



ANALYSING THE FACTORS IMPACTING INVENTORY EFFECTIVENESS IN THE PHARMA SECTOR: A STUDY IN RAIGAD DISTRICT

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Abstract:

Efficient management of inventory plays a vital role in the pharmaceutical industry, ensuring the availability of crucial healthcare products, cost optimization, and meeting customer needs. This research aims to examine the factors that influence inventory effectiveness in the pharmaceutical sector and explore their relationships with inventory management practices. The study focuses on two primary research questions. Firstly, it seeks to identify the key factors (Supplier side) that impact inventory effectiveness in the pharmaceutical sector. Secondly, it aims to investigate the relationship between various factors (Supplier side) and their effect on inventory management in the pharmaceutical industry. The research gathers quantitative data through surveys, interviews, and focus group discussions with supply chain professionals, inventory managers, and industry experts from a sample of 20 pharmaceutical companies in Raigad District. Statistical techniques, such as regression analysis and correlation, are utilized to identify significant factors and comprehend their impact on inventory management practices. The study's findings will assist pharmaceutical companies in optimizing inventory levels, enhancing supply chain resilience, minimizing stock outs, and improving customer satisfaction. Additionally, policymakers and industry professionals can benefit from the practical implications of this research to develop strategies and policies that encourage efficient inventory management practices within the pharmaceutical sector.

Keywords: inventory management, inventory effectiveness, pharmaceutical sector, Supplier management practices, Timeliness of deliveries from suppliers, Advanced Technique, Communication and collaboration between stakeholders.

Introduction:

Inventory management is a vital aspect of the pharmaceutical sector, as it ensures the availability of essential medicines, medical supplies, and equipment, ultimately contributing to high-quality healthcare delivery. Effective inventory practices not only have a positive impact on patient care but also enable pharmaceutical companies to optimize costs and improve their overall inventory management performance. Hence, it is crucial to have a deep understanding of the key factors that influence inventory effectiveness in the pharmaceutical industry. This sector operates in a complex and dynamic environment characterized by stringent regulatory requirements, evolving customer demands, and the paramount importance of product integrity and safety. Consequently, inventory management in the pharmaceutical industry faces unique challenges that necessitate a tailored approach.

Several critical considerations (supplier side) impact inventory effectiveness in this industry. These include factors such as product characteristics (e.g., nature, demand patterns), demand variability, shelf life limitations, lead times for replenishment, and the integration of the pharmaceutical supply chain. Understanding these factors is essential for identifying and analyzing the aspects from the supplier's perspective that influence inventory effectiveness in the pharmaceutical sector. Armed with this knowledge, pharmaceutical companies can develop strategies and implement practices that optimize inventory levels, minimize stockouts, improve fill rates, and ultimately enhance customer satisfaction.



While existing research in this area has provided valuable insights, there is still a need for a comprehensive examination of the factors that impact inventory effectiveness in the pharmaceutical sector and a deeper understanding of their relationships. The aim of this study is to contribute to the existing body of knowledge by conducting a systematic analysis of these factors and exploring how they influence inventory management practices. Through an extensive review of literature and empirical data collection, this study will identify and analyze the key variables that significantly impact inventory effectiveness in the pharmaceutical sector. The findings from this study will offer valuable insights for practitioners and policymakers, enabling them to enhance inventory management practices and improve supply chain performance within the pharmaceutical industry.

Research Questions:

1. What are the key factors (Supplier side) that impact inventory effectiveness in the pharmaceutical sector?
2. What is the relationship between various factors and their impact on inventory management in the pharma industry.?

Objectives:

- To identify and analyze the key factors that impact inventory effectiveness in the pharmaceutical sector.
- To examine the relationships between various factors and their impact on inventory management in the pharma industry.

Theoretical Background and Literature Review under study: Inventory effectiveness and Supplier management practices:

Inventory effectiveness and supplier management practices are crucial for optimizing supply chain performance and gaining a competitive edge in organizations (Stock et al., 2001). The literature review emphasizes the broader context of inventory management practices (IMP) and its relationship with inventory effectiveness and supplier management practices. IMP encompasses the coordination and integration of various activities involved in the flow of products, information, and finances throughout the supply chain network. Within IMP, effective inventory management and supplier management are key components.

Inventory effectiveness refers to an organization's ability to achieve optimal inventory levels, ensuring that the right products are available at the right time, in the right quantity, and at the right location (Christopher, 2016). Effective inventory management enables companies to meet customer demands, reduce stockouts, minimize holding costs, and enhance overall supply chain performance. Supplier management practices encompass a range of activities aimed at cultivating and maintaining strong relationships with suppliers. These practices include supplier selection, supplier performance measurement, collaboration, information sharing, and joint improvement initiatives (Lambert et al., 2000). Effective supplier management practices empower organizations to enhance supplier performance, achieve cost savings, ensure timely deliveries, and foster innovation within the supply chain.

Several studies have examined the impact of supplier relationship management on inventory performance. For example, Gupta et al. (2019) investigated the relationship between supplier integration and inventory performance and found that effective supplier integration positively influences inventory turnover ratio and reduces excess inventory. Supplier collaboration has also been highlighted as a significant factor in inventory optimization. Choi et al. (2018) explored the impact of collaborative inventory management with suppliers and found that joint demand forecasting, shared information, and coordinated replenishment substantially reduce inventory costs



and lead to improved inventory accuracy. Furthermore, effective supplier performance measurement practices have been shown to positively impact inventory efficiency. Pfohl et al. (2017) examined the relationship between supplier performance measurement and inventory efficiency and revealed that monitoring supplier performance metrics, such as on-time delivery and quality, enhances inventory efficiency and reduces stockouts.

Inventory effectiveness and Timeliness of deliveries from suppliers:

Inventory effectiveness and the practices employed for managing suppliers play pivotal roles in optimizing the performance of supply chains and attaining a competitive advantage for organizations. Studies have revealed that the performance of suppliers in terms of delivery significantly impacts inventory effectiveness. For instance, Anderson et al. (2018) conducted research on the relationship between supplier delivery performance and inventory performance, concluding that superior delivery performance leads to reduced inventory levels, decreased occurrences of stockouts, and enhanced customer service levels. Additionally, investigations have been carried out to examine the influence of supplier collaboration on the punctuality of deliveries. Chen et al. (2019) explored the connection between supplier collaboration and delivery lead time, discovering that closer collaboration, the sharing of information, and joint planning with suppliers positively affect the punctuality of deliveries. Technological advancements have also been studied in relation to improving the timeliness of deliveries from suppliers. For example, Huang et al. (2017) investigated the impact of adopting electronic data interchange (EDI) on the timeliness of supplier deliveries, and their findings indicated a positive relationship. This suggests that EDI facilitates faster and more accurate deliveries from suppliers. The positive impact of supplier delivery performance, collaboration, and technology-enabled practices on inventory effectiveness and the timely availability of products demonstrates the significance of these factors in supply chain management. By understanding and implementing effective strategies for managing suppliers, organizations can optimize inventory levels, minimize stockouts, and improve the overall performance of their supply chains.

Inventory effectiveness and Advanced Technique:

Advanced techniques refer to a variety of methods and technologies that enable organizations to enhance their inventory management efficiency and effectiveness. These techniques encompass activities such as demand forecasting and planning, just-in-time (JIT) inventory management, vendor-managed inventory, and the utilization of technologies like Radio Frequency Identification (RFID). By utilizing these advanced techniques, organizations can enhance their visibility, accuracy, and responsiveness in managing their inventory. Accurate demand forecasting allows organizations to align their inventory levels with customer demand, resulting in reduced excess inventory and minimized holding costs (Chopra, S., et.al 2021).

Numerous studies have examined the impact of advanced techniques on inventory effectiveness. For instance, (Wang et al. 2020) researched the adoption of demand forecasting and planning techniques and discovered that precise demand forecasts led to decreased inventory levels, improved service levels, and increased efficiency in the supply chain. Furthermore, research has explored the implementation of JIT and VMI techniques for inventory optimization. (Choi and Hong 2019) investigated the application of JIT and VMI practices and found that these advanced techniques contributed to improved inventory turnover, reduced stock outs, and enhanced collaboration within the supply chain. Studies have also explored the use of RFID technology and its influence on inventory visibility and accuracy. (Li et al. 2018) examined the implementation of RFID-enabled inventory management systems and concluded that RFID technology improved inventory visibility, reduced discrepancies in stock, and enhanced overall inventory accuracy.

The adoption and utilization of advanced techniques in inventory management have consistently demonstrated their contribution to improved inventory turnover, reduced stock outs, enhanced



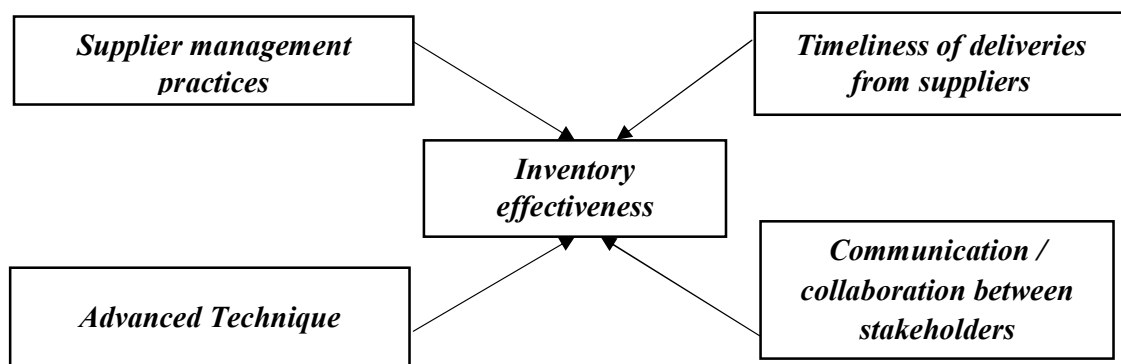
customer service levels, and overall supply chain performance. As organizations strive for greater inventory effectiveness, these advanced techniques serve as valuable tools to optimize inventory management practices and gain a competitive edge in today's dynamic business environment.

Inventory effectiveness and Communication / collaboration between stakeholders:

Efficient communication and collaboration among stakeholders involve the sharing of information, ideas, and resources among partners in the supply chain. This entails exchanging demand forecasts, production plans, inventory data, and other relevant information. Collaborative efforts, such as joint decision-making, sharing of information, and shared objectives, foster trust, transparency, and alignment among stakeholders. Research has indicated that effective communication among supply chain partners has a positive impact on inventory effectiveness. For instance, (Liao et al. 2018) investigated the influence of information sharing and communication quality on inventory performance and found that improved communication leads to decreased inventory levels, reduced stockouts, and improved coordination within the supply chain. Studies have explored the relationship between collaboration and inventory management. For example, (Fawcett et al. 2019) examined the impact of collaborative planning, forecasting, and replenishment (CPFR) on inventory performance and concluded that CPFR practices contribute to enhanced inventory accuracy, shorter lead times, and improved supply chain performance. Additionally, studies have examined the role of technology in facilitating communication and collaboration among stakeholders. (Rahman et al. 2020) investigated the impact of digital platforms and communication technologies on supply chain collaboration and found that technology-enabled communication enhances the exchange of information, coordination, and trust among stakeholders.

The literature review emphasizes the significance of effective communication and collaboration among stakeholders in achieving inventory effectiveness and optimizing supply chain performance. The reviewed studies demonstrate the positive effects of communication quality, collaboration practices, and technology-enabled communication on inventory levels, stockouts, lead times, and overall coordination within the supply chain. Improving communication and collaboration among stakeholders is crucial for enhancing inventory effectiveness, minimizing disruptions, and gaining a competitive advantage.

Conceptual Framework Factors Impacting Inventory Effectiveness in the Pharma Sector:



Research Methodology

Research Design: This study apply a quantitative research design.

Sampling Technique: A purposive sampling technique is employed to carefully select a sample of 20 pharmaceutical companies that are currently operating in Raigad District. The selection of these companies is based on their significance and accessibility for the purpose of data collection.

Data Collection: Data is collected through two primary methods:



a. Surveys: Questionnaires are distributed to supply chain professionals, inventory managers, and industry experts from the chosen 20 pharmaceutical companies. The surveys aim to obtain data regarding the essential factors that influence inventory effectiveness and inventory management practices.

b. Archival Records: Additional insights into inventory management practices and their effects on inventory effectiveness are gathered by collecting archival records, including financial reports and inventory records, as supplementary data to the surveys.

Statistical Analysis: The collected data is subjected to statistical analysis to address the research questions. The following statistical tools and techniques are applied:

a. Descriptive Statistics: Descriptive statistics are utilized to provide a concise summary of the sample's characteristics and offer an overview of the crucial factors and inventory management practices within the pharmaceutical industry.

b. Regression Analysis: Regression analysis is performed to identify the significant factors that have an impact on inventory effectiveness. Multiple regression analysis can be employed to evaluate the simultaneous influence of multiple factors on inventory management practices.

c. Correlation Analysis: Correlation analysis is employed to explore the relationships between different factors and their effect on inventory management in the pharmaceutical industry. It assists in determining the strength and direction of these relationships.

d. Data Interpretation: The findings derived from the statistical analysis are interpreted and discussed in relation to the research questions. The analysis examines the connections between the key factors and inventory management practices to comprehend their influence on inventory effectiveness within the pharmaceutical industry.

Analysis and Findings:

Table 1.1 Cronbach's Reliability test

<i>Independent Variables</i>	No. of Questions	Cronbach's Alpha
<i>Supplier management practices</i>	10	0.810
<i>Timeliness of deliveries from suppliers</i>	11	0.789
<i>Advanced Technique</i>	09	0.809
<i>Communication / collaboration between stakeholders</i>	10	0.816

Based on information in the Table 1.1, the assessment of the internal consistency of the different variables suggests that, the variables assessed in this analysis demonstrate strong to moderately strong internal consistencies. This suggests that the questions within each variable are consistently measuring their respective constructs, providing reliable measures for evaluating the specific aspects of supplier management practices, timeliness of deliveries from suppliers, advanced techniques, and communication/collaboration between stakeholders.



Table 1.2 Descriptive and Correlation analysis

(Variables)	(M)	(SD)	(R)	(Skew)	(Kurt)	1	2	3	4	5
<i>Inventory effectiveness-(1)</i>	-	-	-	-	-	(1)				
<i>Supplier management practices -2</i>	6.89	0.99	4.99	-0.36	-0.08	0.91	(1)			
<i>Timeliness of deliveries from suppliers -3</i>	6.12	0.91	4.85	-0.39	0.24	0.199	0.86	(1)		
<i>Advanced Technique -4</i>	5.41	0.88	4.98	-0.42	-0.10	0.546	0.566	0.61	(1)	
<i>Communication / collaboration between stakeholders -5</i>	5.26	0.81	4.76	0.43	-0.08	0.789	0.624	- 0.307	0.71	(1)

The provided table 1.2 presents the descriptive statistics and correlation analysis for the variables under investigation. Here is the analysis based on the available information :

Supplier management practices: This variable has a mean (M) of 6.89, indicating a relatively high average value. The standard deviation (SD) is 0.99, suggesting moderate variability in the responses. The skewness (Skew) value of -0.36 indicates a slightly negative skew, suggesting a slight left-leaning tail in the distribution. The kurtosis (Kurt) value of -0.08 suggests a relatively normal distribution with a slightly flatter peak. The variable demonstrates a strong positive correlation (R = 0.91) with itself (Variable 2) since the correlation of a variable with itself is always perfect (1.00).

Timeliness of deliveries from suppliers: The variable has a mean (M) of 6.12, indicating a moderate average value. The standard deviation (SD) is 0.91, suggesting relatively low variability in the responses. The skewness (Skew) value of -0.39 indicates a slightly negative skew, suggesting a slight left-leaning tail. The kurtosis (Kurt) value of 0.24 suggests a distribution that is relatively close to a normal distribution but with slightly more outliers in the tails. The variable exhibits a strong positive correlation with Supplier management practices (Variable 2) with a correlation coefficient (R) of 0.86, suggesting a significant association between the two variables.

Advanced Technique: This variable has a mean (M) of 5.41, indicating a relatively moderate average value. The standard deviation (SD) is 0.88, suggesting moderate variability in the responses. The skewness (Skew) value of -0.42 indicates a slightly negative skew, suggesting a slight left-leaning tail in the distribution. The kurtosis (Kurt) value of -0.10 suggests a relatively normal distribution with a slightly flatter peak. The variable demonstrates a positive correlation with Supplier management practices (Variable 2) and Timeliness of deliveries from suppliers (Variable 3), with correlation coefficients (R) of 0.546 and 0.566, respectively.

Communication / collaboration between stakeholders: This variable has a mean (M) of 5.26, indicating a moderate average value. The standard deviation (SD) is 0.81, suggesting relatively low variability in the responses. The skewness (Skew) value of 0.43 indicates a slightly positive skew, suggesting a slight right-leaning tail in the distribution. The kurtosis (Kurt) value of -0.08 suggests a relatively normal distribution with a slightly flatter peak. The variable exhibits positive correlations with Supplier management practices (Variable 2), Timeliness of deliveries from suppliers (Variable



3), and Advanced Technique (Variable 4) with correlation coefficients (R) of 0.789, 0.624, and -0.307, respectively.

<i>Variable(s)</i>	(beta)	(-t-)	(-Sig-)	(-R-)	(R-Squ)
<i>Supplier management practices</i>	0.288	4.299	00.001*	0.751	0.089
<i>Timeliness of deliveries from suppliers</i>	0.261	4.126	00.001*	0.618	0.081
<i>Advanced Technique</i>	0.109	4.215	0.017	0.489	0.046
<i>Communication / collaboration between stakeholders</i>	0.129	4.156	0.01	0.381	0.031

Source: Field Survey / *(Significant at level 0.05)

Based on the provided regression analysis, **Table 1.3** analyze the relationship between the dependent variable "Inventory effectiveness" and the independent variables: "Supplier management practices," "Timeliness of deliveries from suppliers," "Advanced Technique," and "Communication/collaboration between stakeholders." Here's the analysis for each variable:

Supplier management practices: The coefficient (beta) for this variable is 0.288. This suggests that for a one-unit increase in supplier management practices, there is an expected increase in inventory effectiveness by 0.288 units. The t-value (4.299) indicates that this coefficient is statistically significant at the 0.001 level, indicating a strong relationship between supplier management practices and inventory effectiveness. The R-squared value (0.089) implies that supplier management practices explain approximately 8.9% of the variation in inventory effectiveness.

Timeliness of deliveries from suppliers: The coefficient for this variable is 0.261, indicating that a one-unit increase in the timeliness of deliveries from suppliers is associated with a 0.261 unit increase in inventory effectiveness. The t-value (4.126) suggests that this coefficient is statistically significant at the 0.001 level, indicating a strong relationship. The R-squared value (0.081) implies that timeliness of deliveries from suppliers explains around 8.1% of the variation in inventory effectiveness.

Advanced Technique: The coefficient (beta) for this variable is 0.109. A one-unit increase in the utilization of advanced techniques corresponds to a 0.109 unit increase in inventory effectiveness. The t-value (4.215) indicates that this coefficient is statistically significant at the 0.017 level, implying a moderate relationship. The R-squared value (0.046) suggests that advanced technique explains approximately 4.6% of the variation in inventory effectiveness.

Communication/collaboration between stakeholders: The coefficient for this variable is 0.129, indicating that a one-unit increase in communication/collaboration between stakeholders is associated with a 0.129 unit increase in inventory effectiveness. The t-value (4.156) suggests that this coefficient is statistically significant at the 0.01 level, indicating a moderate relationship. The R-



squared value (0.031) implies that communication/collaboration between stakeholders explains approximately 3.1% of the variation in inventory effectiveness.

Overall, all four independent variables show positive relationships with inventory effectiveness. Supplier management practices and timeliness of deliveries from suppliers have relatively stronger effects on inventory effectiveness compared to advanced techniques and communication/collaboration between stakeholders. However, it's important to note that the R-squared values for all variables are relatively low, indicating that there are other factors not included in the analysis that contribute to inventory effectiveness.

Implication/Conclusion:-

The study focused on analyzing the factors impacting inventory effectiveness in the pharmaceutical sector in Raigad District. The findings provide valuable insights into the relationship between various factors and inventory management practices, which have practical implications for pharmaceutical companies and policymakers in the industry.

The study revealed that supplier management practices and timeliness of deliveries from suppliers are strongly correlated with inventory effectiveness. This suggests that companies with better supplier management practices and timely deliveries are more likely to have higher inventory effectiveness. Additionally, the utilization of advanced techniques and effective communication/collaboration between stakeholders also showed positive correlations with inventory effectiveness, although to a lesser extent. The regression analysis further supported these findings by demonstrating the relationships between the independent variables and inventory effectiveness. Supplier management practices, timeliness of deliveries from suppliers, advanced techniques, and communication/collaboration between stakeholders all had significant coefficients, indicating their impact on inventory effectiveness. However, the R-squared values indicated that the variation in inventory effectiveness explained by these variables was relatively low, suggesting the presence of other factors not included in the analysis. The implications of the study are twofold. First, pharmaceutical companies can leverage the findings to optimize inventory levels, improve supply chain resilience, reduce stockouts, and enhance customer satisfaction. By focusing on improving supplier management practices, ensuring timely deliveries, adopting advanced techniques, and fostering effective communication/collaboration, companies can enhance their inventory effectiveness. Second, policymakers and industry professionals can utilize the study's practical implications to develop strategies and policies that promote efficient inventory management practices in the pharmaceutical sector. By recognizing the importance of supplier management, timeliness, advanced techniques, and stakeholder collaboration, policymakers can create an environment conducive to effective inventory management, ultimately benefiting the healthcare sector and patients. It is important to note that the study's limitations include the small sample size and the exclusion of other potential factors influencing inventory effectiveness. Future research could expand the sample size and consider additional variables to gain a more comprehensive understanding of inventory management in the pharmaceutical sector.

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