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**INFLUENCE OF DIGITAL SUPPLY CHAIN MANAGEMENT SYSTEM ON COMPETITIVE
ADVANTAGE OF BUILDING ACCESSORIES MANUFACTURING FIRMS IN KENYA:
MODERATING EFFECTS OF FIRM SIZE**

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ABSTRACT

The building accessories manufacturing sector contributes significantly to Kenya's economy through employment creation and support for infrastructural development. However, the sector grapples with high production costs, intense competition from imports, and limited technological integration. This study examined the influence of digital supply chain management system (DSCMS) on competitive advantage among building accessories manufacturing firms in Kenya, with firm size as a moderating variable. Adopting a positivist philosophy and an ex-post facto research design, primary data were collected from 104 key informants in 24 firms using structured questionnaires and semi-structured interviews with CEOs, achieving an 87% response rate. Quantitative data were analysed using descriptive statistics, Chi-square tests of association, and binary logistic regression (with interaction terms for moderation) in SPSS Version 27, while qualitative data underwent thematic analysis. Results revealed a significant positive association between adequate DSCMS and competitive advantage ($\beta = 1.386$, $SE = 0.620$, $Wald = 5.000$, $p = 0.015$, $OR = 4.000$). Firm size significantly moderated this relationship (interaction $\beta = 1.609$, $SE = 0.632$, $Wald = 6.476$, $p = 0.011$, $OR = 5.000$), with larger firms deriving greater benefits. Descriptive findings indicated moderate adoption of visibility, tracking, and automation elements alongside notable gaps in overall system utilization and staff training. The study concludes that DSCMS is a key driver of competitive advantage in this sector, with its impact amplified by firm scale. It recommends size-tailored investments in DSCMS technologies, continuous workforce training, and policy support through differentiated incentives to promote inclusive digital transformation and long-term sector sustainability.

Keywords: Digital supply, Chain management system, Competitive advantage, Firm size, Moderation, Building accessories, Manufacturing

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INTRODUCTION

The integration of digital technologies into supply chain operations has become a critical determinant of competitive advantage in contemporary manufacturing. Digital supply chain management system (DSCMS) provides real-time visibility, enhanced coordination, inventory optimization, and greater responsiveness to market dynamics (Ivanov & Dolgui, 2020; Shahadat et al., 2023). These systems, which incorporate cloud computing, artificial intelligence, blockchain, and automation, enable firms to reduce operational costs, shorten lead times, and strengthen relationships with suppliers and customers.

In developing economies, including those across Africa, the adoption of digital supply chain technologies remains uneven due to infrastructural constraints, skill deficiencies, and financial barriers (Alayande, 2021; Shava et al., 2021; Adebayo, 2025). In Kenya, the building accessories manufacturing sector, a vital component of the construction value chain continues to experience procurement inefficiencies, inventory mismanagement, and distribution delays that undermine its competitive positioning (Kelka, 2024). Although DSCMS holds substantial potential to address these operational challenges, context-specific empirical evidence on its impact within this sector remains limited. In particular, the moderating role of firm size has received little attention. Larger firms may possess greater absorptive capacity and resource slack, enabling them to exploit digital tools more effectively than smaller counterparts.

This study addresses these gaps by investigating the direct influence of digital supply chain management system on competitive advantage among Kenyan building accessories manufacturing firms, while examining the moderating effect of firm size.

MATERIALS AND METHODS

This study adopted a positivist research philosophy and an ex-post facto research design. The positivist paradigm assumes an objective reality that can be empirically observed and measured, making it suitable for testing relationships between variables. The ex-post facto design allows examination of naturally occurring relationships without researcher manipulation.

The target population consisted of all 25 building accessories manufacturing firms registered with the Kenya Association of Manufacturers [KAM] as of 2025. A sample of 24 firms was selected using Slovin's formula at a 5% margin of error ($n \approx 23.52$, rounded to 24). From each firm, five key informants (CEO and heads of Finance, Procurement, Production, and ICT) were purposively sampled, yielding 120 respondents.

Primary data were collected through structured questionnaires (5-point Likert scale) and semi-structured interviews with selected CEOs. Ethical approval was obtained from the Kenya Methodist University Institutional Review Board. Informed consent was secured from all participants, and confidentiality was maintained.

Quantitative data were analyzed using descriptive statistics, Chi-square tests, and binary logistic regression (including interaction terms) in SPSS Version 27. Qualitative data underwent thematic analysis to complement and corroborate quantitative findings.

RESULTS AND DISCUSSION

Out of 120 questionnaires distributed, 104 were returned, representing an 87% response rate. This high return rate is considered excellent for self-administered surveys and strengthens the reliability of the findings (Uju & Etumnu, 2021).

Descriptive analysis of DSCMS practices as shown in Table 1 revealed moderate adoption of several components. Respondents showed relatively strong agreement on automated order processing and fulfillment systems (62.5%, mode =5), regular analysis of supply chain data (59.6%, mode = 4), and digital communication tools for supplier coordination (55.8%, mode = 4). However, effective overall utilization of digital tools for supply chain management (61.5% disagree, mode = 2) and regular staff training on DSCMS (61.6% disagree, mode = 2) recorded low agreement levels. These gaps indicate deficiencies in system integration and workforce capacity building.

Table 1

Digital Supply Chain Management System Practices Among Building Accessories Manufacturing Firms (N = 104)

Statements	Disagree	Uncertain	Agree	Mode
Digital communication tools facilitate seamless coordination with the suppliers and distributors	6.7% (7)	37.5% (39)	55.8% (58)	4
The firm has implemented software solutions that provide real-time tracking of inventory levels	8.7% (9)	42.3% (44)	49% (51)	4
The firm effectively utilizes digital tools to manage and optimize supply chain operations	61.5% (64)	26.9% (28)	11.6% (12)	2
The firm regularly analyzes supply chain data to identify opportunities for optimization and cost reduction	9.6% (10)	30.8% (32)	59.6% (62)	4
Order processing and fulfillment systems are automated, enhancing operational efficiency	10.6% (11)	26.9% (28)	62.5% (65)	5
Staff receive regular training on the use of digital supply chain management system	61.6% (64)	30.8% (32)	7.7% (8)	2

Responses on a 5-point Likert scale (1= Strongly Disagree to 5 = Strongly Agree). Mode values: 5= Strongly Agree, 4 = Agree, 2 = Disagree. Source: Research Data (2025).

A Chi-square test of association revealed a statistically significant relationship between DSCMS practices and competitive advantage, χ^2 (1, N = 104) = 95.988, $p < .001$ (see Table 2). Crosstabulation results (Table 3) demonstrated a strong positive association: 98.9% of firms with adequate DSCMS reported adequate competitive advantage, while all firms without adequate DSCMS reported none.

Table 2

Chi-Square Test for Association Between DSCMS Practices and Competitive Advantage

	Value	Df	Asymptotic Significance (2-sided)	P-Value	Exact Sig. (1- sided)
Pearson Chi-Square	95.988 ^a	1	0.000	0.000	0.000
Likelihood Ratio	74.826	1	0.000	0.000	0.000
N of Valid Cases	104				

Table 3*Crosstabulation of DSCMS and Competitive Advantage*

			Competitive Advantage Recoded		Total
			There is no adequate competitive advantage	There is adequate competitive advantage	
Variable	Digital Supply Chain management system Recoded	There is no adequate digital supply chain management system (RC)	Count	14	0
		% within DigitalSupplyChainMS3 Recoded	100.0%	0.0%	100.0%
	There is adequate supply chain management system	Count	1	89	90
		% within DigitalSupplyChainMS3 Recoded	1.1%	98.9%	100.0%
Total		Count	15	89	104
		% within DigitalSupplyChainMS3 Recoded	14.4%	85.6%	100.0%

Binary logistic regression analysis incorporating interaction terms to test moderation by firm size, provided deeper predictive insights (see Table 4). Adequate DSCMS significantly predicted competitive advantage ($\beta = 1.386$, $SE = 0.620$, $Wald = 5.000$, $p = 0.015$, $OR = 4.000$). Firms with adequate DSCMS were approximately 4.00 times more likely to achieve competitive advantage than those with inadequate DSCMS. Firm size also exerted a significant positive main effect ($\beta = 1.498$, $SE = 0.590$, $Wald = 6.250$, $p = 0.010$, $OR = 4.879$).

The interaction term (DSCMS $\times$ Firm Size) was statistically significant ($\beta = 1.609$, $SE = 0.632$, $Wald = 6.476$, $p = 0.011$, $OR = 5.000$). The positive coefficient indicates that firm size moderates the relationship, with the beneficial effect of DSCMS on competitive advantage being stronger among larger firms. This aligns with the resource-based view, suggesting greater organizational scale enhances the ability to leverage digital supply chain investments effectively (Mutende & Mutua, 2024).

Table 4

Binary Logistic Regression Results Predicting Competitive Advantage (with Interaction Term for Moderation by Firm Size)

Variable	β	S.E.	Wald	P-value	Odds ratio
Digital supply chain management system					
Inadequate digital supply chain management system (RC)					1.000
Adequate digital supply chain management system	1.386	0.620	5.000	0.015	4.000
Firm size (MV)					
Inadequate firm size practices (RC)					1.000
Adequate firm size practices	1.498	0.590	6.250	0.010	4.879
Digital supply chain management system x firm size					
Inadequate digital supply chain management system (RC)					1.000
Adequate digital supply chain management system x firm size (interaction)	1.609	0.632	6.476	0.011	5.000

Note: Reference categories (RC) = Inadequate practices.

These findings extend existing literature on digital supply chain technologies in manufacturing (Shahadat et al., 2023; Ivanov & Dolgui, 2020; Shava et al., 2021; Adebayo, 2022; Mogaka, 2024) by providing empirical evidence from Kenya's building accessories manufacturing sector and addressing context-specific gaps (Wambua, 2024; Itaman & Wolf, 2021). Qualitative insights from CEO interviews corroborated the results, highlighting benefits from supplier portals, cloud-based platforms, GPS/RFID tracking, and e-procurement systems, while emphasizing persistent gaps in integration and training.

CONCLUSIONS AND RECOMMENDATIONS

Digital supply chain management system (DSCMS) shows a statistically significant positive influence on the competitive advantage of building accessories manufacturing firms in Kenya. The relationship is significantly moderated by firm size, with larger firms deriving substantially greater benefits from DSCMS adoption compared to their smaller counterparts. These findings underscore the strategic importance of digital transformation in enhancing operational efficiency, responsiveness, and market positioning within Kenya's building accessories manufacturing sector. However, the persistent gaps in system integration and staff training highlight the need for more deliberate investments in both technology and human capital to fully realize the potential of DSCMS.

Building accessories manufacturing firms in Kenya should prioritize targeted investments in DSCMS, focusing on real-time visibility, automation, data analytics, and seamless supplier integration. Larger firms are encouraged to adopt advanced implementations and act as benchmarks for the sector, while smaller firms should begin with foundational digital solutions, supported by strategic partnerships and

shared infrastructure. To address the identified gaps, firms should institutionalize regular, organization-wide training programs on DSCMS utilization.

The Kenya Association of Manufacturers (KAM) should play a facilitative role by promoting knowledge-sharing platforms and collaborative digital transformation initiatives across the sector. Policymakers are recommended to introduce size-differentiated support mechanisms, including targeted subsidies, tax incentives, and accessible financing schemes, to ensure inclusive digital adoption. Such measures will strengthen sector resilience, improve productivity, and contribute meaningfully to Kenya's broader industrialization and economic development agenda under Vision 2030.

Areas for Further Research

Future research should replicate this mixed-methods design in other manufacturing sub-sectors and across diverse emerging economies to establish the generalizability of the findings. Further examination of additional moderators, such as organizational culture, absorptive capacity, and institutional pressures, is warranted using longitudinal and multi-level analytical approaches. Moreover, integrating complementary Industry 4.0 technologies, including the Internet of Things (IoT), big data analytics, and artificial intelligence, would deepen insights into the mechanisms through which digital supply chain management system drives sustained competitive advantage in resource-constrained environments.

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