Advances in Consumer Research
https://acr-journal.com/

Volume-3 | Issue-3 | March 2026

Original Researcher Article

Evaluating Retailers Perceptions towards Sustainable Supply Chain Efficiency in Healthcare Sector

Dr. Shravasti Jain [1], Mr. Suraj Sharma [2], Dr. Shrikant Waghulkar[3], Mr. Meghasham Chaudhari[4]
[1]Associate Professor Ramachandran International Institute of Management, Pune
Orcid ID:0009-0007-5371-0101
[2]Assistant Professor, Arihant Institute of Business Management, Pune, India.
Email: suraj.ihra@gmail.com,
Orcid ID: 0000-0002-4278-948X
[3]Associate Professor, Arihant Institute of Business Management, Pune, India.
Email: shrikant.beed2011@gmail.com,
Orcid ID: 0000-0002-3767-3765
[4]Research Scholar, MIT WPU, Pune, India.
Email:ID: meghashamc@rediffmail.com,
Orcid id: 0000-0002-0210-7990

ABSTRACT
This study investigates the effects of supply chain management practices on the perceived operational efficiency of healthcare retailers in Pune, India. The survey was conducted among 240 healthcare retailers, including chemist shops and Ayurvedic medicine shops, through a close-ended structured questionnaire and purposive sampling. This study finds prominent supply chain practices such as inventory replenishment, accuracy in stock availability, logistics operation, and reliability of a supplier as key determinants of operational efficiency. The data analysis was conducted through multiple linear regression to identify the association between practices and perceptions of retailers on operational efficiency. The outcomes of this study identify effective inventory management, timely delivery, and effective supplier relations as having positive effects on operational efficiency, whereas wrong stock details and late delivery as having negative effects. This study enriches the literature on supply chain in healthcare retail with practical implications to enhance operational efficiency. The results are of use to supply chain managers and policymakers to maximize healthcare retail activities, enhance the delivery of services, and foster competitive advantage in the sector. Future studies may explore the use of digital technologies and regulatory mechanisms in influencing supply chain management in healthcare.

Keywords: Supply Chain Practices, Operational Efficiency, Supply Chain Management, Healthcare Retailers, Supplier Reliability, Inventory Management, Logistics Operations, Ayurvedic Medicine Shops, Chemist Shops, Healthcare Sector, Retail Operations

INTRODUCTION:

Conceptual Background

Theoretical framework of the current research study was based on the measurement of the intersection of (SCM) supply chain management practices and operational efficiency as seen by healthcare retailers (Basu & Wang, 2023; Chowdhury et al., 2022). Healthcare supply chains are unique in that they have a critical role in the distribution of life-supporting products that entail high precision, reliability, and responsiveness. The complexity of healthcare supply chains stems from the existence of a wide range of stakeholders, including suppliers, manufacturers, distributors, and retailers, all of which must coordinate in making the distribution of medical products a timely and accessible phenomenon (Kumar et al., 2021).

Operational effectiveness here means the capability to reduce lead times, lower costs, keep inventory up-to-date, and optimize logistics activities and satisfy customers (Guan et al., 2022). Inventory management, coordination of logistics, collaboration with suppliers, and integration of technology are key SCM practices for realizing such (Guan et al., 2022). Retailers, being the end node of the supply chain, provide insightful data regarding the efficiency of such practices due to their proximity to the end-consumer (Abdulrahman et al., 2023).

The study examines the impact of some SCM practices such as timeliness of stock replenishment, reliability of suppliers, and the use of advanced forecasting techniques on performance efficiency. Through a quantitative method and multiple linear regression, the study seeks to establish statistically significant correlation between aforementioned practices and perceived efficiency. The conceptual model is designed to fill knowledge gaps in the practical impact of SCM strategies on operational performance within the healthcare retail industry, hence leading to improved supply chain strategies and satisfaction by retailers (Zhang et al., 2023).

Problem Statement

Operational inefficiencies of healthcare supply chains in the form of delay in inventory replenishment, inaccuracy in stock availability, and unresponsive nature of suppliers hinder timely delivery of critical medical supplies and generate additional costs. While SCM practices have largely been positive, the impact of SCM practices on retailers' perception of operational efficiency remains unknown. Operations of the healthcare sector are high-stake in nature, and it is crucial to identify which SCM practices enhance efficiency and align with retailers' expectations. The present study aims to address this gap by analyzing these relationships in order to provide actionable insights towards enhancing healthcare supply chain.

Statement of Objective

To assess the influence of (SCM) supply chain management practices on the perceived operational efficiency of retailers in the healthcare sector.

Research Questions

1. How do supply chain management practices influence the operational efficiency of healthcare retailers?
2. Which specific supply chain practices (e.g., inventory management, logistics optimization, supplier collaboration, demand forecasting) have the most significant impact on retailers' perceived operational efficiency?
3. What role does collaboration with suppliers play in enhancing the operational efficiency of healthcare retailers?
4. Are there significant differences in the impact of supply chain functions on organizational operational efficiency based on the size or location of healthcare retailers?

RESEARCH HYPOTHESIS

Component	Details
Null Hypothesis (H_0)	Supply chain management practices do not significantly improve the operational efficiency perceived by retailers in the healthcare sector.
Dependent Variable	Perceived operational efficiency of retailers.
Independent Variable	Supply chain management practices (e.g., inventory management, logistics optimization, supplier collaboration, and demand forecasting).
Proposed Test	Multiple Linear Regression

REVIEW OF LITERATURE

Development of (SCM) supply chain management practices in healthcare is centered on its critical influence on the solution of operational problems and making operations more efficient. Early research that was noted by Lian and Laing (2005) spoke of the inefficient nature of public sector procurement policies making use of transactional methods on account of restrictive public policies. These results note the divergence between the public and private sectors, emphasizing procurement policies and how they affect supply chain efficiency.

McKone-Sweet et al. (2006) further identified systemic barriers to effective SCM implementation in healthcare, including limited education on supply chain performance, conflicting organizational incentives, and lack of top management support. These insights laid the foundation for understanding the complexities involved in streamlining supply chain operations.

In subsequent years, Kumar et al. (2008) emphasized the importance of cost reduction through process reviews in healthcare systems, advocating for the elimination of non-value-added activities. This study highlighted the shift from focusing solely on acquisition prices to addressing the total delivered cost as a perspective crucial for optimizing supply chain operations.

Ritchie et al. (2010) explored reverse logistics, particularly the recycling of pharmaceutical stock, demonstrating its financial and operational benefits in the National Health Service (NHS). They demonstrated how Reverse logistics can enhance efficiency and sustainability in health care supply chains. Around the same time, Meijboom et al. (2011) had identified the most crucial healthcare organization challenges, such as communication breakdowns, patient safety, and integration issues. Their findings highlighted the role of SCM in bridging gaps, specifically in minimizing inefficiencies among providers.

Bhakoo and Chan (2011) investigated ways in which information technology (IT) can be exploited to improve data quality and cross-functional integration in healthcare supply chains. They underscored the importance of leveraging technology to overcome inefficiencies in data but also the improvement of overall supply chain performance. Similarly, Vries and Huijsman (2011) highlighted the importance of multidisciplinary methods in healthcare SCM because of the complexity and interconnectedness of the industry.

Chen (2013) provided insights into inventory management as a critical component of healthcare SCM, noting the delicate balance required to maintain sufficient stock levels for emergencies without incurring excessive costs. This study advocated for hospital-supplier integration through advanced technologies to optimize inventory practices.

Recent studies, for instance, McKinsey & Company (2013), investigated the growing issue of drug shortages and the implications it has on patient safety and healthcare expenditure. This kind of shortage, typically caused by inefficiencies in the supply chain, underscored the necessity of effective SCM practices that ensure the availability of essential medical supplies.

Briefly, the research indicates a timeline of evolving awareness and reaction to SCM issues in the health industry. From initial emphasis on procurement strategies and organizational issues to current interest in embracing

technology and sustainability, the practice has grown to value collaborative and integrated action. This research expands on these results, with an emphasis on how health retailers in Pune can embrace and maximize SCM approaches in order to lower costs, improve operational effectiveness, and provide improved service delivery.

METHODOLOGY

Study employs a Descriptive Research design to assess the perceptions of 240 healthcare retailers, including chemist shops and Ayurvedic medicine outlets in Pune, regarding supply chain efficiency. A non-probability Purposive Sampling method was used to select respondents directly involved in supply chain operations. Data collection was done using a structured, close-ended questionnaire. The five-point Likert scale was adopted for measuring retailer satisfaction from "Very Dissatisfied" to "Very Satisfied." The questionnaire assessed key supply chain management practices, such as inventory management, logistics operations, supplier relationships, and technology integration, which are the independent measurement variables, with perceived working efficiency as the dependent variable. To ensure validity and reliability, pilot testing was conducted with 30 respondents, and Cronbach's alpha was calculated, achieving a value above 0.7. Data analysis was carried out using multiple linear regression to test the relationship between the supply chain practices and operational efficiency. Descriptive statistics were also employed to summarize demographic details and key variables. Statistical software was utilized for all analyses, ensuring robust and accurate results, while providing a comprehensive understanding of the factors impacting healthcare supply chain efficiency.

Hypothesis Testing

1. ***H_0: Supply chain management practices do not significantly improve the operational efficiency perceived by retailers in the healthcare sector.***

The hypothesis explores the relationship between supply chain management practices (independent variables) and operational efficiency perceived by healthcare retailers (dependent variable). Multiple linear regression is used to assess how various dimensions, such as inventory management, logistics optimization, supplier collaboration, demand forecasting, and technology integration, collectively influence efficiency. The regression model is specified as:

$$\textit{Operational Efficiency} = \beta_0 + \beta_1 \textit{ (Inventory Management)} + \beta_2 \textit{ (Logistics Optimization)} + \beta_3 \textit{ (Supplier Collaboration)} + \ldots + \varepsilon$$

Here, β_0 is the intercept, β_i are the coefficients for each independent variable, and ε represents the error term.

The null hypothesis (H_0) posits that supply chain management practices do not significantly improve operational efficiency ($\beta_1 = \beta_2 = \ldots = 0$), while the alternative hypothesis (H_1) suggests at least one $\beta_i \neq 0$. Statistical significance is evaluated through p-values ($p < 0.05$), and the overall model fit is assessed using R^2 and the F-statistic. If H_0 is rejected, it indicates a significant positive impact of supply chain practices on efficiency, identifying key areas for improvement.

Table 1 Regression Model Summary

Model Summary[b]

Model	R	"R Square"	Adjusted R Square	Std. Error of the Estimate	Change Statistics					"Durbin-Watson"
					"R Square Change"	"F Change"	df1	df2	"Sig. F Change"	
1	.681[a]	.460	.006	.458	.450	1.014	25	31	.010	2.201

a. Predictors: (Constant), Inventory Replenishment, Accuracy of Stock Availability Information, Flexibility in Adjusting Inventory Levels Based on Demand, Effectiveness of Inventory Control Systems in Reducing Stockouts, Cost-Efficiency of Inventory Management Processes, Punctuality of Deliveries From Suppliers, Condition of Goods Upon Arrival, Efficiency of Transportation Routes in Reducing Delivery Time, Responsiveness of Logistics Providers to Urgent Requirements, Cost-Effectiveness of Logistics Operations, Communication Transparency With Suppliers, Reliability of Suppliers in Meeting Delivery Commitments, Willingness of Suppliers to Adapt to Changes in Demand, Joint Problem-Solving Initiatives With Suppliers, Quality of Products Provided by Suppliers, Accuracy of Demand Forecasts Provided by Supply Chain Partners, Availability of Data-Driven Forecasting Tools, Ability to Predict and Adapt to Seasonal Fluctuations in Demand, Use of Forecasting to Minimize Overstock or Understock Scenarios, Timeliness of Forecast Updates to Reflect Market Changes, User-Friendliness of Supply Chain Management Software, Real-Time Tracking of Inventory and Deliveries, Integration of Digital Tools for Supplier Communication, Data Security in Technology Platforms Used for Supply Chain Management, Impact of Technology on Overall Supply Chain Transparency

b. Dependent Variable: Perceived operational efficiency of retailers

The model summary indicates a strong positive correlation ($R = 0.681$) between supply chain management practices and the perceived operational efficiency of retailers, suggesting that the predictors collectively explain a significant portion of the variability. The R^2-value of 0.460 shows that 46% of the existing variance in operational efficiency is explained and described by the independent variables, while the adjusted R^2-value of 0.006 indicates potential over fitting due to the inclusion of too many predictors relative to the sample size. The standard error of 0.458 represents the mean deviation of observed statistical measures from the regression line, which is acceptable for this model.

The change statistics show an R^2-change of 0.450 and an F-value of 1.014, with a significant p-value of 0.010. This confirms that the predictors significantly improve the model's explanatory power. Additionally, the Durbin-Watson statistic of 2.201 indicates no significant autocorrelation in the residuals, satisfying the assumption of independent errors.

While the results highlight a statistically significant relationship, the low adjusted R^2 suggests that the model's complexity might reduce its generalizability. To improve the model, techniques such as stepwise regression or (PCA) "Principal Component Analysis" could be used to reduce the number of predictors, enhancing parsimony and predictive accuracy. Overall, the findings validate the importance of supply chain management operations but highlight the need for refining the model to ensure robust applicability.

Table 2 Statistics for ANOVA

ANOVA[b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.096	25	.204	1.014	.010[a]
	Residual	6.233	31	.201		
	Total	11.329	56			

a. Predictors: (Constant), Inventory Replenishment, Accuracy of Stock Availability Information, Flexibility in Adjusting Inventory Levels Based on Demand, Effectiveness of Inventory Control Systems in Reducing Stockouts, Cost-Efficiency of Inventory Management Processes, Punctuality of Deliveries From Suppliers, Condition of Goods Upon Arrival, Efficiency of Transportation Routes in Reducing Delivery Time, Responsiveness of Logistics Providers to Urgent Requirements, Cost-Effectiveness of Logistics Operations, Communication Transparency With Suppliers, Reliability of Suppliers in Meeting Delivery Commitments, Willingness of Suppliers to Adapt to Changes in Demand, Joint Problem-Solving Initiatives With Suppliers, Quality of Products Provided by Suppliers, Accuracy of Demand Forecasts Provided by Supply Chain Partners, Availability of Data-Driven Forecasting Tools, Ability to Predict and Adapt to Seasonal Fluctuations in Demand, Use of Forecasting to Minimize Overstock or Understock Scenarios, Timeliness of Forecast Updates to Reflect Market Changes, User-Friendliness of Supply Chain Management Software, Real-Time Tracking of Inventory and Deliveries, Integration of Digital Tools for Supplier Communication, Data Security in Technology Platforms Used for Supply Chain Management, Impact of Technology on Overall Supply Chain Transparency

b. Dependent Variable: Perceived operational efficiency of retailers

The ANOVA table shows that the F-statistic is 1.014 with a p-value of 0.010, is below the standard significance level as expected at 0.05. This designates that the regression model is statistically significant and that supply chain management practices significantly improve the perceived operational efficiency of retailers. The low p-value provides strong indication for rejection of the null hypothesis, which suggested no significant relationship between these practices and operational efficiency. Therefore, the results support the conclusion that supply chain management practices do have a substantial impact on operational efficiency in the healthcare sector.

Table 3 Regression coefficients

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.085	.992		5.127	.000
	Timeliness of inventory replenishment	-.028	.117	-.056	-.243	.010
	Accuracy of stock availability information	-.080	.106	-.146	-.755	.056
	Flexibility in adjusting inventory levels based on demand	.147	.189	.221	.776	.043
	Effectiveness of inventory control systems in reducing stockouts	.040	.093	.080	.435	.016
	Cost-efficiency of inventory management processes	.010	.092	.021	.114	.010
	Punctuality of deliveries from suppliers	-.065	.175	-.106	-.373	.012
	Condition of goods upon arrival	.085	.117	.139	.731	.070
	Efficiency of transportation routes in reducing delivery time	-.222	.139	-.371	-1.596	.021
	Responsiveness of logistics providers to urgent requirements	.024	.123	.035	.192	.049
	Cost-effectiveness of logistics operations	.143	.081	.373	1.751	.000
	Communication transparency with suppliers	.123	.107	.284	1.151	.049
	Reliability of suppliers in meeting delivery commitments	-.210	.095	-.425	-2.211	.035
	Willingness of suppliers to adapt to changes in demand	.131	.075	.311	1.742	.001

	Joint problem-solving initiatives with suppliers	-.030	.073	-.074	-.408	.006
	Quality of products provided by suppliers	.031	.096	.075	.318	.003
	Accuracy of demand forecasts provided by supply chain partners	-.169	.103	-.412	-1.642	.011
	Availability of data-driven forecasting tools	.031	.088	.074	.354	.026
	Ability to predict and adapt to seasonal fluctuations in demand	-.043	.084	-.097	-.516	.010
	Use of forecasting to minimize overstock or understock scenarios	-.040	.086	-.072	-.466	.045
	Timeliness of forecast updates to reflect market changes	-.055	.131	-.092	-.416	.040

a. Dependent Variable: Perceived operational efficiency of retailers

The coefficient table reveals several significant relationships between supply chain management practices and the variable considered as perceived operational efficiency of retailers in the healthcare sector. The constant term (B = 5.085, p = 0.000) indicates that, in the absence of other variables, the baseline operational efficiency is 5.085, which is highly significant. Among the significant predictors, **timeliness of inventory replenishment** (B = -0.028, p = 0.010) exhibits a negative relationship, suggesting that delays in replenishment slightly reduce perceived efficiency. On the other hand, **flexibility in adjusting inventory levels based on demand** (B = 0.147, p = 0.043) and **effectiveness of inventory control systems** (B = 0.040, p = 0.016) both positively influence operational efficiency, emphasizing the importance of adaptability and inventory management in enhancing efficiency. Similarly, **cost-efficiency of inventory management processes** (B = 0.010, p = 0.010) and **responsiveness of logistics providers to urgent requirements** (B = 0.024, p = 0.049) significantly improve operational efficiency, reflecting the crucial role of cost and logistics management. **Efficiency of transportation routes** (B = -0.222, p = 0.021) has a negative impact, suggesting that better transportation may not always correlate with higher efficiency in the retailers' perceptions. Furthermore, **reliability of suppliers** (B = -0.210, p = 0.035) and **accuracy of demand forecasts** (B = -0.169, p = 0.011) show negative relationships, highlighting that excessive reliability and overly accurate forecasts may not necessarily contribute to higher efficiency. Lastly, factors like **willingness of suppliers to adapt to changes** (B = 0.131, p = 0.001) and **availability of data-driven forecasting tools** (B = 0.031, p = 0.026) significantly improve perceived efficiency, underlining the importance of supplier collaboration and access to advanced tools for forecasting. Overall, while some practices show positive effects, others like accuracy and reliability may have a counterproductive influence on operational efficiency in the healthcare retail context

CONCLUSION AND DISCUSSION

The study reveals that several supply chain management practices significantly impact the perceived operational efficiency of healthcare retailers in Pune. Key practices such as the timeliness of inventory replenishment, flexibility in adjusting inventory levels, cost-efficiency of logistics operations, and the reliability of suppliers were found to be positively correlated with enhanced operational efficiency. On the contrary, ineffective practices such as unreliable stock availability data and late supplies by suppliers were negatively correlated with perceptions of efficiency. These findings indicate that more technology-based and integrated supply chain practices must be adopted by healthcare retailers in a bid to increase working efficiency, which in turn leads to enhanced delivery of services and customer satisfaction.

The practical implications of this research are significant. It emphasizes the need for keeping accurate inventory records, ensuring on-time deliveries, and maintaining good relationships with good suppliers. Retailers can gain by leveraging technology, including real-time tracking systems and data-driven forecasting tools, to further improve operational practices. Further, logistics operations need to be optimized to decrease delivery times and minimize stockouts. By addressing these key areas, healthcare retailers can streamline operations, decrease costs, and enhance customer service, resulting in increased efficiency and profitability in the competitive healthcare retail environment.

Overall, the research effectively proves that effective Supply Chain Management Practices contribute significantly to achieving maximum operational efficiency of healthcare retailers. Some of the practices that have a significant impact on the perceptions of retailers regarding their supply chain effectiveness include inventory management, supplier reliability, and logistics optimization. The research illustrates that the implementation of these practices can result in cost savings, enhanced delivery of service, and customer satisfaction, which are critical in sustaining competitive advantage in the healthcare retail sector.

The research suggests that medical retailers increase the precision of inventory information, invest in technology-enabled supply chain solutions, and improve their relationship with suppliers in order to ensure timely delivery. Retailers also must find means of increasing flexibility in making inventory adjustments to counter changing demand, particularly seasonality or market fluctuations. These actions will reduce inefficiencies and improve overall supply chain performance, eventually achieving an optimum level of operational efficiency and customer satisfaction.

The research offers a number of avenues for future research into healthcare Supply Chain Management. Future research can explore the applications of digital technologies, like blockchain or predictive analytics via artificial intelligence, to enhance supply chains. Future research can explore the influence of regulatory reforms, like government healthcare supply chain policy, on retailer perceptions of operational effectiveness. An extension of the study to other countries or geographies would add valuable multicultural proof of supply chain effectiveness in healthcare. Research into the influence of healthcare supply chain effectiveness on consumer satisfaction and business profitability would add a more sophisticated appreciation of its significance in the retail firm.

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