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A STUDY ON INVENTORY MANAGEMENT IN AXA PARENTERALS LTD

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ABSTRACT

This study investigates the inventory management practices at AXA Parenterals Ltd., a pharmaceutical company specializing in sterile injectable products. Effective inventory control is critical in the pharmaceutical sector to ensure the availability of life-saving drugs while minimizing wastage and storage costs. The study analyzes the current inventory systems, evaluates challenges such as overstocking, stockouts, and expiry management, and explores the integration of technology in streamlining inventory operations. Data was collected through on-site observations, interviews, and analysis of inventory records. The research aims to recommend best practices to enhance operational efficiency, reduce carrying costs, and improve supply chain responsiveness.

Keywords:
Inventory Management, Pharmaceutical Industry, Supply Chain, AXA Parenterals Ltd.

INTRODUCTION

AXA Parenterals Ltd. is an Indian pharmaceutical company established in 2005, specializing in sterile parenteral preparations and hospital products. Headquartered in Delhi, it operates a WHO-GMP certified manufacturing facility in Roorkee, equipped with advanced Form-Fill-Seal technology. The company also has a subsidiary, Heilsa Life Sciences, focused on injectable vials and ampoules. AXA exports to over 60 countries and holds certifications from global regulatory authorities. In FY 2024, it reported revenue of ₹218 crore, with a healthy profit margin and about 31% revenue from exports. The company employs over 300 people and maintains a strong presence in African, CIS, and Southeast Asian markets.

Its plays a significant role in the pharmaceutical industry by ensuring the availability of high-quality, life-saving injectable medicines both in India and internationally. Its advanced manufacturing capabilities and adherence to global regulatory standards make it a trusted partner for healthcare providers worldwide. By exporting to over 60 countries and contributing to affordable healthcare solutions, AXA supports global public health initiatives, especially in developing nations. The company's consistent growth and innovation in sterile formulations further underline its importance in the pharma sector.

The pharmaceutical industry plays a vital role in both the economy and society by driving healthcare innovation, improving life expectancy, and generating employment. It contributes significantly to GDP through manufacturing, research, and exports, especially in countries like

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India, which is known as the "pharmacy of the world." Socially, the industry ensures the availability of affordable and essential medicines, helping to control and prevent diseases on a global scale. It also supports public health systems, particularly in low- and middle-income countries, by making critical drugs accessible. Moreover, it fuels scientific advancement and strengthens healthcare infrastructure, which are key to long-term societal development. Inventory management is a critical function in the pharmaceutical industry, ensuring the availability of life-saving medicines while minimizing costs and waste. AXA Parenterals Limited, a WHO-GMP accredited company based in Roorkee, Uttarakhand, specializes in sterile parenteral preparations and exports to over 61 countries. Effective inventory management is essential for such companies to balance stock levels, manage expiration dates, and comply with regulations. This study explores inventory management practices, focusing on AXA Parenterals Limited, to identify strategies for operational improvement. The research aims to provide actionable insights for pharmaceutical companies operating in India's diverse market.

LITERATURE REVIEW

Lim and Wang (2017) introduce a target-oriented robust optimization approach to inventory management, addressing uncertainties in demand and supply. Their model seeks to achieve desired performance targets rather than simply minimizing costs. By incorporating robustness into traditional inventory models, they enhance decision-making under uncertainty. The authors demonstrate how their approach offers better trade-offs between service level and cost. They compare their model with conventional optimization techniques, showing improved performance. This study contributes to the literature by bridging robust optimization and inventory target-setting in complex environments.

Alawneh and Zhang (2018) examine inventory management in a dual-channel supply chain with stochastic demand. Their study focuses on coordinating warehouse operations between online and offline sales channels. They develop a mathematical model that captures the interactions and uncertainties within both channels. The research emphasizes optimal inventory allocation strategies to reduce total system costs. Simulation results highlight the effectiveness of dynamic coordination policies under demand variability. This work extends traditional inventory models by integrating multi-channel retailing and uncertainty.

Ahmadini et al. (2021) propose a multi-objective optimization model for sustainable green supply chain management in inventory and production. The model incorporates environmental and economic objectives, balancing cost efficiency with ecological impact. They employ advanced optimization techniques to handle conflicting goals and system complexities. The study emphasizes the integration of sustainability into traditional supply chain models. Results show improved performance in both cost reduction and environmental compliance. This research enriches the field by promoting green practices in supply chain optimization.

Shafiee et al. (2021) develop a robust multi-objective optimization model for inventory and production management with a focus on environmental and social factors. Their model is applied to a real-world case in the dairy industry, enhancing practical relevance. The study integrates sustainability into supply chain decisions by considering emissions, waste, and social

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responsibilities. It uses robust optimization to manage uncertainty while achieving balanced performance. Results indicate significant improvements in both operational efficiency and sustainability goals. This work contributes by aligning production planning with sustainable development principles.

Sun (2020) presents a comprehensive review of multi-echelon inventory control within supply chain systems. The paper categorizes various inventory control models based on echelon structure, coordination, and demand characteristics. It highlights the importance of information sharing and integration across supply chain levels. The review also identifies challenges such as lead time variability and demand uncertainty. Emphasis is placed on the role of advanced technologies in improving inventory coordination. This study offers valuable insights for developing efficient and responsive multi-echelon inventory systems.

Hooshangi-Tabrizi et al. (2022) propose a two-stage robust optimization model for managing perishable inventory under uncertainty. The model allows order modifications to adapt to demand fluctuations, enhancing flexibility. It addresses the challenges of perishability, such as spoilage and limited shelf life. The study emphasizes robustness in decision-making to reduce risk and waste. Computational results show improved service levels and reduced costs compared to traditional methods. This work contributes by integrating robustness and adaptability in perishable inventory systems.

Giallombardo et al. (2021) present an integrated model for managing the harvest, storage, and distribution of perishable crops. The study introduces two mathematical models: one for single-supplier optimization and another facilitating horizontal collaboration among agri-companies. These models aim to minimize waste and operational costs by coordinating production and distribution activities. The research addresses challenges in perishable supply chains, such as product spoilage and delivery timeliness. Computational experiments validate the models' effectiveness in real-life scenarios. This work contributes to sustainable agricultural logistics by enhancing decision-making processes.

Sajadi and Ahmadi (2022) propose an integrated optimization model addressing assortment planning, shelf space allocation, and inventory management for perishable products. The model considers demand dependencies on shelf space and customer substitution behaviors, aiming to maximize sales and profits while accounting for supplier selection and procurement costs. Due to the NP-hard nature of the problem, the authors employ metaheuristic algorithms—genetic algorithm (GA) and vibration damping optimization (VDO)—to solve large-scale instances effectively. A real-world case study validates the model's applicability and efficiency. This research contributes to retail operations by integrating key decision areas in managing perishable goods.

San-José et al. (2022) develop an inventory model with time-varying demand and partial backordering. The model incorporates discrete inventory cycles and a power function for demand variation. It considers multiple costs, including ordering, holding, and lost sales, to maximize profit. Partial backordering reflects realistic customer behavior during stock outs.

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The authors use a nonlinear optimization approach to derive optimal inventory policies. This study advances inventory theory by integrating demand variability with discrete cycle planning.

Sebatjane and Adetunji (2021) develop a model for optimal lot-sizing and shipment decisions in a three-echelon supply chain for growing items. The model considers inventory level- and expiration date-dependent demand, reflecting realistic consumer behavior. It incorporates item mortality at the farming level and age-dependent deterioration at the retail level. A policy allowing non-zero ending inventory with clearance sales is proposed to enhance profitability. The study integrates farming, processing, and retail operations for perishable goods.

Teerasoponpong and Sopadang (2022) propose a decision support system (DSS) for sourcing and inventory management in small and medium-sized enterprises (SMEs). The system integrates artificial neural networks and genetic algorithms to manage uncertainties in raw material demand, pricing, and lead times. It assists SMEs in selecting suppliers and determining optimal order quantities. A case study in the food industry demonstrated that the DSS reduced raw material costs by 51.62% and inventory holding costs by 54.24%. This research highlights the potential of AI-driven tools to improve decision-making in SMEs. The study emphasizes the value of advanced systems in optimizing supply chain operations.

This review examines contemporary research on supply chain management, inventory optimization, and emerging technologies in logistics, highlighting their impact on operational efficiency, sustainability, and crisis responsiveness. The studies collectively emphasize the growing role of machine learning, blockchain, and mathematical modeling in managing uncertainties and improving demand forecasting. Key insights include the significance of accurately modeling uncertainty during crises (Dhanesvar, 2023), the potential of micro-blockchain for decentralized trust systems (Chen, 2023), and the enhanced performance of machine learning in forecasting for specific supply networks (Kmiecik, 2023). Integration of deep learning into inventory systems (Setty, 2022) and the use of advanced optimization algorithms (Hooshangi & Bhuiyan, 2022) have been shown to increase efficiency and responsiveness.

Limited research exists on inventory management practices for mid-sized pharmaceutical companies in India, particularly those exporting globally. Most studies focus on large multinational corporations or generic supply chain models, overlooking the unique challenges faced by mid-sized firms like AXA Parenterals Limited, such as balancing export-driven demand with domestic supply needs.

RESEARCH METHODOLOGY

This study is essential to address the lack of research on inventory management practices in mid-sized pharmaceutical companies like AXA Parenterals Limited. Unlike large multinational firms, these companies face unique challenges in balancing export-driven demand with domestic supply needs while ensuring compliance and cost-effectiveness. By analyzing inventory strategies such as ABC analysis and turnover ratios, the study aims to provide practical insights that can improve

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stock control, minimize wastage, and enhance operational efficiency. This research is particularly relevant for similar firms navigating the complexities of the global pharmaceutical market.

The scope of this study is confined to analyzing inventory management practices within the Indian pharmaceutical sector, specifically focusing on AXA Parenterals Limited. It examines the company's inventory handling techniques, such as ABC analysis and inventory turnover, during the period from 2020 to 2025. The study emphasizes the operational and financial impact of inventory strategies on a mid-sized pharmaceutical firm engaged in global exports. It aims to offer relevant insights that can be applied to similar companies seeking to optimize inventory efficiency and regulatory compliance in a competitive market.

OBJECTIVES OF THE STUDY

- To evaluate inventory management practices in the pharmaceutical sector.
- To analyze the financial impact of inventory on AXA Parenterals Limited using a sample balance sheet.
- To recommend strategies for improving inventory efficiency

This study follows a case study research design, focusing on AXA Parenterals Limited to analyze its inventory management practices in detail. The approach allows an in-depth examination of the company's strategies related to stock control, financial performance, and operational efficiency. Key techniques such as ABC analysis and inventory turnover ratio are utilized to evaluate inventory trends. The study relies on secondary data from financial reports, audit documents, and industry publications, offering a structured framework to assess real-world inventory challenges in the pharmaceutical sector.

This study relies on secondary data obtained from company annual reports, financial statements, audit reports, and relevant industry reports. Additional financial data may be collected from company websites, stock market reports, and government publications.

Inventory management requires robust data analysis to optimize stock levels and ensure operational efficiency Data analysis focuses on evaluating inventory performance over a five-year period.

ABC Analysis is used to classify inventory based on consumption and value. Inventory Turnover Ratio measures how frequently inventory is used or sold. Data is sourced from secondary materials like reports and official publications. These techniques help identify inefficiencies and areas for improvement. The goal is to support informed decision-making and operational efficiency.

DATA ANALYSIS AND INTERPRETATION

ABC Analysis

Most important technique widely used for the inventory management that when to order, at which level to order, how much quantity to order.

A- Life-Saving Injectables

B - Standard IV Fluids

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C - Packaging Materials

Table 1 ABC Analysis technique followed in the organisation

Financial year	Life-saving injectables (%)	Standard iv fluids (%)	Packaging materials (%)
2019-2020	72	19	9
2020-2021	70	23	7
2021-2022	72	20	8
2022-2023	73.3	18.4	8.3
2023-2024	81.2	13.4	5.4

Source: Secondary Data

Table 1 shows life-saving injectables: High-value, critical medicines requiring strict control. Their share increased from 72% in 2019-2020 to 81.2% in 2023-2024, indicating a strategic focus on high-value products, likely due to export demand (AXA exports to 61 countries) or a shift to specialized injectables. Standard IV Fluids: Medium-value items like saline and dextrose solutions. Their share decreased from 19% to 13.4% over the same period, suggesting reduced focus, possibly due to streamlined production or outsourcing. Packaging Materials: Low-value, high-volume items like vials, syringes, and labels. Their share dropped from 9% to 5.4%, reflecting efficient inventory management, likely through bulk purchasing or standardization.

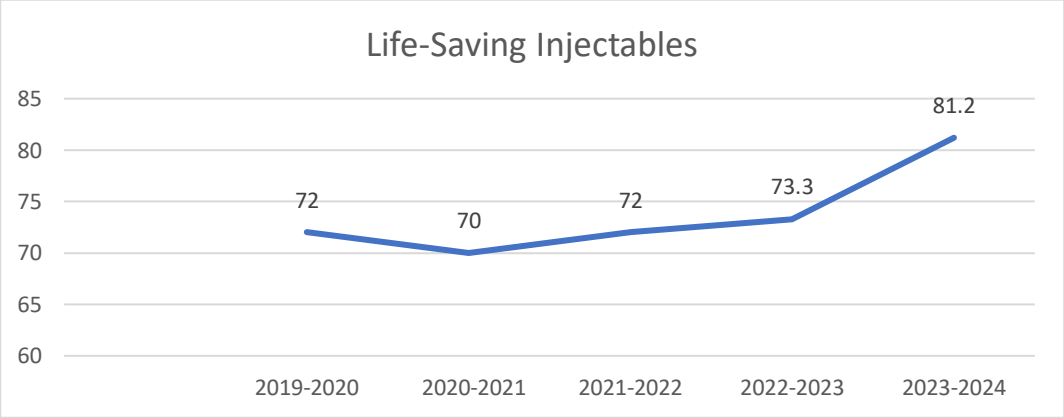

Figure 1 ABC Analysis technique followed in the organization

From the above figure 1 reveals Life-Saving Injectables: High-value items rose from 72% (2019-2020) to 81.2% (2023-2024), showing a focus on critical medicines, likely due to export demand Standard IV Fluids: Medium-value items dropped from 19% (2019-2020) to 13.4% (2023-2024), indicating less focus, possibly from streamlined production Packaging Materials: Low-value items fell from 9% (2019-2020) to 5.4% (2023-2024), reflecting efficient management, likely via bulk purchasing.

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2. Inventory Turnover ratio

A ratio which measures the number of times that a firm inventory is sold during the year. Inventory or stock turnover is measured in terms of ratio of the use of materials consumed to the average inventory during the period. High ratio indicates that the material is a fast moving one, when the ratio is low it indicates that material did not goes up to the desirable item.

Table 2 Inventory Turnover Ratio

Year	ITR
2019-2020	**2.07**
2020-2021	**0.87**
2021-2022	**0.82**
2022-2023	**1.2**
2023-2024	**0.57**

Source: Secondary Data

Table 2 shows that the inventory turnover ratio (ITR) shows how often a company sells and replaces its inventory in a year. For AXA Parenterals Limited, the ITR started at 2.07 in 2019-2020, which is typical for pharmaceuticals (2-4 times yearly). It then dropped sharply to 0.87 in 2020-2021, possibly due to COVID-19 disruptions, and continued to decline to 0.82 in 2021-2022. There was a slight recovery to 1.2 in 2022-2023, but it fell again to 0.57 in 2023-2024, the lowest point, suggesting slow inventory turnover**.**

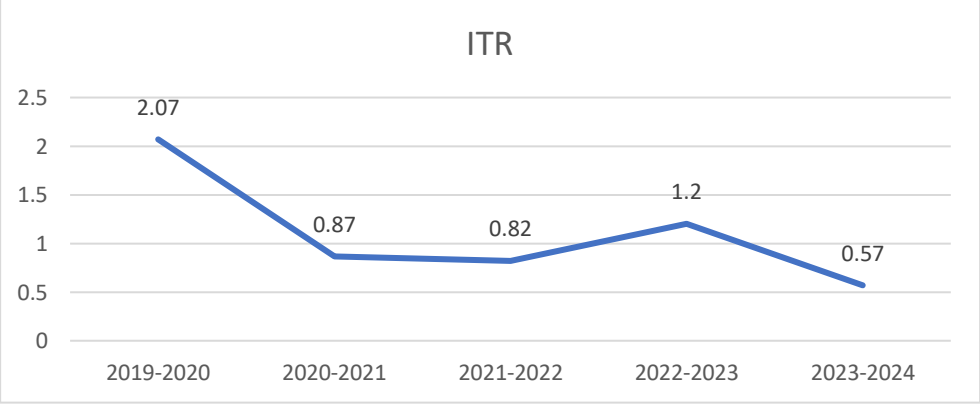

Figure – 2 Inventory Turn Over Ratio

Figure 2 reveals that it is clearly states that the Inventory turnover Ratio is higher in the 2019-2020 than the other years and in the year 2022-2023 is also increased to 1. More than 1 represents the company is selling and making the ordering time perfectly and the materials consumed is in the good state and for the year 2019-2020 and in the year 2021-2022 is above 1, and so that the materials consumption and the management of inventory is not that much good state. In the year 2023-2024, the Inventory turnover ratio is 0.57 and it shows that the inventory system is not in a

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good state because it is not nearer to the 1 and it shows that the inventory monitoring and controlling is not in a good state. It is suggested to make the control and monitor the inventory in the company.

ANALYSIS OF FINDINGS

From ABC Analysis, it founds that material Life-Saving Injectables is consumed higher in the 2022-2023 year and in the same year oxygen and electrode paste consumption is lower than the other years. From the ABC Analysis, it is found that the material consumption of Standard IV Fluids is higher in the year of 2020-2021. From the inventory turnover ratio, it is found that the ratio levels are not in a gradual manner and in the year 2019-2020 only the ratio is higher and it is higher than 1. In the year 2023-2024,the inventory turnover ratio is drastically very low compared to the previous years and it does not nearer to 1. In the year 2021-2022, the ratio is also increased to the1and only these 2 years performs the ratio which is higher than 1 and remaining years are lesser than 1.

RECOMMENDATIONS

Managers

To improve inventory efficiency, AXA Parenterals Ltd. should implement a robust inventory management system with barcode/RFID tracking to ensure traceability and reduce human error. Managers should enforce FEFO/FIFO principles to prevent losses due to expired stock, especially critical in pharmaceutical operations. Regular cycle counts and audits must be conducted to maintain accuracy and regulatory compliance. Adopting ABC/XYZ analysis will help prioritize high-value and sensitive items. Additionally, optimized storage conditions and staff training are essential for maintaining product quality and GMP standards.

Policy Makers

Policymakers should encourage the adoption of digital inventory systems in pharmaceutical companies to ensure transparency, traceability, and regulatory compliance. Mandating FEFO/FIFO practices and regular audits can minimize wastage and enhance drug safety. Support for local manufacturing and supply chain resilience policies can reduce dependency on imports for critical raw materials. Incentives for training programs in Good Manufacturing Practices (GMP) and inventory handling will strengthen workforce competency. Lastly, promoting public-private partnerships in logistics and warehousing can help streamline inventory flow, especially for essential and emergency medicines.

Industry Development

To enhance inventory management at AXA Parenterals Ltd., it's recommended to adopt an advanced inventory management system integrated with barcode or RFID tracking for real-time monitoring and traceability. Implementing ABC/VED analysis and maintaining optimal safety stock can improve control and reduce stockouts. FEFO-based expiry management, regular cycle counting, and digital compliance with GMP/FDA norms are essential for operational efficiency. Industry-wide, digitization of the supply chain, standardization of inventory practices, data-driven demand forecasting, and eco-friendly waste management should be prioritized. Collaborative

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warehousing, supplier partnerships, and continuous workforce training can further support sustainable growth and regulatory excellence in the pharmaceutical sector.

Scholarly Contribution

Scholarly contributions should focus on developing innovative inventory optimization models tailored for pharmaceutical manufacturing under strict regulatory frameworks. Research can explore the integration of AI and IoT for predictive inventory management, cold chain monitoring, and expiry control. Case studies from companies like AXA Parenterals Ltd. can offer practical insights into ERP adoption, compliance challenges, and cost-efficiency. Collaborative research between academia and industry could also help standardize inventory best practices. Moreover, contributions addressing sustainable practices and waste reduction in pharmaceutical logistics can significantly impact policy and operational improvements.

Scope for further study

The scope for further study includes exploring the effectiveness of AI-driven forecasting models and machine learning algorithms in minimizing stock outs and overstock situations. Future research could examine the impact of real-time inventory tracking on regulatory compliance and operational efficiency. Comparative studies across pharma firms of varying sizes may reveal scalable best practices. Additionally, there is potential to investigate the role of block chain in enhancing transparency and traceability within the pharmaceutical supply chain. Sustainability-focused research, particularly in waste reduction and eco-friendly packaging, also presents a valuable area for exploration.

Limitations

The present study is subject to several limitations. Firstly, it focuses solely on AXA Parenterals Limited, and therefore, the findings may not be applicable to other firms within the pharmaceutical industry. Secondly, the analysis is based entirely on secondary data, which may not always reflect the real-time financial condition of the company. Additionally, variations in accounting policies or unforeseen market fluctuations could impact the results, yet such factors fall outside the scope of this study. Furthermore, external influences such as economic downturns, inflation, and changes in government regulations may significantly affect the company's financial performance, but these aspects have not been examined in depth.

CONCLUSION

This analysis provides a foundation for your article on inventory management at AXA Parenterals Limited. Use the sample balance sheet, discuss industry practices like ABC analysis and EOQ, and include graphical representations like pie charts for inventory composition. Given your deadline, you can copy and paste the provided data, ensuring to cite sources appropriately. For better marks, highlight the importance of inventory management in pharmaceuticals and acknowledge the limitations of publicly available data.

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