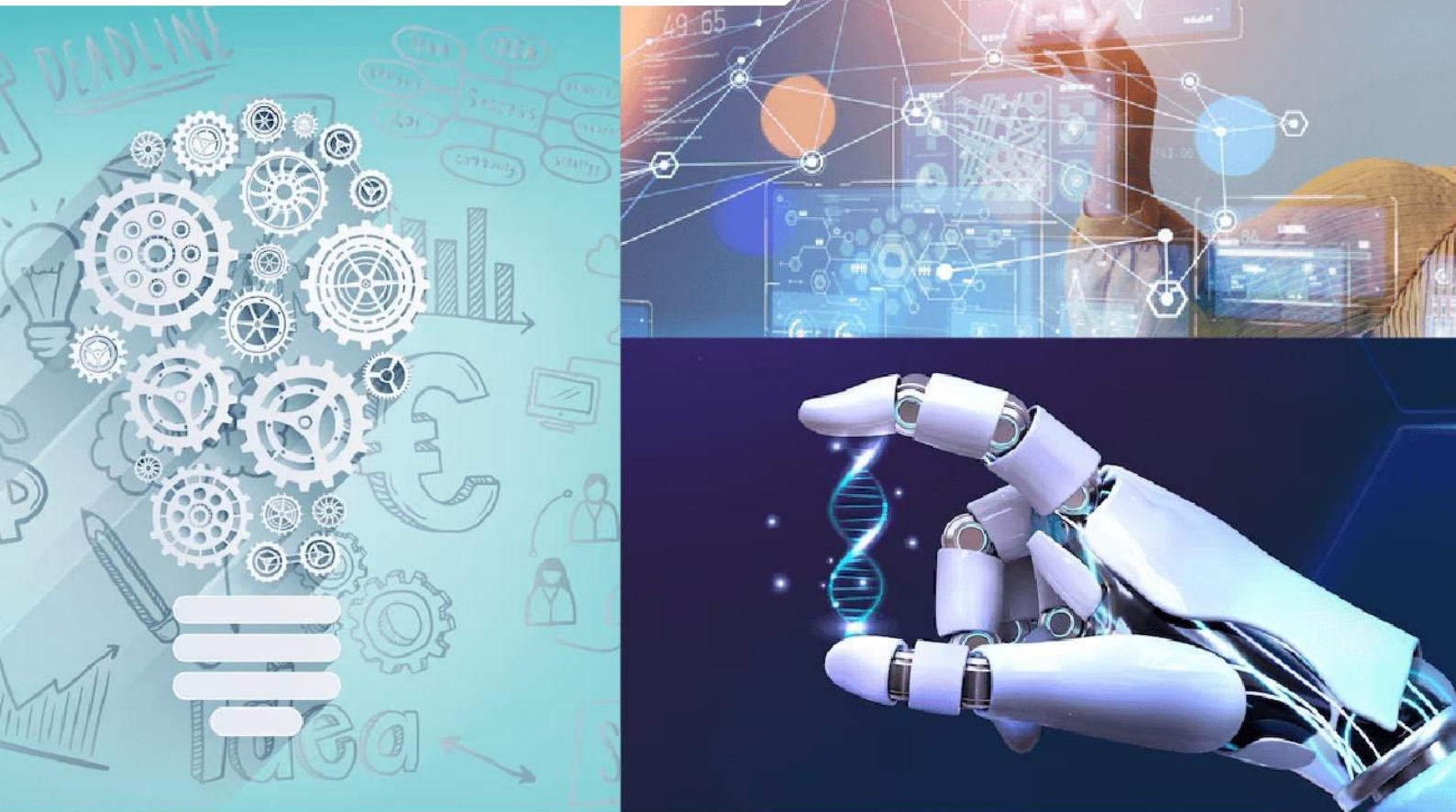




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Reducing Operational Costs through Enhanced Pharmaceutical Inventory Control

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ABSTRACT: The pharmaceutical industry is a critical component of the global healthcare system, responsible for ensuring the continuous availability of safe and effective medications. However, this sector faces significant operational challenges, particularly in managing inventory efficiently while controlling costs. Pharmaceutical inventory is unique due to factors such as high product value, strict regulatory requirements, sensitivity to storage conditions, and limited shelf life. These complexities make inventory control both a financial and clinical priority. Operational costs in pharmaceutical organizations are heavily influenced by how inventory is managed. Poor inventory practices can lead to a range of issues, including overstocking, understocking, product obsolescence, and expiration-related losses. Overstocking increases holding costs such as storage, insurance, and capital lock-in, while understocking can result in stockouts, delayed treatments, and reduced patient satisfaction. To address these challenges, pharmaceutical organizations are shifting from conventional inventory methods to more advanced and data-driven approaches. Enhanced inventory control integrates modern technologies such as Enterprise Resource Planning (ERP) systems, automated dispensing systems, barcode scanning, and Radio Frequency Identification (RFID). These technologies enable real-time visibility of stock levels, improve accuracy, and reduce human errors in inventory tracking.

KEYWORDS: Pharmaceutical inventory management, operational cost reduction, inventory control systems, stock optimization.

I. INTRODUCTION

The pharmaceutical industry is a critical component of the global healthcare system, responsible for ensuring the continuous availability of safe and effective medications. However, this sector faces significant operational challenges, particularly in managing inventory efficiently while controlling costs. Pharmaceutical inventory is unique due to factors such as high product value, strict regulatory requirements, sensitivity to storage conditions, and limited shelf life. These complexities make inventory control both a financial and clinical priority. Operational costs in pharmaceutical organizations are heavily influenced by how inventory is managed. Poor inventory practices can lead to a range of issues, including overstocking, understocking, product obsolescence, and expiration-related losses. Overstocking increases holding costs such as storage, insurance, and capital lock-in, while understocking can result in stockouts, delayed treatments, and reduced patient satisfaction. Additionally, expired drugs not only represent financial loss but also pose environmental and compliance challenges in their disposal. The increasing globalization of pharmaceutical supply chains has further complicated inventory management. Multiple suppliers, long lead times, fluctuating demand, and unpredictable disruptions (such as pandemics or geopolitical events) make it difficult to maintain optimal stock levels. For instance, during the COVID-19 pandemic, healthcare systems worldwide experienced severe shortages and surpluses of different medicines, highlighting the weaknesses in traditional inventory systems. To address these challenges, pharmaceutical organizations are shifting from conventional inventory methods to more advanced and data-driven approaches. Enhanced inventory control integrates modern technologies such as Enterprise Resource Planning (ERP) systems, automated dispensing systems, barcode scanning, and Radio Frequency Identification (RFID). These technologies enable real-time visibility of stock levels, improve and reduce human errors in inventory tracking.

OBJECTIVES OF THE STUDY

- To evaluate current inventory management practices
- To identify key factors contributing to high operational costs
- To assess the impact of inventory control on cost reduction

- To explore the role of technology in inventory management
- To develop strategies for optimizing inventory levels
- To improve drug availability and reduce stockouts
- To enhance overall operational efficiency
- To provide recommendations for cost-effective inventory control systems
- Propose practical solutions that can be implemented in real-world pharmaceutical settings.

II. REVIEW OF LITERATURE

(Akter, 2024) One of the major gaps identified is the limited real-world implementation of advanced models. While many studies propose optimization techniques such as EOQ, ABC-VED, and AI-based models, their practical application in hospital settings is still limited. Factors such as high implementation costs, lack of infrastructure, and resistance to change restrict adoption.

(Singh, 2023). A study by Singh (2023) highlights that pharmaceutical inventory management involves multiple analytical techniques such as ABC analysis, VED analysis, Economic Order Quantity (EOQ), Just-in-Time (JIT), and fuzzy logic. The study concludes that combining these techniques with automated systems can significantly help maintain optimal inventory levels and reduce wastage (Singh, 2023).

(Gupta & Kant, 2019) Several authors have focused on classification techniques such as ABC and VED analysis. ABC analysis categorizes inventory based on value and consumption, allowing organizations to prioritize high-cost items, while VED analysis classifies drugs based on their criticality (vital, essential, non-essential). These methods help in better allocation of financial resources and improved decision-making in procurement.

(Sharma & Gupta, 2018). The Economic Order Quantity (EOQ) model is widely used to determine the optimal order size that minimizes total inventory costs, including ordering and holding costs. Studies have shown that implementing EOQ along with ABC classification can improve purchasing efficiency and reduce unnecessary expenses in hospital pharmacies

III. RESEARCH METHODOLOGY

This study adopts a descriptive research design. Quantitative is adopted in this study. Both primary data and secondary data are applied to the study. The size of the sample to be used in this study is 120 respondents. Percentage analysis has been used in this study.

Data analysis and interpretation

Table No. 1 EFFECTIVENESS OF TECHNOLOGY

OPTION	RESPONSE	PERCENTAGE
HIGH EFFECTIVE	40	33.33
EFFECTIVE	30	25
MODERATE	25	20.83
SLIGHTLY EFFECTIVE	15	12.5
NOT EFFECTIVE	10	8.3

Source: Primary data

Interpretation

Technology is generally effective but not fully optimized.

Table No. 2 DEMAND FORECASTING ACCURACY

OPTION	RESPONSE	PERCENTAGE
Very accurate	24	20
Accurate	36	30

Moderate	30	25
Inaccurate	18	15
Very inaccurate	12	10

Source: Primary data

Interpretation

Forecasting accuracy is moderate, indicating improvement potential.

Table No. 3 OVERALL SYSTEM EFFECTIVENESS

OPTION	RESPONSE	PERCENTAGE
HIGH EFFECTIVE	40	33.33
EFFECTIVE	30	25
MODERATE	25	20.83
SLIGHTLY EFFECTIVE	15	12.5
NOT EFFECTIVE	10	8.3

Source: Primary data

Interpretation

Most respondents rate systems as moderately to highly effective.

Table No. 4 OVERALL SYSTEM EFFECTIVENESS

OPTIONS	RESPONSE	PERCENTAGE
REAL – TIME TRACKING	45	37.5
PERIODIC CHECKING	35	29.16
MANUAL TRACKING	25	20.83
NO STRUCTURED METHOD	15	12.5

Source: Primary data

Interpretation

Real-time tracking is used but not universally adopted.

Table No. 5 LEAD TIME CONSISTENCY

OPTIONS	RESPONSE	PERCENTAGE
VERY CONSISTENT	25	20.83
CONSISTENT	35	29.16
MODERATE	30	25
INCONSISTENT	20	16.16
HIGHLY INCONSISTENT	10	8.33

Source: Primary data

Interpretation

Lead time variability affects inventory planning.

Table No. 6 COST IMPACT OF EXPIRED DRUGS

OPTIONS	RESPONSE	PERCENTAGE
VERY HIGH	40	33.33
HIGH	35	29.16
MODERATE	30	25

LOW	15	12.5
VERY LOW	10	8.33

Source: Primary data

Interpretation

Expiry contributes heavily to operational costs.

Table No. 7 ADOPTION OF BARCODE/RFID SYSTEMS

OPTIONS	RESPONSE	PERCENTAGE
FULLY IMPLEMENTED	35	29.16
PARTIALLY IMPLEMENTED	30	25
PLANNED	25	20.83
NOT IMPLEMENTED	30	25

Source: Primary data

Interpretation

Technology adoption is still developing.

IV. SUGGESTIONS

- Implementation of modern analytics tools would help the organization to become more accurate in its demand forecasting since the moderate rates of forecasting are leading to overstocking and stock-outs.
- The company needs to control the high inventory cost (33.3%), which should be achieved through implementation of stricter inventory planning policies because it is identified as the primary cause of this high inventory cost.
- Expiry costs should also be minimized by enhancing stock rotation systems and timely checks since expiry is a major cost in the operation of the organization.
- The company should also enhance the real time inventory tracking systems since the partial application of technology and moderate visibility can only affect the efficiency of inventory.
- The implementation of barcode and RFID systems in the organization should be done in totality; because the partial implementation is currently limiting accuracy and transparency of inventory.
- The company needs also to improve the process of supplier coordination and evaluation to ensure a constant lead-time and reduce planning discontinuities.
- Staff training programs should also be reinforced by the organization since moderate levels of staff awareness are being used to create inefficiencies in inventory management.
- To lessen gaps and inefficiencies in planning, the company needs to enhance inter-departmental collaboration among the procurement, pharmacy and logistics and finance departments.
- The organization should strive to improve the storage practice management since currently, the average-to-good storage conditions are maintained.
- To assess the performance of the inventory, the company should introduce periodical system audits to manage the inefficiencies in predicting and monitoring the inventory and controlling stock.
- The company should introduce an all-inclusive and incorporated inventory control system where forecasting, automation, and supplier control and management are incorporated to reduce the overall operation costs.
- All departments will need to increase their inventory visibility because the low-to-moderate visibility is affecting decision-making and efficiency.

V. CONCLUSION

The conclusion is that good pharmaceutical inventory control is important in lowering the costs of operation by enhancing the management of stock, decreasing wastage, and ensuring enhanced supply of medicines. The results show that overstocking, moderate forecasting accuracy, partial technology adoption, and inconsistent supplier performance, are the major factors that lead to high costs of inventory. Another thing that is apparent is that even though most organizations have been embracing inventory management systems, their efficiency is not sufficient and thus efficiencies in monitoring and control of stock are not achieved. It is also concluded that enhancing the demand forecasting methods, integration of technology like barcode and RFID systems, coordination of suppliers and staff

training can make a big difference in making the inventory efficient. Inventory visibility and real time tracking systems are needed to minimize the losses that occur due to stock-outs and expiry. In general, a better interdepartmental coordination and the introduction of a technology-based all-inclusive inventory management strategy are the keys to the cost-effective pharmaceutical operations.

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