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## DIGITALIZATION AND PERFORMANCE OF SUPPLY CHAINS OF DAIRY FIRMS IN KIAMBU COUNTY, KENYA

DANIEL KASHERO SANGA  
SALOME WAMBUI RICHU

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## DIGITALIZATION AND PERFORMANCE OF SUPPLY CHAINS OF DAIRY FIRMS IN KIAMBU COUNTY, KENYA

Daniel Kashero Sanga<sup>1</sup>, Salome Wambui Richu<sup>2</sup>

### Abstract

**Digitalization is fundamentally transforming business operations and redefining how value is created across supply chains. In the dairy industry, this adoption of technology has enhanced the efficiency, visibility, and responsiveness of supply chain functions. This study investigated the effect of digitalization on the performance of supply chains among dairy firms in Kiambu County, Kenya. The study employed the Dynamic Capability Theory, Technology Acceptance Model, and Network Perspective Theory, and adopted a census approach targeting all 17 dairy firms registered with the Kenya Dairy Board in the region. Primary data was gathered using structured questionnaires, and appropriate diagnostic tests were conducted to validate the data. The study used both descriptive and inferential statistical methods to analyze the relationships between the digitalization practices and supply chain performance. The results indicated a statistically significant positive effect of data management, buyer/supplier collaboration, system management, and billing management practices on supply chain performance. Data management practices ranked highest in terms of impact, followed by billing management, buyer/supplier collaboration, and system management. The model yielded an R-squared value of 0.646, suggesting that 64.6% of the variance in supply chain performance was explained by the digitalization variables examined. The ANOVA test confirmed the model's overall significance ( $p < 0.001$ ). The study underscores the importance of investing in modern digital infrastructure and recommends the integration of advanced technologies to enhance operational and supply chain performance. The study contributes to digital transformation literature in agri-based supply chains and offers practical insights for decision-makers in the dairy sector. Future research may explore comparative insights across different agricultural sub-sectors to generalize the findings further.**

**Keywords:** Digitalization, Performance, Supply Chains, Dairy Firms, Kiambu County

<sup>1</sup> Department of Management Science and Project Planning, University of Nairobi, Nairobi, Kenya

<sup>2</sup> ORCID : <https://orcid.org/0000-0001-8756-4949>, Department of Management Science and Project Planning, University of Nairobi, Nairobi, Kenya - [salomerichu@uonbi.ac.ke](mailto:salomerichu@uonbi.ac.ke)

## Introduction

In the current competitive market, many organizations worldwide are increasingly conducting business through information technology. Digitization of business transactions within the procurement entity is expanding in both scope and significance (Hasanah, Shino, & Kosasih, 2022; Mtsweni, Mokwena, & Moeti, 2021). Emergence of digitalization at the supplier level has transformed the interactions and transactions that organizations have with their numerous suppliers (Eadie et al 2021). According to Rachinger, et al (2018), transformation of a conventional business into a modern digital enterprise is referred to as digitalization. Wang et al. (2020) defines organizational digitalization as the process by which companies improve organizational and business processes, create ecological positioning, develop business models, and use new technologies. According to Lambert and Enz (2017) and Brady (2006), supply chain performance may be characterized as a strategy used by a firm or organization to oversee the movement of items via an inventory management system from the supplier to the end user. Supply chain performance may be evaluated either qualitatively or quantitatively. The qualitative measure relates to customer satisfaction with the service or product, while the quantitative metric includes reaction time, delivery performance, and resource use (Kurien & Qureshi, 2011; Gunasekaran, Patel, & Tirtiroglu, 2001; Beamon, 1999). Mutimbia (2018) asserts that supply chain efficiency may be evaluated by customer satisfaction, reaction time, service delivery, and flexibility.

A larger share of the company's financial resources are devoted to procurement of commodities and amenities required for operation of the business (Hawking, Stein, Wyld, & Forster, 2014; Lancioni, Smith, & Oliva 2017). Gross domestic product and food security in Kenya are greatly impacted by the dairy industry. However, the sector's capacity to compete well in local and foreign markets has faced issues with value addition activities, marketing, and distribution, posing technical, governmental, legal, and economic challenges encountered throughout the course of milk production (Bebe & Wakhungu, 2021; Njarui et al., 2010; Karanja, 2008). The industry represents around 4% of the Kenyan economy, contributing an estimated 14% to the over-all agricultural GDP and over 44% to the livestock GDP. Yearly milk output is around 5.2 billion litres, supported by an estimated population of 4.5 million dairy cattle (USDA Foreign Agricultural Service, 2024; Ministry of Agriculture and Livestock Development, 2024, KDB, 2024). There are a number of milk processors in Kiambu County, which makes it an important location in the country for milk production and processing. Dairy farming is a crucial economic sector in Kiambu County, accounting for 17.4 percent of the county's GDP and directly or indirectly employs over 1.28 million people. There were 17 dairy enterprises in Kiambu County listed and licensed, with a combined annual production of over 350 million litres of milk (IFAD, 2016; Michoki, 2020; Mburu, 2016; Kibe, 2011).

Digitalization together with growth of innovation, is transforming the way business is conducted across all enterprises, while also altering value creation and organizational advantages.

Consumer behaviour is further significantly influenced by the widespread availability of the internet, global access to information, and the rapid development of social networks (Alipour Sarvari et al., 2020; Mohanty & Mohanty, 2023). The utilization of IT applications, websites, and physical storefronts enables businesses to expand their reach from a local to a global scale, facilitating the attraction, engagement, and sale of their products and services (Soto-Acosta & Pedro, 2020). Empirical studies related to this research's variables were noted, and contributed to the need for undertaking the study. For instance, Okwaro et al. (2017) examined how electronic procurement affected the operational performance of Kenyan county administrations; the impact of online purchasing on the productivity of eateries in Nairobi County, Kenya was the subject of Otieno's (2018) study; Ibem, et.al (2018) surveyed digital technologies applied in procuring building projects in Nigeria. Additionally, Swamy et al. (2014) investigated the effectiveness of electronic procurement among Indian manufacturing enterprises. This empirical review pointed to a research gap that triggered this study's general objective, which was to examine the effect of digitalization on the performance of supply chains of dairy firms in Kiambu County, Kenya.

### Literature Review

The theoretical foundation of the study is grounded on three theories, namely: the dynamic capability theory, technology acceptance model and network perspective theory. The dynamic capability theory, which was developed by David J. Teece, along with Gary Pisano and Amy Shuen in 1997, highlights a firm's ability to incorporate, build, and reconfigure internal plus external competencies to address dynamic environments

(Eisenhardt & Martin, 2000; Wang & Ahmed, 2007). The theory explains the capacity of an establishment to deliberately organize its resources for enhancement of performance (Oteki, 2019). To adapt to highly dynamic and uncertain environments, firms must develop organizational competencies that create a competitive advantage to effectively handle external challenges (McLaughlin, 2017; Helfat et al., 2009). Fred Davis pioneered the Technology Acceptance Model, (TAM), in 1989. The TAM outlines the factors influencing users' acceptance and adoption of technological systems. The model identified two key factors, namely Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). The theory focuses on perceived usefulness and ease of use of technologies like digital milk tracking and inventory systems. The Model can help explain how dairy firms adopt digital supply chain tools. High acceptance leads to improved coordination, efficiency, and performance. The TAM guides understanding of digitalization impact on supply chain outcomes (Davis, 1989; Venkatesh & Davis, 2000; Moturi, 2016). Network Perspective Theory, developed by Håkansson and Snehota in the 1980s, views firms as part of interconnected business networks. It underscores the key role of relationships and interdependence among supply chain actors. In supply chains, it explains value co-creation, resource sharing, and innovation through collaboration. The theory supports strategic network-based decision-making in business (Håkansson & Snehota, 1989; Håkansson & Ford, 2002).

Digitalization practices are pivotal in enhancing supply chain efficiency and performance. Effective data management allows for better

decision-making through real-time tracking and improved forecasting (Karttunen et al., 2023). Strengthening buyer/supplier collaboration through digital platforms improves communication and trust, leading to greater responsiveness (Oliver, 2017). System management, which integrates various digital tools, ensures better optimization and visibility across supply chain processes (Oboloo, 2024). Furthermore, billing management through digital solutions streamlines financial transactions, minimizing errors and delays. In the dairy industry, these digitalization practices are increasingly critical to enhancing supply chain performance. Efficient data management supports timely decision-making through accurate tracking of milk volumes, quality parameters, and logistics, improving coordination between producers and processors (Darbanian et al., 2020; Li et al., 2024). Strengthening buyer–supplier collaboration through digital platforms facilitates better alignment on delivery schedules, quality expectations, and pricing, which enhances trust and long-term partnerships (Alshawabkeh et al., 2024). System management, including the use of cloud-based inventory systems and IoT for cold-chain monitoring, enhances visibility and responsiveness in dairy logistics (Zhang et al., 2024). Additionally, the adoption of digital billing systems reduces manual errors and transaction delays, ensuring smoother financial flows between farmers, cooperatives, and retailers (Zhang et al., 2024). Collectively, these digital solutions advance a more efficient, traceable, and resilient dairy supply chain in regions like Kiambu County, where timely delivery and product quality are crucial for market competitiveness.

A digital practice is a plan designed to maximize the commercial benefits of data assets and technology-focused activities (Rego, Jayantilal, Ferreira, & Catayannis, 2021). An effective digital strategy involves a cross-functional team composed of people from senior leadership, marketing, and information technology (IT). It entails dismantling silos between leaders of information technology and other customer-facing divisions in order to create a uniform digital customer experience. An efficient digital supply chain (DSC) guarantees the effective electronic distribution of products from source to destination. The DSC utilizes advanced technologies to establish a transparent, flexible, and reliable supply chain management system. Technologies associated with digital supply chains enable companies to respond to pressing requirements of customers promptly (Hallikas et al., 2021). According to Mahdillou & Akbary, (2014), supply chain management's primary function is to align an organization's activities with those of its clients or other stakeholders. To obtain a competitive edge, supply chain management aims to maximize customer value by streamlining supply-side processes such as the flow of goods, services, and information. Gutierrez, Kothari, Mazuera, & Schoenherr (2020) note that to achieve the system's goal, all links in the supply chain need be in synchronous with each other. By doing away with the paper trail of approvals, requisitions, and receipts, a modern e-procurement software system may drastically cut down on the time and energy needed to accomplish purchasing transactions (Mahdillou & Akbary, 2014). Automating processes and keeping all relevant records digitally, enables billing management to cut down

on overhead expenses (Xu et al., 2019; Mutindi et al., 2019).

As far as supply chain management is concerned, performance measures are crucial for evaluating operational efficiency and achieving organizational goals. These measures include quality of services and products, cost minimization and productive efficiency (Dahinine, Laghouag, Bensahel, Alsolamy, & Guendouz, 2024; Khan & Zaman, 2023). Quality of services and products is a critical performance measure, as it directly influences customer satisfaction and loyalty. Consistent product quality enhances customer retention and brand trust (Khare et al., 2012). Cost minimization is another vital performance metric, as it focuses on reducing operational expenses, such as procurement, inventory management, and transportation, without compromising product quality. Cost efficiency directly contributes to enhanced profitability and competitive advantage (Dahinine et al., 2024; Hausman, 2004). Productive efficiency is the third key measure, emphasizing the optimization of resources, including labor, raw materials, and time. Research indicates that improving productive efficiency

leads to better utilization of assets and minimized waste, resulting in lower operational costs (Khan & Zaman, 2023; Kusriani et al., 2014). The integration of these measures enables firms to identify inefficiencies and improve processes, leading to overall enhanced supply chain performance. Monitoring and analyzing these performance dimensions, allows organizations to strategically align their operations with market demands, improve responsiveness, and ensure long-term sustainability in competitive industries (Gunasekaran et al., 2001).

### Conceptual Framework

The study aimed to examine the effect of digitalization on the performance of supply chains of dairy firms in Kiambu County, Kenya. The independent variable was digitization which was measured by four key practices: data management, buyer-supplier collaboration, system management in addition to billing system. The dependent variable was supply chain performance, whose sub-constructs were quality of services and products, cost minimization and productive efficiency. The relationship among these study variables is shown in Figure 1 below:

#### Independent Variables

##### Digitalization Practices

- Data management
- Buyer/Supplier Collaboration
- System Management
- Billing Management

#### Dependent Variable

##### Supply Chain Performance

- Quality of services and products.
- Cost minimization.
- Productive efficiency.

**Figure 1: Conceptual Model**

Source: Authors own

## Methodology

The study applied the descriptive cross-sectional research design. Guided by clearly defined objectives, the study investigated the relationships among different variables, namely digitalization practices and supply chain performance. On this basis, the study adopted a descriptive research design as the most appropriate methodological approach (Check & Schutt, 2012; Cooper & Schindler, 2011). Cross-sectional designs involve data collection at one point in time and are widely utilized in descriptive studies (Hair et al., 2015; Spector, 2019; Zikmund et al., 2013). The population of the study was all 17 dairy enterprises in Kiambu County, Kenya which are recognized and regulated by the Kenya Dairy Board (KDB, 2023). Based on the nature of the dairy firms in terms of organizational structure compared to study variables, five sections were identified, and one manager picked from each section as the key respondents. The sections identified were: administration, I.T., supply chain, finance and maintenance, this ensured data necessary for the research was captured. A total of 85 respondents were targeted. The study utilized semi-structured questionnaires to obtain primary data, where 68 duly filled questionnaires were received, forming a response rate of 80%.

Descriptive and inferential statistics were applied in analyzing the data. Prior to regression analysis, key diagnostic tests were conducted to verify model assumptions, including tests for normality, multicollinearity, and autocorrelation. Data normality was evaluated using the Shapiro–Wilk test, and all p-values exceeded 0.05, indicating no significant departure from normal distribution. Multicollinearity was assessed using tolerance and Variance Inflation Factor (VIF) statistics. All

independent variables recorded tolerance values above 0.10 and VIF values below 10, confirming the absence of multicollinearity among the study variables. The Durbin–Watson statistic was 1.967, which is close to the ideal value of 2, indicating the absence of significant autocorrelation in the residuals and suggesting that they were largely independent, thus satisfying one of the key assumptions of linear regression. (Park, 2015; Donald, 2016; Field, 2013; Li, 2018).

## Results

The objective of the study was to examine the effect of digitalization on the performance of supply chains of dairy firms in Kiambu County, Kenya. Background information of the respondents revealed that 51.5% were males, whereas 48.5% were females; 54.4% had an age above 41years; 67.5% indicated to have worked for more than 10 years in the dairy firms; and 76.4% had college, university and postgraduate achievements.

### Digitalization Practices:

The independent variable of the study, digitization, was analyzed by four sub-variables, namely: data management practices, buyer-supplier collaboration practices, system management practices and billing system practices.

### Data management Practices

The study aimed to assess the level of agreement with various statements on the influence of data management practices on supply chain performance among dairy firms in Kiambu County.

**Table 1: Data management Practices**

	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>
The firm has the capacity to collect, analyze and store data.	68	4.662	0.507
The firm has the personnel to assist with data management activities.	68	4.103	0.813
We have an effective data management system	68	4.206	1.059
Having proactive, robust data quality controls aids in ensuring that downstream systems and users are offered with clean, accurate information on a regular basis	68	4.059	1.118
Data management ensures that we are able to better serve current and potential customers and to make more accurate forecasts.	68	4.471	0.782

**Mean Average: 4.3002**

A mean average of 4.3002 meant that respondents strongly agreed with the fact that data management practices affected performance of supply chains of dairy firms.

influence of buyer/supplier collaboration practices on the performance of the supply chains within dairy enterprises in Kiambu County.

**Buyer/supplier collaboration Practices**

The study sought to assess the level of agreement regarding various assertions concerning the

**Table 2: Buyer/supplier collaboration Practices**

	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>
Strategic buyer–supplier collaboration is essential for effective logistics management.	68	4.088	1.194
Buyer-supplier relationships have evolved over time	68	3.824	1.209
Information sharing and trust are crucial in a buyer/supplier collaboration	68	4.265	0.940
The capacity of an organization to adapt to change that is both unexpected and dynamic is significantly impacted by the collaborative connections that exist between its buyers and its suppliers.	68	4.147	0.919

**Average Mean: 4.081**

Based on the average mean of 4.081, the respondents strongly agreed that buyer/supplier collaboration practices influenced the performance of the supply chains within dairy enterprises in Kiambu County.

The study sought to evaluate the extent of agreement with selected statements on the influence of system management practices on the performance of supply chains among dairy firms in Kiambu County.

### System management practices

**Table 3: System management practices**

	N	Mean	Std. Deviation
We operate using an e-procurement software system	68	4.206	1.100
The lack of a systems means we rely on traditional paper for payment approvals and requisitions	68	2.088	1.181
Having an e-procurement software would significantly enhance the invoicing and payment process.	68	4.574	0.676
The current system available is not effective	68	2.206	1.229
<b>Mean Average:</b>		<b>3.2685</b>	

An average mean of 3.2685 show that system management practices moderately influence the performance of supply chains of dairy firms in Kiambu County.

the influence of billing management practices on the performance of the supply chains within Kiambu County dairy firms.

### Billing management Practices

The research aimed to assess the level of consensus regarding various statements related to

**Table 4: Billing management Practices**

	N	Mean	Std. Deviation
We may compute ordering charges with the help of the billing system, or we can utilize it to spread running expenses across certain orders.	68	4.162	1.031
We operate under fixed pricing	68	4.103	1.108
We operate under dynamic pricing	68	4.471	0.782
Having a billing management system reduces transaction costs	68	4.029	0.977
All our billing systems are automated	68	3.824	1.209
<b>Mean Average:</b>		<b>4.1178</b>	

Based on the mean average of 4.1178, the respondents strongly agreed billing management system had an effect on the performance of the supply chains within dairy firms in Kiambu County.

**Table 5: Summary and a Comparison of the Digitization Practices**

<b>Ranking</b>	<b>Digitization Practice</b>	<b>Average Mean</b>	<b>Comments</b>
1	Data management practices	4.3002	Widely adopted and seen as critical to effective supply chain coordination.
2	Billing management practices	4.1178	Strongly implemented with positive impact on financial tracking and transparency.
3	Buyer/supplier collaboration practices	4.081	Generally well-practiced, enhancing responsiveness and trust in the supply chain.
4	System management practices	3.2685	Least developed; may require investment in infrastructure and training

### **Supply chain performance of dairy firms in Kiambu County**

The study evaluated the extent of agreement with statements concerning supply chain performance of dairy firms in Kiambu County.

**Table 6: Supply Chain Performance**

	N	Mean	Std. Deviation
There is efficiency in responsiveness to customer needs	68	4.162	1.323
Reliability in terms of service delivery was enhanced by the digitalization practices	68	4.147	0.919
The level Returns to scale was registered in the entire in most occasions	68	4.206	1.100
Flexibility in terms of service delivery to customers improved due to digitalization practices	68	4.088	1.181
The level of Service delivery has been enhanced due to digitization	68	4.574	0.676
<b>Mean Average:</b>	<b>4.2354</b>		

Based on the mean average of 4.2354, the respondents strongly agree that the supply chains of the dairy firms in Kiambu County were above average.

**Regression Analysis**

**Table 7: Model Summary**

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.804 <sup>a1</sup>	0.646 <sup>1</sup>	0.616	1.035

**A value of R-Square 0.646 means that approximately 64.6% of the variability in the performance of supply chains of Kiambu County dairy firms is explained by digitalization practices included in the model.** Therefore, digitalization (data management, system management, buyer/supplier collaboration, billing system) is a significant driver of supply chain performance. The remaining 35.4% of the variation may be

expounded by factors not included in the model like policy environment, infrastructure, or human capacity.

**Table 8: ANOVA<sup>a</sup>**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	98.8484	4	24.7121	21.580	0.00003
	Residual	72.1419	63	1.14511		
<b>Total</b>		<b>170.9903</b>	<b>67</b>			

- a. Predictors: data management practices, buyer/supplier collaboration practices, system management practices and billing management practices  
 b. Dependent Variable: Performance of supply chain of dairy firms in Kiambu County=

The ANOVA findings confirm that the regression model provides a statistically significant fit to the data ( $F = 21.580$ ,  $p < 0.05$ ), indicating that digitalization practices significantly predict the

performance of supply chains among dairy firms in Kiambu County.

**Table 9: Regression Coefficients**

	Unstandardized <sup>1</sup> Coefficients <sup>1</sup>		Standardized <sup>1</sup> Coefficients <sup>1</sup>		
	B <sup>1</sup>	Std. Error <sup>1</sup>	Beta <sup>1</sup>	T <sup>1</sup>	Sig. <sup>1</sup>
(Constant)	3.771	0.451		8.359	0.000
Data management practices	0.795	0.179	0.126	4.441	0.000
Buyer/supplier collaboration practices	0.782	0.221	0.146	3.538	0.001
System management practices	0.473	0.173	0.142	2.734	0.009
Billing management practices	0.634	0.301	0.172	2.106	0.042

Regression results show that data management, buyer–supplier collaboration, system management, and billing management all significantly affect supply chain performance. Strengthening these digital practices can enhance operational efficiency and overall supply chain effectiveness in dairy firms in Kiambu County, Kenya.

### Discussion

Results reveal that data management is the highest-priority digitalization practice among the sub-constructs studied, in Kiambu County dairy firms, suggesting a strong reliance on accurate and timely data to support operational and strategic decisions across the supply chain. Results also show that billing management is also prioritized by dairy farmers in Kiambu County,

indicating that firms are leveraging automated billing systems to streamline financial processes, reduce manual errors, and enhance transactional transparency. Further, results also show that, Buyer-supplier collaboration is a significant practice, pointing to a growing recognition of the significance of digital platforms in strengthening supply chain relationships and communication. However, system management practices ranked lowest, signaling a lag in adopting integrated digital systems. This supports Onjala's (2017) observation that while some e-procurement tools have been implemented in Kenya's dairy sector, full-scale digital integration remains limited due to technical and security-related challenges. Similarly, Wairimu et al. (2022) found that institutional and organizational innovations, including system upgrades, are often constrained by limited access to information, income disparities, and skills gaps. In line with this, Kwamboka et al. (2022) emphasized that the industry's digital transformation is hindered by inadequate technical capacity and infrastructure, indicating a need for targeted investment in digital systems and workforce development to fully leverage digitalization in the dairy supply chain.

An  $R^2$  of 0.646 indicates that the four digitalization practices collectively explain about 64.6% of the variation in supply chain performance of dairy firms in Kiambu County. This suggests a strong explanatory power of the model, highlighting the importance of these digitalization practices in influencing supply chain performance. Furthermore, the ANOVA results strengthen the model's validity, with an F-value of 21.580 and a p-value of 0.00003, indicating that the regression model as a whole is statistically significant. The regression model

explains a substantial portion of the variation in supply chain performance, as shown by the Sum of Squares for the regression (98.8484), while the residual sum of squares (72.1419) represents the unexplained variation. Specifically, data management practices ( $B = 0.795$ ,  $p = 0.000$ ), buyer/supplier collaboration ( $B = 0.782$ ,  $p = 0.001$ ), system management practices ( $B = 0.473$ ,  $p = 0.009$ ), and billing management practices ( $B = 0.634$ ,  $p = 0.042$ ) each contribute positively and significantly to supply chain performance. These findings emphasize the critical role of digitalization in enhancing the efficiency and responsiveness of dairy supply chains, supporting the need for continued digital investment in the sector (Gutierrez, et al., 2020; Xu et al, 2019; Mutindi et al. 2019; Mahdillou & Akbary, 2014).

The DCT, TAM, and Network Perspective Theories offer valuable frameworks for understanding the digitalization practices and supply chain performance of dairy firms in Kiambu County. According to Dynamic Capability Theory, firms must continuously adapt their processes and resources to respond to changes in the competitive landscape (Teece, 2007). The study's results, particularly the strong effects of data management and buyer/supplier collaboration practices, align with this theory, as these practices allow dairy firms to dynamically reconfigure their operations to enhance supply chain performance. The TAM further supports the findings, particularly regarding the adoption of digital tools like billing and data management systems. With significant p-values ( $p < 0.05$ ) and high standardized coefficients, these practices indicate that dairy firms recognize the perceived usefulness and ease of use of digitalization, consistent with TAM's assertion that users'

attitudes toward technology influence their decision to adopt it (Davis, 1989). The Network Perspective Theory underscores the significance of inter-organizational relationships in improving coordination and performance, which is evident in the positive impact of buyer/supplier collaboration on supply chain performance. This study's findings, particularly the strong effect of collaboration practices, reflect the importance of leveraging network relationships for more effective supply chain management (Johanson & Mattsson, 1987). Collectively, these theories offer a comprehensive perspective on the critical role of digitalization practices in improving the efficiency and competitiveness of dairy supply chains in Kenya.

## Conclusion

This study investigated the effect of digitalization on the performance of supply chains among dairy firms in Kiambu County, Kenya. Focusing on four digitalization practices: data management, buyer–supplier collaboration, system management, and billing management, the findings demonstrate that all these components have a significant and positive impact on supply chain performance. The regression model's  $R^2$  value of 0.646 indicates that these practices account for a substantial proportion of the variation in performance, highlighting the critical role of digital tools in enhancing operational efficiency, responsiveness, and coordination within the dairy sector. The significance of the ANOVA results further confirms that the model is statistically robust and reliable. Overall, the study provides a meaningful contribution to the field of supply chain management by empirically demonstrating how digitalization practices can strengthen supply chain performance in the dairy industry; offering

empirical support for the integration of digital practices in agri-business environments, particularly in developing economies. From a theoretical standpoint, the findings validate the relevance of the Dynamic Capability Theory, Technology Acceptance Model, and Network Perspective Theory. These frameworks collectively explain how digital competencies enable firms to respond swiftly to market dynamics, how user acceptance influences technology uptake, and how inter-organizational networks enhance collaborative efficiency. The triangulation of these theories deepens the understanding of digital transformation within supply chains, extending their practical application to Kenya's dairy industry.

On a practical level, the results highlight the need for dairy firms to prioritize investments in digital infrastructure and capabilities. Improving data management systems, enhancing supplier and buyer collaboration through digital platforms, optimizing internal system processes, and digitizing billing operations are all essential strategies for improving supply chain performance. Additionally, industry regulators and policymakers can draw from these findings to support digital transformation initiatives, including capacity-building programs, funding support for digital technologies, and the development of favorable regulatory frameworks. Future work could explore how digitalization influences supply chain performance over time employing longitudinal research designs. Further research might also assess the role of digital skills, technological infrastructure readiness, and cultural or behavioral factors that influence digital adoption and performance outcomes. Expanding the scope to include other counties or sectors

could provide broader insights and contribute to generalizable strategies for improving supply chain performance through digital innovation.

### Recommendations

In light of the findings, the study recommends that dairy firms in Kiambu County invest in strong data management systems, adopt integrated digital tools to enhance buyer–supplier collaboration, and implement efficient system and billing management practices to improve supply chain performance. Emphasis should be placed on real-time data processing, automation of internal operations, and transparent financial transactions to increase efficiency and responsiveness. Additionally, stakeholders such as the Kenya Dairy Board should support the digitalization agenda through training, incentives, and partnerships to foster technology adoption. Future work could explore the long-term impact of digitalization using longitudinal studies, as well as the role of advanced technologies like blockchain and AI in enhancing dairy supply chains

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### Conflicts of Interest

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