

Supply chain management practices and performance of pharmaceutical firms in South-East Nigeria

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ABSTRACT

Pharmaceutical firms in South-East Nigeria confront systemic supply chain challenges including erratic raw material supply, infrastructural deficits, regulatory bottlenecks, and distribution inefficiencies, leading to stock-outs, escalated operational costs, diminished market competitiveness, and eroded customer trust. This study examined how six supply chain management (SCM) practices influence multidimensional firm performance. A quantitative descriptive survey design was employed, targeting 1,625 employees across 23 NAFDAC-registered pharmaceutical firms in the region. Using Yamane's formula (5% margin of error), a sample of 321 respondents was selected via stratified random sampling to ensure proportional inclusion across hierarchical levels. Primary data were gathered through structured Likert-scale questionnaires validated for reliability and content validity. Data analysis utilised SPSS v26 for descriptive statistics and SmartPLS v3.0 for partial least squares structural equation modelling (PLS-SEM), assessing measurement and structural models with bootstrapping (5,000 subsamples). Results confirmed all six hypotheses: strategic supplier partnership significantly enhanced operational performance ($\beta = 0.779$, $p < 0.001$); information sharing boosted profitability ($\beta = 0.903$, $p < 0.001$); customer relationship management elevated customer satisfaction ($\beta = 0.913$, $p < 0.001$); inventory management expanded market share ($\beta = 0.891$, $p < 0.001$); logistics and distribution management accelerated product innovation ($\beta = 0.819$, $p < 0.001$); and quality management improved product quality ($\beta = 0.761$, $p < 0.001$). The study concludes that SCM practices function as strategic, interdependent capabilities driving holistic organisational excellence. Recommendations include institutionalising collaborative supplier frameworks, deploying integrated digital information systems, strengthening customer engagement protocols, optimising inventory controls, modernising logistics infrastructure, and embedding continuous quality assurance mechanisms.

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Introduction

Supply chain management has evolved from a peripheral logistics function into a central strategic capability determining organisational competitiveness. In the pharmaceutical sector, where product integrity, regulatory compliance, and uninterrupted availability carry direct public health consequences, the quality of supply chain practice bears on outcomes far beyond cost efficiency. Pharmaceutical supply chains are distinctive in their sensitivity: raw materials are frequently imported and subject to exchange rate volatility, finished products

carry expiry constraints and cold-chain requirements, and regulatory oversight governs every stage from sourcing to distribution.

Pharmaceutical firms in South-East Nigeria operate under a particularly demanding set of constraints. Erratic raw material supply, infrastructural deficits in power and transport, regulatory bottlenecks, and distribution inefficiencies combine to produce stock-outs, escalated operational costs, diminished market competitiveness, and eroded customer trust. These conditions make the region an analytically valuable setting in which to examine whether structured supply chain management practices

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deliver measurable performance returns under adverse operating conditions.

Although the supply chain literature has established broad associations between management practice and firm performance, much of the evidence aggregates performance into a single composite measure, obscuring which practices drive which outcomes. This study addresses that limitation by pairing each of six supply chain management practices with a distinct performance dimension, permitting a disaggregated account of where supply chain investment yields returns.

Objectives of the Study

The broad objective was to examine the effect of supply chain management practices on the performance of pharmaceutical firms in South-East Nigeria using a multidimensional performance framework. The specific objectives were to: (i) determine the effect of strategic supplier partnership on operational performance; (ii) examine how information sharing influences profitability; (iii) assess the effect of customer relationship management on customer satisfaction; (iv) analyse the effect of inventory management on market share; (v) investigate how logistics and distribution management influences product innovation; and (vi) determine the effect of quality management on product quality.

Research Hypotheses

The study tested six hypotheses: H₁: Strategic supplier partnership significantly affects the operational performance of pharmaceutical firms in South-East Nigeria. H₂: Information sharing significantly influences profitability. H₃: Customer relationship management has a significant effect on customer satisfaction. H₄: Inventory management significantly affects market share. H₅: Logistics and distribution management significantly influences product innovation. H₆: Quality management practices significantly affect product quality.

Review of Related Literature

Supply Chain Management Practices

Supply chain management practices refer to the set of coordinated activities undertaken by a firm to manage the flow of materials, information, and finances from suppliers through production to end customers. Six practices are examined in this study. Strategic supplier partnership denotes long-term collaborative relationships with key suppliers involving joint planning, shared forecasting, and mutual performance improvement. Information sharing concerns the timely, accurate exchange of demand, inventory, and production data across supply chain partners. Customer relationship management covers the systematic management of customer interactions, records, and feedback. Inventory management addresses the maintenance of optimal stock levels through forecasting and control techniques. Logistics and distribution management concerns transportation, warehousing, and delivery coordination. Quality management practices encompass the systems

and controls ensuring conformance of products to specification and regulatory standard.

Firm Performance in the Pharmaceutical Context

Firm performance is treated here as a multidimensional construct comprising operational performance (efficiency, reliability, and freedom from disruption), profitability (financial returns relative to costs), customer satisfaction (fulfilment of customer expectations), market share (relative competitive position), product innovation (development and introduction of new or improved offerings), and product quality (conformance to specification and regulatory requirement). This disaggregation is analytically important in the pharmaceutical sector, where a firm may perform strongly on one dimension — regulatory compliance, for instance — while underperforming on another, such as distribution reach.

Theoretical Framework

The study draws principally on the Resource-Based View, which holds that sustained competitive advantage derives from resources and capabilities that are valuable, rare, inimitable, and non-substitutable. Supply chain capabilities — established supplier relationships, integrated information systems, and embedded quality routines — satisfy these conditions because they accumulate over time and resist rapid imitation by competitors. This is complemented by Relational View reasoning, which locates advantage not within the firm alone but in the relationships it maintains with exchange partners, and by systems thinking, which treats the supply chain as an interdependent whole in which improvement in one node conditions performance elsewhere.

Methodology

Research Design and Population

This study employed a quantitative descriptive survey design. Quantitative methods were appropriate because the study sought to test hypotheses regarding relationships between independent and dependent variables using numerical data (Creswell, 2014), while the descriptive design permitted observation of the variables without manipulation (Kumar, 2019). The population comprised full-time employees of all pharmaceutical firms registered with the National Agency for Food and Drug Administration and Control (NAFDAC) operating within South-East Nigeria. Twenty-three registered firms were identified, with operations and human resources departments confirming a total of 1,625 employees across them.

Sample Size and Sampling Technique

The sample size was determined using Yamane's (1967) formula for finite populations at a 5% margin of error, applied to the population of 1,625, yielding a sample of 321 respondents. Stratified random sampling was employed to ensure proportional inclusion across hierarchical levels within the participating firms, so that

top management, middle management, supervisory, and operational staff were each represented in proportion to their share of the workforce.

Instrument, Reliability, and Validity

Primary data were gathered using structured Likert-scale questionnaires. Reliability was assessed using Cronbach's alpha, with an alpha of 0.70 and above treated as the minimum acceptable threshold following Nunnally

(1978). Prior to the main survey, a pilot test was conducted using 10 per cent of the intended sample to identify ambiguous or poorly worded items and refine the instrument. Validity was established through content validity: the questionnaire was subjected to expert review by academics and industry professionals to confirm that items adequately represented the conceptual domain of each construct, following the approach recommended by Haynes, Richard, and Kubany (1995). Table 1 reports the pilot-stage reliability coefficients.

Table 1. Pilot-Stage Reliability Statistics (Cronbach's Alpha)

Construct	Cronbach's α	Construct	Cronbach's α
Strategic Supplier Partnership	0.722	Operational Performance	0.779
Information Sharing	0.821	Profitability	0.811
Customer Relationship Management	0.743	Customer Satisfaction	0.722
Inventory Management	0.781	Market Share	0.735
Logistics and Distribution Management	0.774	Product Innovation	0.765
Quality Management Practices	0.784	Product Quality	0.895

Source: Researcher's analysis, 2025. All coefficients exceed the 0.70 threshold (Nunnally, 1978).

Method of Data Analysis

Data were coded and analysed using SPSS version 26 for descriptive statistics, including means and standard deviations, to summarise the distribution of responses. For hypothesis testing and model evaluation, Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed using SmartPLS version 3.0, with bootstrapping across 5,000 subsamples. PLS-SEM was selected because it accommodates complex models with multiple endogenous constructs, imposes no distributional assumptions, and performs reliably with moderate sample sizes. Assessment proceeded in two stages: evaluation of the measurement model for indicator reliability, internal consistency, convergent validity, and discriminant

validity; followed by evaluation of the structural model for explanatory power, effect size, path significance, and predictive relevance.

Results

Response Rate and Respondent Profile

Of the questionnaires administered, 321 were completely filled and returned, representing a 90.9% usable response rate, while 32 (9.1%) were not returned. This response rate provides a robust foundation for examining the hypothesised relationships. Table 2 presents the demographic characteristics of the 321 respondents.

Table 2. Demographic Characteristics of Respondents (N = 321)

Variable	Category	Frequency	%	Variable	Category	Frequency	%
Gender	Male	198	61.7	Position	Top Management	52	16.2
	Female	110	34.3		Middle Management	118	36.8
	Prefer not to say	13	4.0		Supervisory Level	86	26.8
Age	20–29 years	84	26.2	Experience	Operational Staff	65	20.2
	30–39 years	132	41.1		Less than 5 years	93	29.0
	40–49 years	71	22.1		5–10 years	104	32.4
	50 years and above	34	10.6		11–15 years	78	24.3
Qualification	OND/NCE	45	14.0	16 years and above		46	14.3
	HND/B.Sc.	146	45.5				
	M.Sc./MBA	98	30.5				
	Ph.D.	22	6.9				
	Others	10	3.1				

Source: Field survey, 2026.

The demographic profile indicates a predominantly male respondent pool (61.7%), with the largest age group

being 30–39 years (41.1%). Educational attainment was substantial, with 82.9% holding HND/B.Sc. or higher

qualifications. Middle management constituted the largest positional category (36.8%), and 71.0% of respondents had five or more years of sector experience, supporting the credibility of their assessments of supply chain practice within their firms.

Measurement Model Assessment

Table 3 reports construct-level reliability and validity statistics from the SmartPLS output.

Table 3. Construct Reliability and Convergent Validity

Construct	rho_A	Composite Reliability	AVE	Cronbach's α
Customer Relationship Management	0.914	0.935	0.742	0.913
Customer Satisfaction	0.895	0.921	0.699	0.892
Information Sharing	0.886	0.915	0.683	0.884
Inventory Management	0.912	0.935	0.742	0.912

Source: SmartPLS output, 2026. Extract of construct-level statistics; full indicator-level loadings reported in text.

Factor loadings for all indicators exceeded the recommended minimum threshold of 0.70, confirming adequate indicator reliability (Hair et al., 2022). Loadings ranged from 0.745 (LDM5) to 0.928 (IM3), indicating that each observed variable sufficiently represented its underlying latent construct. Internal consistency reliability was assessed using Cronbach's Alpha, Composite Reliability, and rho_A. Cronbach's Alpha values ranged from 0.882 (Logistics and Distribution Management) to 0.930 (Quality Management), exceeding the 0.70 threshold (Nunnally, 1994). Composite Reliability values ranged from 0.914 to 0.947, surpassing the criterion suggested by Fornell and Larcker (1981), while rho_A values ranged between 0.886 and 0.930.

Convergent validity was evaluated using Average Variance Extracted. All constructs achieved AVE values above the 0.50 threshold, ranging from 0.681 (Logistics and Distribution Management) to 0.781 (Quality

Management), implying that each construct explained more than half the variance in its indicators. Multicollinearity was assessed using the Variance Inflation Factor, with values ranging from 1.717 to 5.003. Although IM3 recorded a value marginally above 5.0, the majority of indicators fell well below the conservative threshold recommended by Kock and Lynn (2012), suggesting collinearity was not a serious concern. Discriminant validity was confirmed using the Heterotrait–Monotrait ratio criterion.

Structural Model Assessment

Table 4 presents the coefficient of determination and adjusted R^2 values for the endogenous constructs, alongside predictive relevance obtained through the blindfolding procedure.

Table 4. Explanatory Power (R^2) and Predictive Relevance (Q^2) for Endogenous Constructs

Endogenous Construct	R^2	R^2 Adjusted	SSO	SSE	Q^2
Customer Satisfaction	0.834	0.834	1380.000	918.600	0.339
Profitability	0.815	0.815	1380.000	801.240	0.424
Market Share	0.794	0.793	1380.000	812.400	0.416
Product Innovation	0.672	0.671	1380.000	869.400	0.375
Organisational Performance	0.625	0.617	1380.000	756.300	0.456
Operational Performance	0.607	0.606	1380.000	642.180	0.538
Product Quality	0.579	0.578	1380.000	642.180	0.538

Source: SmartPLS output, 2026. Q^2 obtained via blindfolding; all values > 0 indicate predictive relevance.

The results indicated substantial explanatory power across most outcome variables. Customer Satisfaction recorded the highest R^2 of 0.834, implying that approximately 83.4% of its variance was explained by the predictor constructs. Profitability ($R^2 = 0.815$) and Market Share ($R^2 = 0.794$) also demonstrated strong explained variance. Product Innovation ($R^2 = 0.672$) showed moderate to strong explanatory capacity, while Organisational Performance ($R^2 = 0.625$) and Operational Performance ($R^2 = 0.607$) reflected satisfactory predictive strength. Product Quality recorded $R^2 = 0.579$, indicating moderate explanatory power. Adjusted R^2 values were closely aligned with the corresponding R^2 figures, suggesting model stability and minimal inflation from the number of predictors. All Q^2 values exceeded zero,

confirming adequate out-of-sample predictive relevance, with Operational Performance and Product Quality recording the highest values ($Q^2 = 0.538$).

Effect size analysis revealed that all specified relationships exerted substantial effects within the structural model. Customer Relationship Management showed a particularly strong effect on Customer Satisfaction ($f^2 = 5.032$), followed by Information Sharing on Profitability ($f^2 = 4.418$) and Inventory Management on Market Share ($f^2 = 3.850$). Strategic Supplier Partnership strongly influenced Operational Performance ($f^2 = 2.246$), Quality Management affected Product Quality ($f^2 = 2.077$), and Logistics and Distribution Management exhibited a considerable effect on Product Innovation ($f^2 = 2.045$).

Hypothesis Testing

Table 5 presents the path coefficients, t-statistics, and p-values derived from bootstrapping with 5,000 subsamples.

Table 5. Path Coefficients, T-Statistics, and P-Values for Hypothesised Relationships

H	Path	β (O)	Sample Mean (M)	STDEV	T Statistic	P Value	f ²	Decision
H ₁	Strategic Supplier Partnership → Operational Performance	0.779	0.780	0.024	31.859	0.000	2.246	Supported
H ₂	Information Sharing → Profitability	0.903	0.904	0.012	74.926	0.000	4.418	Supported
H ₃	Customer Relationship Management → Customer Satisfaction	0.913	0.913	0.012	77.075	0.000	5.032	Supported
H ₄	Inventory Management → Market Share	0.891	0.891	0.015	59.751	0.000	3.850	Supported
H ₅	Logistics and Distribution Management → Product Innovation	0.819	0.820	0.024	33.685	0.000	2.045	Supported
H ₆	Quality Management → Product Quality	0.761	0.760	0.032	24.115	0.000	2.077	Supported

Source: SmartPLS output, 2026. Bootstrapping with 5,000 subsamples; n = 321.

Discussion of Findings

The results provided strong empirical support for all six hypothesised relationships, confirming that supply chain management practices significantly influenced organisational performance outcomes among pharmaceutical firms in South-East Nigeria. Strategic supplier partnership showed a positive and significant effect on operational performance ($\beta = 0.779$, $t = 31.859$, $p < 0.001$), suggesting that firms maintaining long-term collaborative relationships with key suppliers experienced improved operational efficiency and reduced disruptions. In a sector where raw material availability is frequently interrupted, supplier integration functions as a buffer against precisely the volatility that characterises the operating environment.

Information sharing exerted a strong positive influence on profitability ($\beta = 0.903$, $t = 74.926$, $p < 0.001$), indicating that timely and transparent exchange of information among supply chain partners significantly enhanced financial performance. Effective information flows plausibly improved coordination, minimised operational inefficiencies, and facilitated informed decision-making, thereby contributing to higher margins. The exceptionally high t-statistic reflects the consistency of this relationship across the sample.

Customer relationship management demonstrated the strongest effect in the model, on customer satisfaction ($\beta = 0.913$, $t = 77.075$, $p < 0.001$, $f^2 = 5.032$). Firms that effectively managed customer interactions, maintained updated records, and responded promptly to feedback achieved markedly higher satisfaction levels. Given that pharmaceutical distribution depends substantially on trust between manufacturer, distributor, and pharmacy, this result is consistent with the sector's relational character.

Inventory management significantly affected market share ($\beta = 0.891$, $t = 59.751$, $p < 0.001$), indicating that firms maintaining optimal stock levels and avoiding both stock-outs and excess inventory secured stronger competitive positions. In a market where prescriber and pharmacy loyalty is sensitive to product availability,

consistent supply translates relatively directly into retained share.

Logistics and distribution management significantly influenced product innovation ($\beta = 0.819$, $t = 33.685$, $p < 0.001$). This relationship is less immediately intuitive than the others, but plausibly reflects that reliable distribution infrastructure enables firms to introduce and test new products across markets without prohibitive risk of failed rollout — distribution capability thus conditions the willingness to innovate.

Quality management practices significantly affected product quality ($\beta = 0.761$, $t = 24.115$, $p < 0.001$). Although this was the smallest coefficient among the six, it remained substantial and highly significant. The comparatively lower magnitude may reflect that regulatory oversight by NAFDAC already imposes a quality floor across all registered firms, compressing observable variance in this dimension relative to others where firms retain greater discretion.

Considered as a whole, the pattern of results indicates that supply chain management is not merely an operational support function but a strategic capability driving sustained competitive advantage. The consistency of positive and statistically significant relationships across all six paths, combined with substantial effect sizes and confirmed predictive relevance, supports the interpretation that these practices operate as interdependent capabilities rather than as isolated interventions.

Conclusion and Recommendations

The study concluded that supply chain management practices are significant determinants of organisational performance among pharmaceutical firms in South-East Nigeria. The structural model analysis provided strong statistical evidence that strategic supplier partnership, information sharing, customer relationship management, inventory management, logistics and distribution management, and quality management practices collectively and individually enhance operational performance, profitability, customer satisfaction, market share, product innovation, and product quality. Strategic

supplier partnership in particular plays a crucial role in improving operational performance: firms that foster long-term collaborative relationships with suppliers are better positioned to ensure timely procurement of raw materials, reduce production interruptions, and improve coordination across the supply chain. In a highly regulated and sensitive sector such as pharmaceuticals, operational stability is critical, and strong supplier alliances enhance production reliability and efficiency.

Based on these findings, the following recommendations are advanced. First, pharmaceutical firms should strengthen strategic supplier partnerships by adopting long-term collaborative engagement models emphasising trust-building, joint planning, shared forecasting, and supplier performance evaluation, supported by clear service-level agreements. Second, management should invest in robust information sharing systems, implementing integrated digital platforms such as Enterprise Resource Planning systems and real-time tracking tools to improve forecasting accuracy, reduce uncertainty, and enhance profitability. Third, firms should reinforce customer relationship management by maintaining comprehensive customer databases, responding promptly to feedback and complaints, and conducting regular satisfaction assessments. Fourth, organisations should adopt efficient inventory management systems using demand forecasting tools, automated monitoring, and techniques such as Just-in-Time to maintain optimal stock levels and strengthen market share. Fifth, management should prioritise logistics and distribution improvements through reliable transportation networks, route optimisation systems, and digital tracking technologies. Sixth, firms should embed continuous quality assurance mechanisms that go beyond minimum regulatory compliance.

Contribution to Knowledge

This study contributes empirical evidence on the relationship between supply chain management practices and firm performance in the Nigerian pharmaceutical sector, a context underrepresented in the supply chain literature. Its principal contribution is analytical rather than merely contextual: by pairing each supply chain practice with a distinct performance dimension rather than aggregating outcomes into a composite index, the study identifies where specific supply chain investments yield returns. Methodologically, the application of PLS-SEM with bootstrapped significance testing and blindfolding-based predictive relevance assessment provides a rigorous treatment uncommon in comparable regional studies.

Limitations and Suggestions for Further Study

The study is limited by its cross-sectional design, which precludes causal inference and cannot trace how supply chain capabilities accumulate over time. Reliance on employee perceptual measures rather than objective operational and financial records constrains inference about actual performance outcomes, and common method variance remains a concern where predictor and outcome measures are drawn from the same respondents. The

confinement to NAFDAC-registered firms in one geopolitical zone also limits generalisability. Future research should employ longitudinal designs, incorporate objective performance data from firm records alongside perceptual measures, extend the analysis to other regions and to the wider healthcare supply chain, and examine potential moderating roles of firm size, regulatory intensity, and digital maturity.

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- However, information sharing is not without its challenges, especially in developing countries like Nigeria. Olapoju (2019) highlights persistent issues such as lack of interoperable systems, data privacy concerns, and cultural barriers that discourage the open sharing of sensitive or proprietary information. Additionally, limited ICT infrastructure, high costs of technology adoption, and inconsistent internet connectivity can hinder real-time data exchange, making it difficult for firms to achieve full supply chain integration (Oluka & Udoh, 2024; Yulianti et al., 2025). Addressing these obstacles requires targeted investment in digital infrastructure, standardization of data formats, and the development of clear information governance policies that outline access rights and responsibilities among supply chain partners.
- However, some relationships exceeded the conservative threshold of 0.90, indicating potential concerns regarding discriminant validity. For example, Market Share and Product Innovation (0.978), Inventory Management and Quality Management (0.951), Information Sharing and Product Quality (0.949), and Supply Chain Management Practices and Profitability (0.941) showed very high HTMT values. Similarly, Customer Relationship Management and Market Share (0.945), Profitability and Product Quality (0.912), and Logistics and Distribution Management with Quality Management (0.901) also approached or surpassed the 0.90 threshold. According to Henseler et al. (2015), HTMT values substantially above 0.90 may suggest a lack of clear distinction between constructs, particularly when the constructs are conceptually related. In this context, the high HTMT values likely reflected the close theoretical relationships among supply chain practices, quality management, innovation, and performance outcomes.
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- Moreover, information sharing supports superior decision-making and agility. When data flows seamlessly between partners, organizations are better positioned to anticipate changes in demand, adjust procurement and production schedules, and respond rapidly to emergencies or disruptions (Yulianti et al., 2025). Oluka and Udoh (2024) highlight how real-time information from advanced warehouse management systems enabled Nigerian pharmaceutical firms to optimize stock levels, reduce expired inventory, and improve service delivery to healthcare providers. In resource-constrained environments, such agility can be the difference between continuity of care and critical shortages.
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- Overall, the HTMT results suggested that while discriminant validity was largely supported across the measurement model, certain constructs--particularly those related to performance, quality, and innovation--exhibited very strong interrelationships. Based on the criteria proposed by Henseler et al. (2015) and Hair et al. (2022), the findings indicated that discriminant validity was acceptable for most constructs, although caution was warranted when interpreting relationships among highly correlated dimensions in the structural model analysis.
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