ability to consistently meet the members' needs (Matuga, 2022). The inadequate procurement performance in prolonged cycle times, where delays in acquiring essential supplies hinder timely and efficient operations. A study by the International Livestock Research Institute (ILRI, 2023) reveals that approximately 70% of Kenyan cooperatives face supply chain inefficiencies. Additionally, the Kenya Institute for Public Policy Research and Analysis (KIPPRA, 2023) report indicated that 60% of farmers' cooperatives struggle with logistical problems, such as unreliable transport, which result in delays and elevated costs.

Furthermore, a survey by the Agricultural Sector Development Support Program (ASDSP, 2022) indicates that cooperatives operate at under 50% capacity on average because of these coordination and logistical issues. Despite the apparent challenges among farmers' cooperative societies, past research works have paid little attention to the relationship between supply chain digitization and procurement performance. Chumba, Bonuke, and Kirui (2022) researched on the advanced supply chain planning systems, supplier relationship, supply chain agility and firm supply chain performance among selected manufacturing firms in Nairobi County. It was established that supply chain agility influences supply chain performance. Contextually, the study focused on manufacturing firms, which operate differently from cooperative societies. Conceptually, supply chain automation, integrated procurement systems, and real-time tracking were inadequately addressed. Kinuthia and Amuhaya (2023) examined the sourcing strategies and organizational performance of Muranga Co-operative creameries. In a bid to fill the existing gaps, the current study assessed the effect of supply chain digitization on the procurement performance of farmers' cooperative societies in Kiambu County.

II. Objective of the Study

The objective of the study was to assess the effect of supply chain digitization on procurement performance of farmers' cooperative societies in Kiambu County.

III. Literature Review

Supply chain digitization make different tools of supply chain work together to optimize integration of processes (Hidalgo, Quiñones-Ruiz, Birkenberg, Daum, Bosch, Hirsch, & Birner, 2023). The supply chain digitization incorporate digital technology into different supply chain activities. Data on inventory location helps to improve picking paths and allows increased efficiency. Bigliardi, Filippelli, Petroni, and Tagliente (2022) contend that Supply chain digitization incorporates process integration and real time inventory aspects. It brings real-time visibility into the supply chain, which enhance minimization of lead times and supply chain velocity improvement. Through digitization, organizations integrate fulfillment software into electronic commerce, which enable them to automatically get orders and ready them for fulfillment (Mudda, Giddi, & Murthy, 2017). The management of real-time inventory guide updating inventory levels and movements in real-time.

Process integration involves seamless integration of various processes and systems within the supply chain to enable efficient and effective information flow, collaboration, and coordination among different stakeholders (Hidalgo *et al.*, 2023). It synchronizes demand and supply information by integrating sales data, production schedules, and inventory levels. This leads to cost savings, improved cash flow, and a more efficient supply chain. Integrated processes make supply chains more agile and adaptable to changing market conditions and customer demands (Bigliardi *et al.*, 2022). The real-time data and insights help to adjust distribution strategies based on changing demand patterns. This agility helps organizations meet customer expectations and minimize disruptions. Process integration also provide valuable insights into market trends and patterns. These insights lead to data-driven decision-making that allow firms to identify and seize optimization opportunities (Panetto, Lezoche, Hormazabal, Diaz, & Kacprzyk, 2020). Supply chain automation streamlines tasks, reduces errors, and lowers costs using robotics and other technologies. Integrated procurement systems consolidate processes into a unified digital platform, enabling efficient management of orders, supplier relationships, contracts, and spend analysis. These systems enhance real-time data sharing, transparency, agility, and decision-making, resulting in a more resilient and responsive supply chain.

Complex adaptive systems (CAS) theory, as cited by Tewari and Wilding (2022), conceptualizes organizations as dynamic networks of interconnected elements that interact and adapt to their environment. In this framework, agents like suppliers, manufacturers, and customers act based on knowledge, leading to emergent behaviors that significantly impact the system. CAS emphasizes flexibility, learning, and adaptability, shaped by unpredictable external and internal influences (Feng, Cai, Dai, Bu, Zhang, Zheng, & Lu, 2024). This perspective encourages organizations to embrace complexity, foster collaboration, and develop strategies to respond effectively to market changes. The CAS approach offers insights into the dynamic nature and co-evolution of supply networks by highlighting the interplay between

systems and complexity (Feng et al., 2024). It recognizes that supply networks are evolving systems where interconnected agents influence and adapt to each other in response to environmental changes. Additionally, the CAS framework promotes a focus on learning and innovation, enabling continuous adaptation to new challenges and opportunities.

Ultimately, CAS theory underscores that supply chains are dynamic networks of agents that evolve in response to changing environments (Sheth & Sinfield, 2024). CAS highlights the significance of information flow and communication among interconnected agents. As supply chains become increasingly digitized, they leverage technologies that facilitate real-time data sharing and enhance visibility across the network (Luevano & Barrientos, 2022). This evolution stems from the CAS principle of learning through interactions; as organizations gather and analyze data, they can better understand patterns and relationships within the supply chain. Supply chain digitization enhances procurement performance by providing real-time visibility and data analytics, which facilitate informed decision-making and optimized purchasing processes. Figure 1 illustrates the conceptual framework illustrating the expected relationship between supply chain digitization and procurement performance.

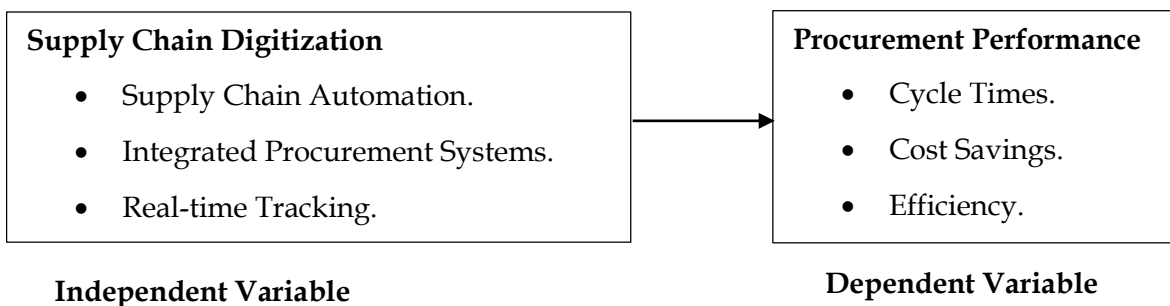


Figure 1: Conceptual Framework

The empirical studies related to supply chain digitization and procurement performance of farmers' cooperative societies were reviewed. Shahadat, Chowdhury, Nathan, and Fekete-Farkas (2023) sought to assess the effect of digital technologies on competitive advantage and supply chain performance. They involved 150 supply chain managers of the ready-made garments firms in Bangladesh. According to the research findings, the supply chain capabilities of the firms are determined by use of digital technologies. The digital supply chain influence the firm's competitive advantage, which affect the overall supply chain performance. In conclusion, the study established that the integration of digital technology contribute to supply chain agility that affect the firms' supply chain performance. Mwangi, and Wambugu (2015) undertook an analysis of determinants of market channel choice among smallholder dairy farmers in Lower Central Kenya. The research employed Multistage sampling technique and multinomial logit regression model (MNL). Findings indicated that milk output, information access and costs of transaction determine the choice of marketing channel. The above determinants significantly affect the performance. Berut (2020) researched on the influence of supply chain collaboration on performance of dairy processing firms in Kenya. The study employed a mixed research design that incorporated both qualitative and quantitative methods. Qualitative research was used to analyze data from interviews, while quantitative research was applied to the data collected through questionnaires. The study targeted 10,488 fresh milk suppliers and 13,906 customers of processed milk products, with a sample size of 384 suppliers and 384 customers. Findings revealed that supply chain information sharing, decision synchronization, incentive alignment and SC teamwork influence dairy firms' performance. The supply chain collaboration determinants accounted for 40.2% variation in dairy processing firms' performance. Omwoyo, Wanyoike, and Mbeche (2019) assessed the influence of lean procurement initiatives on supply chain agility in manufacturing firms in Nakuru County. The research focused on 34 licensed manufacturing firms in Nakuru County and sought responses from 96 procurement, finance, and operations managers. Data was gathered using a structured questionnaire. The findings indicated that the surveyed manufacturing firms adopted lean procurement initiatives to varying degrees, and it was determined that lean procurement significantly enhances supply chain agility.

Research gaps were identified from the reviewed empirical studies, which the current study sought to fill. Shahadat *et al* (2023) established the effect of digital technologies on the competitive advantage and the resultant effect on real-made garment firms' supply chain performance. The current study assessed the direct effect of supply chain digitization on procurement performance. It was specifically focused on process integration and lead time aspects of digitization and

how they influence the farmers' cooperative societies. Mwangi and Wambugu (2023) found that strategies such as milk collection schedules, ICT optimization, and milk pricing positively and significantly affect performance. Although the study underscores the benefits of these strategies, it failed to address the crucial aspect of agility, which is essential for enhancing adaptability and resilience in dynamic environments. Berut (2020) assessed the effect of supply chain collaboration on performance in general. He emphasized supply chain information sharing and decision synchronization. The current study looks into procurement performance of farmers' cooperative societies. It addresses the supply chain digitization, under which supply chain information sharing and synchronization are adequately discussed.

IV. Research Methodology

The current study aimed to describe the determinants of supply chain digitization and its effect of procurement performance. Since descriptive research design takes a systematic and structured approach in acquiring information on the issue of interest, it fitted the study and was therefore utilized. The present study's target population is the 35 farmers' cooperative societies in Kiambu County. These cooperative societies were the unit of analysis. The unit of observation was the 201 procurement committee members and 35 general managers of the farmers' cooperative societies, thus the total number was 236 respondents. Stratified random sampling was applied. Nasiuma's (2001) sample determination formula was employed as shown:

Sample Determination for Procurement Committee Members

$$n = \frac{[NC^2]}{[C^2 + (N-1)e^2]}$$

Where;

n=Sample size

N=Population size

C=Coefficient of variation which is 50%

e= Error margin which is 0.05

The sample size will be determined as follows:

$$\begin{aligned} n &= \frac{[201 \times 0.5^2]}{[0.5^2 + (201-1)0.05^2]} \\ &= 50.25 / 0.25 + 0.5 \\ &= 50.25 / 0.75 \\ &= 67 \end{aligned}$$

Sample Determination for Managers

$$n = \frac{[NC^2]}{[C^2 + (N-1)e^2]}$$

Where;

n=Sample size

N=Population size

C=Coefficient of variation which is 50%

e= Error margin which is 0.05

The sample size will be determined as follows:

$$\begin{aligned} n &= \frac{[35 \times 0.5^2]}{[0.5^2 + (35-1)0.05^2]} \\ &= 8.75 / 0.25 + 0.085 \\ &= 8.75 / 0.335 \\ &= 26.119 \approx 26 \end{aligned}$$

Total sample= 67+26=93

Therefore, the sample size was 93 respondents, comprising the procurement committee members and the general managers of farmers of cooperative societies. The sample was picked from the population using random numbers.

Questionnaires were utilized in data collection. In data analysis, descriptive and inferential statistical methods were employed. Under descriptive analysis, means, percentages and standard deviations were used while inferential analysis employed Pearson's correlation and multiple regression analysis. Statistical Packages for Social Sciences (SPSS) aided data analysis. Tables were used in presenting the findings. The following regression model was applied:

$$Y = \beta_0 + \beta_1 X_1 + \epsilon$$

Where;
 Y Procurement Performance
 β_0 Constant
 X_1 Supply Chain Digitization
 β_1 Beta Coefficient
 ε Error of Margin

V. Findings and Discussions

The sample size was 93 procurement committee members and general managers of the farmers' cooperative societies. Therefore, 93 questionnaires were prepared and distributed. 67 of these were fully filled and returned. This was 72% response rate that was adequate for the study.

5.1 Descriptive Findings and Discussions

The study sought to determine the effect of supply chain digitization on procurement performance. The findings are presented in Table 1:

Table 1: Effect of Supply Chain Digitization on Procurement Performance

	n	SA 5	A 4	N 3	D 2	SD 1	Mean	Std. Dev.	
	Percentage (%)								
Digitized supply chain activities reduce operational costs.	67	55.2	20.9	13.4	6	4.5	4.16	1.149	
Digital technologies streamline supply chain processes.	67	37.2	25.4	19.4	11.9	6	3.76	1.244	
We adapt collaborative approach in our supply chain activities.	67	32.8	23.9	23.9	7.5	7.5	3.63	1.265	
Digital platforms avail real-time data for decision-making.	67	29.9	50.7	10.4	7.5	1.5	4.00	0.921	
We regularly analyze the accuracy and effectiveness of real-time inventory systems.	67	47.8	38.8	7.5	1.5	4.5	4.24	0.986	

The descriptive findings established that 55.2% of the respondents strongly agreed and 20.9% agreed thus 76.1% at least agreed (Mean=4.16; Std. Dev.=1.149) that digitized supply chain activities reduce operational costs. Digitized supply chain activities enhance efficiency and enable real-time data access. These lower operational costs and improve overall productivity in farmers' cooperative societies. 37.2% of strongly agreed that digital technologies streamline supply chain processes. Digital technologies optimize supply chain processes by automating functions like inventory tracking, order management, and data analysis, minimizing manual errors and speeding up operations. This heightened efficiency provides greater visibility into supply chain activities, facilitating informed decision-making and ultimately improving procurement performance through better cost management, quicker response times, and enhanced alignment with market demands. However, the respondents were indifferent (Mean=3.63; Std. Dev.=1.265) that they adapt collaborative approach in their supply chain activities. The findings revealed that 80.6% of the respondents agreed (Mean=4.00; Std. Dev.=0.921) that digital platforms avail real-time data for decision-making. With access to up-to-date information on inventory levels, supplier performance, and market conditions, procurement teams can quickly respond to changes, optimize purchasing strategies, reduce costs, and ensure that they align closely with customer needs and market demands. Moreover, 47.8% of the respondents strongly agreed and 38.8% agreed thus 86.6% at least agreed (Mean=4.24; Std. Dev.=0.986) that farmers' cooperative societies regularly analyze the accuracy and effectiveness of real-time inventory systems. This enables procurement teams to make informed decisions regarding purchasing, reduce the risk of stock outs or overstock situations, and optimize reorder points. Consequently, these systems lead to improved cost management, enhanced supplier relationships, and increased responsiveness to market demands, all of which enhance overall procurement efficiency. The findings are consistent with Shahadat et al. (2023), which explored the impact of digital technologies on competitive advantage and supply chain performance. The research indicated that a digital supply chain enhances a firm's competitive edge, thereby influencing the overall performance of ready-made garment companies. In this study, it was revealed that supply chain digitization also affects farmers' cooperative societies.

Table 2: Procurement Performance of Farmers' Cooperative Societies

	n	SA 5	A 4	N 3	D 2	SD 1	Mean	Std. Dev.
Percentage (%)								
We are able to consistently reduce the procurement cycle times.	67	53.7	28.4	11.9	4.5	1.5	4.28	0.950
We collaborate closely with suppliers to streamline to reduce lead times.	67	34.3	49.3	10.4	0	6	4.06	0.998
Our procurement activities are efficient.	67	22.4	41.8	32.8	3	0	3.84	0.809
Automated procurement enhance cost savings.	67	32.8	46.3	14.9	4.5	1.5	4.04	0.895
Our procurement practices prioritize streamlining processes to save resources.	67	41.8	38.8	10.4	9	0	4.13	0.936

According to the findings, 53.7% of the respondents strongly agreed and 28.4% also agreed thus 82.1% at least agreed (Mean=4.28; Std. Dev.=0.950) that they are able to consistently reduce the procurement cycle times. Additionally, 83.6% of the respondents agreed (Mean=4.06; Std. Dev.=0.998) that their respective farmers' cooperative societies collaborate closely with suppliers to streamline to reduce lead times. 64.2% of the respondents agreed that their procurement activities are efficient. Furthermore, 79.1% of the respondents agreed (Mean=4.04; Std. Dev.=0.895) that automated procurement enhance cost savings. 80.6% of the respondents agreed (Mean=4.13; Std. Dev.=0.936) that procurement practices prioritize streamlining processes to save resources. Overall, the findings indicate that digitization streamlines processes and enhances data visibility, enabling real-time inventory tracking for quicker decision-making and reduced operational costs.

5.2 Inferential Findings and Discussions

The correlation and regression analysis methods were employed to examine the relationship between supply chain digitization and procurement performance.

5.2.1 Correlation Analysis Findings and Discussions

The correlation analysis was conducted to establish the strength and direction of relationship between supply chain digitization and procurement performance. The findings are presented in Table 3:

Table 3: Correlation between Supply Chain Digitization and Procurement Performance

		Procurement Performance
Supply Chain Digitization	Pearson Correlation	.707**
	Sig. (2-tailed)	.000
	N	67

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

The results revealed that the relationship between supply chain digitization and procurement performance was strong, positive and significant ($r=0.707^{**}$; $p=0.000$) at 1% significance level. This means increased supply chain digitization contributes to increased procurement performance. The findings indicate that supply chain digitization plays a crucial role in enhancing procurement performance within farmers' cooperative societies. Specifically, the integration of supply chain automation, comprehensive procurement systems, and real-time tracking improves operational efficiency and responsiveness. This digital transformation empowers cooperatives to streamline their processes and make more informed decisions, ultimately boosting their procurement performance.

5.2.2 Regression Analysis Findings and Discussions

Regression analysis was done to establish the relationship between supply chain digitization and procurement performance of farmers' cooperative societies. The findings are shown in tables 4, 5 and 6:

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.707 ^a	.499	.491	.36547

a. Predictors: (Constant), SupplyChainDigitization

The regression model summary reveals a correlation coefficient of 0.707, with a coefficient of determination of 0.499. This indicates that 49.9% of the variation in procurement performance was explained by supply chain digitization. Thus, it can be concluded that supply chain digitization has a significant effect on the procurement performance of farmers' cooperative societies.

Table 5: ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.654	1	8.654	64.790	.000 ^b
	Residual	8.682	65	.134		
	Total	17.336	66			

a. Dependent Variable: Procurement Performance

b. Predictors: (Constant), Supply Chain Digitization

The findings shows that the f-test value was 64.790 was significant (p=0.000) at 95% confidence level. This means that the overall model was significant and fit. As such, supply chain digitization affected the procurement performance.

Table 6: Regression Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Std. Error			
(Constant)	1.693	.299		5.664	.000
Supply Chain Digitization	.601	.075	.707	8.049	.000

a. Dependent Variable: Procurement Performance

The regression analysis model was interpreted as: $Y = 1.693 + 0.601X_1 + \epsilon$. The findings indicate that the beta coefficient for supply chain digitization is 0.601, a one-unit variation in supply chain digitization leads to a 0.601 unit change in procurement performance. The findings shows that procurement performance can be predicted based on variations in supply chain digitization. The t-value of 8.049 was significant (p = 0.000) at a 95% confidence level. This indicates that supply chain digitization within supply chain agility has a significant effect on the procurement performance of farmers' cooperative societies.

VI. Conclusion

In conclusion, supply chain digitization within supply chain agility significantly affects the procurement performance of farmers' cooperative societies. By embracing digital technologies, these cooperatives enhance their ability to collect and analyze data, leading to more informed decision-making and improved responsiveness to market demands. This transformation allows for greater efficiency and better alignment with consumer needs. Supply chain automation streamlines repetitive tasks and reduces manual errors, leading to increased efficiency and faster processing times. Integrated procurement systems facilitate better data management and enhance collaboration among stakeholders, enabling more strategic sourcing decisions. Moreover, the real-time tracking provides valuable visibility into inventory levels and order statuses, allowing for timely adjustments and improved responsiveness to market fluctuations. This affects the farmers' cooperative societies' procurement performance.

Recommendation

The study recommends that farmers' cooperative societies should prioritize the establishment of standardized processes for information sharing among members to facilitate better coordination and decision-making. Furthermore, fostering partnerships with relevant stakeholders can create synergies that support the adoption of digital tools, ultimately improving procurement performance.

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