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INVENTORY MANAGEMENT OF WAREHOUSE USING ERP SOFTWARE

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ABSTRACT:
This study examines the role of ERP (Enterprise Resource Planning) software in enhancing the efficiency and accuracy of warehouse inventory management. With increasing demands for streamlined supply chain operations, ERP systems provide an integrated solution that centralizes data across warehouse functions, from inventory tracking to order processing. By using real-time data and automation, ERP software improves visibility into stock levels, supports precise demand forecasting, and reduces manual errors, thereby optimizing replenishment and reducing stockouts or overstock situations. This paper analyzes how ERP software influences key performance indicators such as inventory accuracy, order fulfillment rates, lead times, and resource allocation within a warehouse environment. Additionally, it evaluates ERP's impact on cost reduction through more efficient space utilization and inventory handling. Findings suggest that ERP adoption significantly enhances warehouse operations, allowing businesses to respond quickly to dynamic market conditions while maintaining high levels of customer satisfaction. The results indicate that ERP software is a scalable, flexible tool that not only refines current inventory management practices but also supports long-term strategic planning, ultimately transforming the warehouse into a leaner and more responsive component of the supply chain.
Keywords: Inventory management, ERP software, warehouse operations, real-time data tracking, demand forecasting, automated inventory controls, order fulfillment, operational efficiency.

1 INTRODUCTION :

The standard EOQ and economic production quantity (EPQ) results are easy to apply but are based on a number of unrealistic assumptions[1]. One of the assumptions is that the demand is normally distributed in any interval; it is assumed that successive demands are independent and, consequently, the accumulated demand over many time units is approximately normal[2]. The realization that inventories operate under less than ideal situations gives rise to a subset of inventory modeling theory that performs sensitivity analysis on models operating under stochastic conditions. Several extensions of the classic EOQ/EPQ model have been, Borg novo presents a good review of them across several fields of research. A branch comprises models where the assumption that all units are of perfect quality is removed, for a deep literature review you can see[3].

Inventory management is important in effective organization. It is vital in the control of materials and goods that have use in the production or exchange activities in case of services[4]. The primary goal of inventory management is to avoid holding too much stock. Inventory problems of too great or too small quantities on hand can cause business failures. If a manufacturer experiences stock-out of a critical inventory item, production stop. Moreover, customer demand the product. If an item is not stocked when the customer thinks it should be, the retailer loses a customer not only on that item but also on many other items in the future[5]. The conclusion one might draw is that

effective inventory management can make a significant contribution to a company's profit as well as increase its return on total assets[6].

The planning involves:

- What quantity of items to order?
- When do we order?
- How do we order for them to maintain the overall stock?

1.1 Background of the Study:

Inventory management is an essential component of every organization that includes the storage and delivery of products[7]. Efficient inventory management ensures that a firm has the right amount of stock to fulfill consumer demand while reducing the expenses associated with excess inventory or stock outs[8]. Traditionally, inventory management has been based on manual procedures or simple software solutions, which may be prone to mistakes and inefficiencies[9]. However, with the fast growth of technology, Enterprise Resource Planning (ERP) software has emerged as an effective tool for improving inventory management in warehouses. ERP software combines numerous company operations[10], creating a centralized system capable of managing and automating tasks such as inventory monitoring, order processing, supply chain management, and reporting[11]. ERP solutions enable businesses to obtain real-time insight into inventory levels, simplify operations, and make data-driven choices. This not only increases accuracy and efficiency, but also decreases the possibility of overstocking or stock outs, resulting in higher customer satisfaction and cost savings[12].

ERP software is critical in warehouse management because it helps optimize space use, monitor inventory turnover, and ensure that the appropriate items are accessible at the right time[13]. It enables smooth communication between several departments, including procurement, sales, and finance, ensuring that inventory levels are in line with real demand and financial goals[14]. Furthermore, integrating new technologies such as barcode scanning, RFID, and IoT into ERP systems improves inventory accuracy and operational efficiency[15].

1.2 Problem Statement:

Warehouse operations are crucial for ensuring timely product availability and overall supply chain efficiency. However, many warehouses face challenges in managing their inventory effectively, leading to issues such as stock outs, overstocking, and inefficiencies in order fulfillment. The implementation of ERP (Enterprise Resource Planning) software offers a potential solution to these challenges by streamlining inventory management processes. However, the impact of ERP software on inventory management efficiency in warehouses is not fully understood. Additionally, warehouses encounter various challenges during the implementation of ERP systems, which may affect their ability to optimize operations.

This study aims to evaluate the impact of ERP software on inventory management efficiency in warehouses, identify the challenges and benefits associated with ERP implementation, and provide recommendations for optimizing warehouse operations using ERP solutions. The goal is to help organizations enhance their inventory management practices and improve overall operational efficiency through the effective use of ERP software.

1.3 Issues with Current Warehouse Management Systems:

Many current warehouse management systems face significant challenges that hinder operational efficiency and inventory accuracy[16]. These systems often rely on manual processes or outdated technology, leading to inefficient inventory tracking and poor demand forecasting. The lack of real-time data integration makes it difficult for warehouse managers to make informed decisions quickly, resulting in delays in order processing and shipment. For organizations managing multiple warehouses, traditional systems may struggle to provide a unified view of inventory across all

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locations, complicating coordination and increasing costs. Additionally, these systems are often not easily scalable, limiting their ability to grow with the business[17]. High error rates due to manual data entry, inflexibility in adapting to changes, and inefficient resource utilization further exacerbate the problem. The integration of different standalone systems is often problematic, creating data silos that hinder overall efficiency[18]. Moreover, the limited reporting and analytics capabilities of these systems make it challenging for warehouse managers to identify areas for improvement and optimize operations. These issues highlight the need for more advanced and integrated solutions, such as ERP software, to enhance warehouse management efficiency[16].

Fig 1. Warehouse Management Challenges

1.4 Inefficiencies in Inventory Tracking and Management

Despite the critical role that inventory management plays in ensuring a business's success, traditional methods of tracking and managing inventory in warehouses are often fraught with inefficiencies[19]. Manual procedures or basic software solutions are commonly used, but these approaches are highly prone to errors, such as inaccurate stock counts, misplaced items, and delays in updating inventory records. These inefficiencies can lead to significant operational challenges, including stock outs, overstocking, and delayed order fulfillment[20]. The lack of real-time visibility into inventory levels further exacerbates these issues, making it difficult for warehouse managers to respond promptly to changes in demand or supply chain disruptions. Consequently, businesses may face increased costs due to excess inventory, missed sales opportunities, and diminished customer satisfaction. The growing complexity of modern supply chains and the increasing demands of customers underscore the need for more advanced, integrated solutions like ERP software to address these inefficiencies and optimize warehouse operations[21].

1.5 Economic Order Quantity (EOQ):

Economic order quantity is defined that quantity of materials, which can be ordered at one time to minimize the cost of ordering and carrying the stocks. In other words, it refers to size of each order that keeps the total cost low.

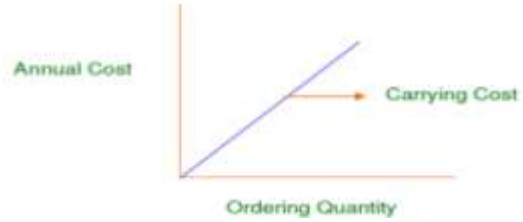

Fig 2 Economic Order Quantity (EOQ)[22]

1.6 Definition on Material Management:

Material management deals with controlling and regulating the flow of materials in relation to changes in variables like demand, prices, availability, quality, delivery schedules etc.

1.7 Objects of materials management:

1. Minimization of materials cost s
2. To reduce inventory for use in production process and to develop high inventory turnover ratios.
3. To procure materials of desired quality when required, at lowest possible overall cost of the country.
4. To reduce paper work procedure in order to minimize delays in procuring materials.
5. To note changes in market conditions and other factors affecting the concern.
6. The purchase, receive, transport, store materials efficiently

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7. To reduce cost, through simplification, standardization, value analysis etc.
8. To conduct studies in new areas e.g., equality consumption and cost of materials so as to minimize cost of production.

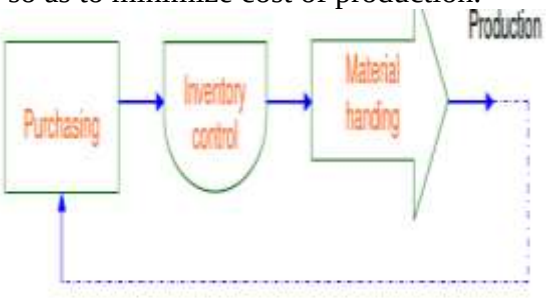

Fig 3. Material Management

1.8 Function of Materials Management:

1. Materials planning and programming
2. Purchasing materials inspection of materials
3. Inspection of Materials
4. Classification, codification and standardization in stores
5. Storage of materials
6. Issuing of materials
7. Maintenance of proper inventory records
8. Materials receiving

1.9 Objectives of the Study

- To evaluate the impact of ERP software on inventory management efficiency
- To identify the challenges and benefits of implementing ERP in warehouses
- To provide recommendations for optimizing warehouse operations using ERP

1.10 Scope of the Study

1.10.1 Focus on warehouse inventory management

Warehouse inventory management is a critical aspect of any organization, directly impacting the ability to meet customer demands and control operational costs. Ensuring that the right amount of stock is available at the right time is essential for avoiding the pitfalls of overstocking, which ties up capital and increases storage costs, or stock outs, which can lead to lost sales and diminished customer satisfaction. Traditionally, managing warehouse inventory has involved manual processes or the use of basic software, both of which are prone to errors and inefficiencies. These outdated methods can lead to inaccuracies in inventory tracking, delays in order fulfillment, and challenges in maintaining optimal stock levels.

As businesses evolve and supply chains grow more complex, the need for a more sophisticated approach to warehouse inventory management becomes increasingly apparent. The integration of Enterprise Resource Planning (ERP) software into warehouse operations offers a powerful solution. By centralizing and automating key processes such as inventory monitoring, order processing, and reporting, ERP systems provide real-time visibility into inventory levels and streamline operations. This not only enhances accuracy and efficiency but also empowers businesses to make data-driven decisions, improving overall warehouse performance. The focus on optimizing warehouse inventory management through ERP software is crucial for organizations aiming to remain competitive in today's fast-paced market, where customer satisfaction and cost efficiency are paramount.

1.10.2 Analysis of ERP software integration

This study will analyze the integration of Enterprise Resource Planning (ERP) software into warehouse inventory management systems, focusing on its impact on operational efficiency and effectiveness. The research will evaluate how ERP software influences inventory accuracy, order fulfillment speed, and overall warehouse performance. It will identify and assess the specific challenges and benefits associated with implementing ERP systems, including integration issues, training requirements, cost implications, and resistance to change. Additionally, the study will provide recommendations for optimizing warehouse operations through ERP software, examining best practices for implementation and strategies for overcoming common obstacles. The analysis will be supported by case studies or examples of successful ERP integrations, offering practical insights into how these systems can enhance

inventory management and streamline warehouse operations. By addressing these aspects, the study aims to offer a comprehensive understanding of how ERP software can address existing inefficiencies and improve warehouse performance.

Fig 4 ERP System Components

1.11 Significance of the Study

The significance of this study lies in its exploration of how Enterprise Resource Planning (ERP) software can enhance inventory management in warehouses, particularly in addressing the limitations of traditional inventory models like Economic Order Quantity (EOQ) and Economic Production Quantity (EPQ). Traditional inventory models often rely on assumptions that may not hold true in real-world scenarios, such as normal demand distributions and perfect quality of units. By investigating the integration of ERP software, this study aims to bridge the gap between theoretical models and practical applications in inventory management.

Effective inventory management is crucial for maintaining optimal stock levels, which directly impacts production continuity, customer satisfaction, and overall business profitability. Stock-outs of critical items can halt production, while overstocking can lead to excessive holding costs. ERP systems provide a solution by offering real-time data, improved accuracy, and streamlined processes, which help mitigate the risks associated with traditional inventory management methods.

This study's findings will be significant for organizations seeking to optimize their warehouse operations by leveraging ERP software. It will provide insights into how ERP systems can address the challenges of inventory management, offer benefits such as enhanced decision-making and cost savings, and ultimately contribute to improved financial performance and competitive advantage. The research will also offer practical recommendations for the successful implementation of ERP solutions, making it a valuable resource for businesses aiming to achieve more efficient and effective inventory management.

2. LITERATURE REVIEW

Inventory control of spare parts is essential across various industries to balance holding costs and avoid stockouts, which can disrupt production or services **(Wisam AL-Dulaime et.al 2019).** In their study at a laptop and electrical appliance supply company in Amman, Jordan, they identified key factors impacting inventory management, including setup, holding, and transport costs, as well as selling prices and reorder points for spare parts. To improve accuracy and efficiency, the study implemented the Economic Order Quantity (EOQ) model alongside XYZ analysis within a software system, streamlining data entry, report generation, and access to item histories. Addressing inventory management in manufacturing[23], **(Saha et.al (2023)** focus on the often-neglected impact of imperfect items, which can inflate costs and reduce operational efficiency. They developed a hybrid model that incorporates demand forecasting, production planning, quality checks, and inventory control, leveraging fuzzy systems and genetic and differential evolution (DE) algorithms. Through sensitivity analysis, they highlighted how varying parameters influence system performance, showing significant reductions in yearly costs and introducing a pioneering DE algorithm that enhances optimization effectiveness. The EOQ model, a foundational inventory control model, has been widely

adapted over the last century to address diverse optimization needs[24]**(Leopoldo Eduardo et.al 2010)**. Recent advances have expanded the EOQ/EPQ model to include both linear and fixed backorder costs. This research suggests an alternative analytic method that applies geometric and algebraic principles to determine optimal lot sizes and backorder levels, enriching traditional EOQ model applications. For auto spare parts supply chains, demand uncertainty significantly affects order planning[25]**(Masoud Mehdizadeh et.al 2019).** Demand inconsistencies between supply chain levels complicate forecasting. This study focuses on sold car numbers and mileages, applying ABC analysis and rough set theory to extract demand forecasting rules. Implementing these rules in an Iranian distributor's periodic review system improved service levels and reduced inventory age and average values, highlighting the importance of targeted demand forecasting in inventory management[26]. **Angel-Bello et.al (2017)** tackled inventory classification by developing a classifier using a discrete artificial neural network with a multi-start constructive algorithm. By training the network with randomized greedy strategies and optimizing weights via linear programming, the classifier achieved efficient and accurate multi-criteria ABC inventory classification. The algorithm's flexibility allows for applications in other multi-class classification problems, demonstrating its versatility and effectiveness in inventory management scenarios.

The integration of Enterprise Resource Planning (ERP) systems with various technological and operational frameworks has become increasingly central to business process optimization and sustainability. In recent years, Life Cycle Assessment (LCA) has been woven into ERP systems to enhance environmental sustainability alongside operational efficiency[27]**(El Haouat et al., 2024).** In Moroccan enterprises, this synergy has led to competitive advantages, enabling companies to consider both environmental and economic impacts in decision-making. Larger firms particularly show a greater inclination towards LCA-ERP integration, aligning their strategic goals with global sustainability targets. Meanwhile, blockchain integration with ERP systems presents another avenue for transforming organizational processes, albeit with high initial costs and disruptions[28]. **Sunmola et al. (2024)** conducted a systematic literature review to identify key success factors for blockchain-ERP integration, categorizing these into technological, organizational, and regulatory contexts. This integration, while complex, can bolster security and traceability in various functional areas, highlighting the importance of a structured, sustainable approach to adoption. Further exploring ERP integration[29], **Gagnon et al. (2023)**developed a reliable measure to assess ERP integration at the module level, identifying system, business process, and user dimensions as key elements. This 3-dimensional construct demonstrates that ERP integration significantly enhances business process performance, providing organizations with a structured framework for evaluating ERP benefits. In logistics, where efficiency and environmental friendliness are critical, Robotic Process Automation (RPA) has emerged as a key solution for managing complex, high-speed processes[30]**(Nalgozhina et al., 2024)**. RPA offers companies an edge in accuracy and speed for tasks like warehouse management, underscoring the value of automation in a globalized, sustainability-focused market. In the context of inventory management, innovative approaches such as Machine Learning (ML) are being explored[31]. **Ferretti et al. (2024)** applied a reinforcement learning-based ML model to optimize inventory levels in an industrial setting, yielding superior performance compared to traditional methods. This approach promises improvements in the order cycle by adapting dynamically to demand fluctuations, thus refining inventory management practices. Collectively, these studies underscore the transformative potential of ERP systems and

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complementary technologies in driving efficiency, sustainability, and optimized decision-making across various organizational functions[32].

3 RESEARCH METHODOLOGY

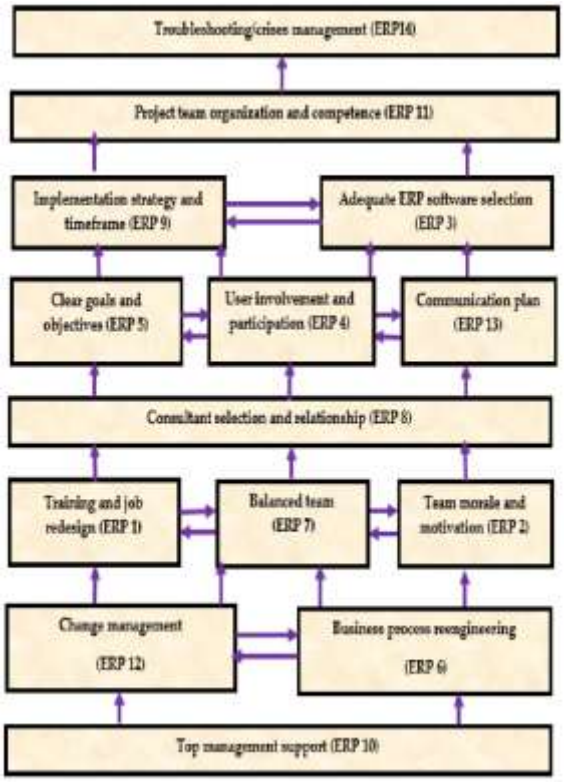

Fig 5. Research Methodology

3.1. Steps EOQ:

Step1:

Total Ordering cost per year = No. of orders placed per year x ordering cost per
Order = (A/S) x O
A = Annual demand
S = Size of each order (units per order)
O = Ordering cost per order

Step2:

Total Carrying cost per year = Average inventory level x Carrying cost per
Year = (S/2) x C
A = Annual demand
S = Size of each order (units per order)
C = Carrying cost per unit

Step3:

EOQ is one where the total ordering is equal to total carrying cost

$$\frac{A}{S}\times O=\frac{S}{2}\times C$$

$$2AO=S^2\times C$$

$$S^2=\frac{2AO}{C}$$

$$S=\sqrt{\frac{2AO}{C}}$$

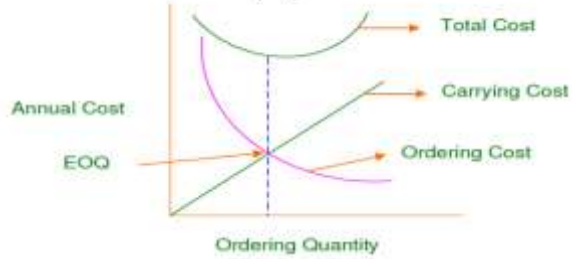

Fig 6. EOQ Analysis

Where S is the Economic order quantity, A is the annual demand in units, O is the ordering cost per order and C is the carrying cost per unit.

4 CASE STUDY

4.1 CASE STUDY

Inventory management is the component of supply chain management that tracks and supervises noncapitalized assets -- or inventory -- and stock items. Inventory management systems oversee the flow of goods from manufacturers to warehouses and from these facilities to the point of sale (POS). A key function of these systems is to keep a detailed record of each new or returned product as it enters or leaves a warehouse or POS. Organizations from small to large businesses can make use of inventory management to track the flow of goods and inventory turnover. There are numerous inventory management techniques that enable businesses to deliver the right amount of the correct product to the right place on time. Inventory control is a separate area of inventory management. It focuses on minimizing the total cost of inventory, while maximizing the ability to provide customers with products in a timely manner. In some countries, the two terms are used synonymously. Effective inventory management lets businesses balance the amount of inventory they have coming in and going out. The better a business

controls its inventory, the more money it can save in business operations.

A business that has too much stock has what's referred to as overstock. Overstocked businesses have money tied up in inventory, limiting cash flow, increasing holding costs and potentially creating a budget deficit. This overstocked inventory, which is also called dead stock, often sits in storage, unable to be sold and eating into the business's profit margin. But, if a business doesn't have enough inventory, it can result in shortages that negatively affect customer service. Lack of inventory causes delays in responding to customer orders and can result in lost sales. Customers are apt to look elsewhere when told a product isn't in stock and has to be back-ordered. An inventory management system can help businesses strike the balance between being under- and overstocked for optimal efficiency and profitability.

Inventory management offers several key benefits, including cost reduction, insight into future trends, and enhanced customer satisfaction. While there are upfront costs associated with setting up inventory management systems, these are outweighed by long-term savings due to more efficient inventory levels and optimized storage. Inventory management systems also provide valuable tools for analyzing sales, predicting future trends, and meeting customer needs. Additionally, features like inventory, transport, and delivery tracking contribute to timely transactions and an improved customer experience. Furthermore, advanced software capabilities, such as real-time inventory tracking using RFID tags and IoT devices, help supply chain managers monitor goods in transit, optimize storage, and maintain strong relationships with suppliers and shippers.

However, inventory management systems also present challenges, particularly in the areas of setup costs, data accuracy, and system integration. The initial investment and startup costs can be burdensome, especially for small and midsize businesses. Traditional inventory software that relies on manual data entry is prone to errors and inconsistencies, which can compromise the system's effectiveness. Integrating inventory management platforms with existing systems, like sales and customer relationship management applications, often requires complex configurations and specialized expertise. Additionally, large warehouses and storage locations pose challenges in tracking inventory and locating products efficiently. Training employees to use these advanced systems can be difficult, and user adoption may be slow, further complicating the transition to a new inventory management process.

4.1.1 Warehouse details

In this study, we focus on the warehouse managed by Patil Developer and Builder, situated in Bhusawal, Maharashtra. This warehouse plays a pivotal role in the company’s supply chain operations. As a key logistical center, it is responsible for the storage, management, and distribution of construction materials required for various ongoing projects.

Patil Developer and Builder utilizes this warehouse to ensure a steady and efficient flow of materials to its numerous construction sites. The warehouse’s operations include receiving incoming materials, organizing and storing them appropriately, and preparing them for distribution. By maintaining an organized inventory and efficient distribution system, the warehouse supports the company’s construction activities, ensuring that materials are readily available when needed and thereby contributing to the timely progression of construction projects.

The focus of this case study is to analyze the inventory management practices within this warehouse, with the aim of identifying key challenges and opportunities for improvement. By examining the processes and systems in place, we seek to understand how effectively the warehouse supports the company’s overall operations and to propose recommendations for enhancing efficiency and effectiveness in material handling and distribution.

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4.2 N B Bhalchandra Akashvan

Site 1:

Fig. 7. 3rd eye view of the actual site

4.3 SITE DETAILS

- Name of site: N B Bhalchandra Akashvan
- Location of site: Punawale, Pune, Maharashtra 411035
- A G+21 proposed building
- Owner and Developer: Nandkumar Bhalchandra Bhondve
- Architect: Samarth Chintamani Properties
- Cost of project: 64 Lakhs per Flat Onwards
- Structural Engineer: JW consultant
- Builder : N B Bhondve Group
- Area: 2.29 Acres
- The residential building has No of Towers: 1, Towers No. of Floors: 21 Floors, No. of Units: 317 Units.
- This project is based on a sustainable structure
- Present condition of the project: under construction
- Possession March 2025

4.5 N B Bhalchandra Akashvan by NB Bhondve group

Fig.8 Plan

4.4 Manpower Allocation

Department/Task	Role	Number of People
Receiving Materials	Receiving Clerks	4-6
	Inventory Data Entry Operators	2-3
Organizing and Storing	Warehouse Associates	6-8
Picking and Packing	Picking Staff	6-8
	Packing Staff	4-6
Logistics and	Logistics	2-3
Distribution	Coordinators	
	Dispatch Staff	4-5
Quality Control	Quality Control Inspectors	2-3
Administrative and Support	Inventory Manager	1-2
	Administrative Assistants	2-3
Maintenance and Safety	Maintenance Technicians	2-3
	Safety Officers	2

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5 DATA ANALYSIS

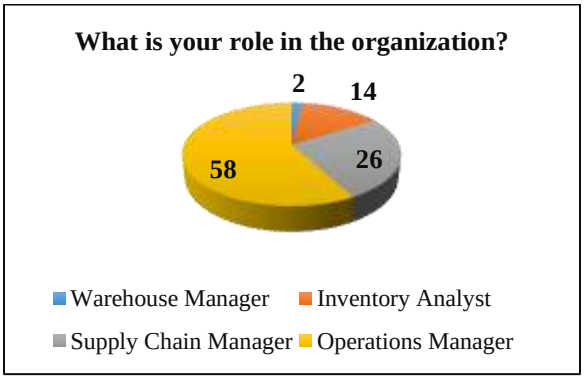
5.1 Introduction

Effective inventory management is crucial for optimizing warehouse operations, reducing costs, and enhancing service levels. This study focuses on analyzing inventory management practices in warehouses utilizing Enterprise Resource Planning (ERP) software. By leveraging ERP systems, organizations can streamline their inventory processes, improve accuracy in stock tracking, and enhance decision-making capabilities. The analysis in this chapter is based on a structured questionnaire distributed to a sample size of 50 respondents, which includes warehouse managers, inventory specialists, and ERP users.

5.2 Frequencies

Table 5.1 What is your role in the organization?

	Frequency	Percent
Warehouse Manager	1	2
Inventory Analyst	7	14
Supply Chain Manager	13	26
Operations Manager	29	58
Total	50	100

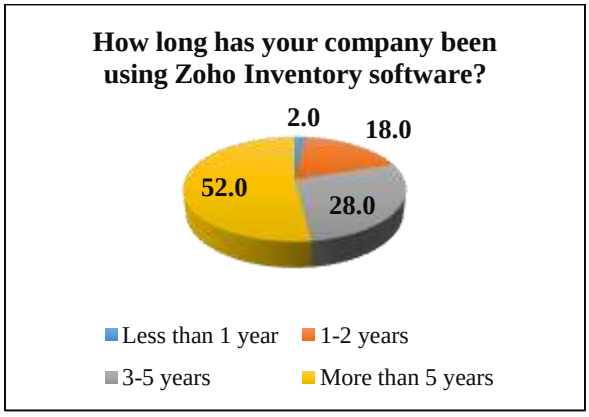


Graph 1 What is your role in the organization?

As shown above graph distribution of roles within the organization, highlighting the frequency and percentage of each position. The majority, comprising 58%, are Operations Managers, indicating a strong focus on operational oversight. Supply Chain Managers follow with 26%, reflecting significant engagement in supply chain processes. Inventory Analysts account for 14%, while Warehouse Managers represent a minimal 2% of the workforce.

Table 5.2 How long has your company been using Zoho Inventory software?

	Frequency	Percent
Less than 1 year	1	2.0
1-2 years	9	18.0
3-5 years	14	28.0
More than 5 years	26	52.0
Total	50	100.0



Graph 2 How long has your company been using Zoho Inventory software?

As shown above graph the majority of respondents (52%) have been using Zoho Inventory software for over five years, indicating strong customer retention and satisfaction. Following this, 28% have utilized the software for 3-5 years, while 18% have been users for 1-2 years. Only 2% of participants have used the software for less than a year. This distribution suggests that a significant portion of users are experienced with the software, which may enhance their ability to leverage its features effectively. Overall, the data reflects a positive long-term engagement with Zoho Inventory among the respondents.

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Table 5.3 What type of inventory do you primarily manage in your warehouse?

	Frequency	Percent
Finished goods	7	14.0
Spare parts	19	38.0
Other	24	48.0
Total	50	100.0

Graph 3 What type of inventory do you primarily manage in your warehouse?

As shown above graph the distribution of inventory types managed in the warehouse. Among the 50 respondents, "Other" categories accounted for the highest percentage at 48%, indicating a diverse range of items not specified as finished goods or spare parts. Spare parts were managed by 38% of the respondents, reflecting a significant focus on maintenance and operational needs. In contrast, finished goods represented only 14% of the inventory, suggesting that the warehouse may not prioritize stocking completed products. This distribution highlights a potential need for further investigation into the specific items categorized as "Other" to optimize inventory management.

5.3 Statistical Analysis

	Mean	SD	Skewness	Kurtosis
What is your role in the organization?	3.40	.808	-1.112	.277
How long has your company been using Zoho Inventory software?	3.30	.839	-.842	-.399
How frequently do you use Zoho Inventory for managing inventory?	2.76	.894	.324	-1.357
What type of inventory do you primarily manage in your warehouse?	3.34	.717	-.615	-.809
How do you determine the reorder level for your inventory items?	2.94	.586	.004	.066
What challenges do you face in managing inventory?	2.88	.824	-.225	-.579
Are you familiar with the Economic Order Quantity (EOQ) model?	2.16	.510	.272	.549
Do you use EOQ analysis in your inventory management process?	2.82	.629	-.363	.660
How has EOQ analysis impacted your inventory management?	3.04	.832	-.519	-.308
What is the biggest advantage of using EOQ in your inventory system?	1.48	.762	1.221	-.114
Which Zoho Inventory feature do you find most useful for managing inventory?	1.68	.621	.334	-.599
What methods do you use to determine the reorder levels for inventory?	1.56	.760	.950	-.583
Which features of Zoho Inventory are most beneficial for your warehouse operations?	1.48	.580	.735	-.414

How effective is Zoho Inventory in managing your stock levels?	1.54	.734	.984	-.421
How frequently do you analyze inventory reports generated by Zoho Inventory?	1.70	.886	1.007	-.002
How satisfied are you with the customization options in Zoho Inventory?	2.08	1.007	.459	-.926
How do you calculate EOQ for your inventory items?	1.90	1.015	.695	-.812
What impact has EOQ analysis had on your inventory management?	1.88	1.043	.699	-.944
How often do you review and adjust your EOQ calculations?	2.28	.970	-.042	-1.157
What challenges do you face in implementing EOQ in your warehouse?	1.82	.919	.702	-.691

The statistical analysis of the data presents insights into the perceptions and experiences of individuals regarding their inventory management practices using Zoho Inventory software. The mean scores across various aspects reveal differing levels of familiarity and effectiveness associated with the software, reflecting users' roles and experiences within their organizations.

- **Mean Scores and Distribution**

The mean score for "What is your role in the organization?" stands at 3.40, indicating a moderate level of engagement and responsibility in inventory management. This suggests that respondents may occupy positions that require regular interaction with inventory systems. In contrast, the lowest mean score of 1.48 for "What is the biggest advantage of using EOQ in your inventory system?" suggests a perceived lack of significant benefits associated with the Economic Order Quantity (EOQ) model, indicating that participants might not fully understand or utilize EOQ principles effectively in their operations. This divergence in mean scores highlights varying levels of expertise and application of inventory management practices.

- **Skewness and Kurtosis Analysis**

The skewness values across most variables are negative, particularly in "What is your role in the organization?" (-1.112) and "How frequently do you use Zoho Inventory for managing inventory?" (0.324), indicating a tendency towards lower values in responses, suggesting that while users may be engaged, they might not frequently rely on advanced inventory management methods like EOQ. Positive kurtosis values, particularly in the "What is your role in the organization?" section (0.277), indicate that the data distribution has heavier tails, suggesting that a few respondents have significantly higher perceptions or experiences than the majority.

5.4 Pearson Correlation and Cronbach Alpha

	Persons correlation	Cronbach Alpha
What is your role in the organization?	0.836	0.763
How long has your company been using Zoho Inventory software?	0.532	0.711
How frequently do you use Zoho Inventory for managing inventory?	0.306	0.734
What type of inventory do you primarily manage in your warehouse?	0.061	0.768
How do you determine the reorder level for your inventory items?	0.251	0.698

What challenges do you face in managing inventory?	0.455	0.823
Are you familiar with the Economic Order Quantity (EOQ) model?	0.199	0.715
Do you use EOQ analysis in your inventory management process?	0.191	0.699
How has EOQ analysis impacted your inventory management?	0.313	0.783
What is the biggest advantage of using EOQ in your inventory system?	0.911	0.816
Which Zoho Inventory feature do you find most useful for managing inventory?	0.963	0.789
What methods do you use to determine the reorder levels for inventory?	0.631	0.726
Which features of Zoho Inventory are most beneficial for your warehouse operations?	0.214	0.702
How effective is Zoho Inventory in managing your stock levels?	0.555	0.766
How frequently do you analyze inventory reports generated by Zoho Inventory?	0.251	0.734
How satisfied are you with the customization options in Zoho Inventory?	0.389	0.759
How do you calculate EOQ for your inventory items?	0.547	0.723
What impact has EOQ analysis had on your inventory management?	0.517	0.698
How often do you review and adjust your EOQ calculations?	0.649	0.81
What challenges do you face in implementing EOQ in your warehouse?	0.189	0.732

The correlation analysis reveals significant relationships between various aspects of inventory management and the use of Zoho Inventory software. The highest Pearson correlation value of 0.963 is observed for the question regarding the usefulness of specific Zoho Inventory features in managing inventory, suggesting a strong positive relationship. This implies that respondents who find certain features beneficial are likely to experience improved inventory management outcomes. Similarly, the question about the biggest advantage of using the Economic Order Quantity (EOQ) model shows a high correlation of 0.911, indicating that those who recognize the advantages of EOQ perceive its integration as essential in their inventory systems.

The Cronbach Alpha values further strengthen the reliability of these responses, with values ranging from 0.698 to 0.823, indicating good to excellent internal consistency. Notably, the highest Cronbach Alpha value of 0.823 corresponds to the challenges faced in managing inventory, suggesting that respondents have a common understanding of the issues they encounter. This reliability is crucial for ensuring that the survey effectively captures respondents' perceptions and experiences related to Zoho Inventory.

6RESULTS AND DISCUSSION

6.1 Introduction

Zoho ERP has proven to streamline warehouse inventory management effectively. The software allows for real-time tracking of stock levels, reducing the possibility of stockouts or overstocking. With automated alerts and reorder points, warehouse managers can ensure optimal stock levels are maintained, enhancing

efficiency. Furthermore, its user-friendly interface enables quicker adoption by warehouse personnel, reducing training time and boosting operational efficiency. The use of Zoho ERP in warehouse operations has resulted in significant cost savings. By automating routine tasks such as order processing and stock updates, the software

6.2 EOQ Model Calculations

This model is known as the EOQ model because it has the most economically advantageous order size to place. It is one of the oldest classic production planning models. With this model, companies can minimize order and storage

Number of order Annual = $\frac{D}{Q}$

Annual Ordering Cost = $\frac{D}{Q}$ Co

Annual Holding Cost = $\frac{D}{Q}$ Ch

Total Cost = $\frac{D}{Q}$ Co + $\frac{D}{Q}$ Ch

EOQ = Q *= $\sqrt{\frac{2DCo}{Ch}}$

Reorder Point =ROP = d x L

1. Data for SS 110mm x 3mtr SWR Pipe:

Demand (D): Annual demand is 240 units (based on the quantity ordered 20 and 12 orders a year).

Ordering cost (Co)**:** ₹500

Holding cost (Ch)**:** 10% of ₹1070 (unit rate) = ₹107 per unit per year.

Using the EOQ formula:

EOQ = $\sqrt{\frac{2DCo}{Ch}}$

= $\sqrt{\frac{2x240x500}{107}}$

EOQ = 47.39

2. SS 75mm x 3mtr SWR Pipe (Item 2)

Demand (D): 336

Ordering cost (Co)**:** ₹596

Holding cost (Ch)**:** ₹59.5

EOQ = $\sqrt{\frac{2DCo}{Ch}}$

= $\sqrt{\frac{2x336x596}{59.5}}$

EOQ = 81.97

3. S 50mm x 3mtr PVC Pipe (Item 3)

Demand (D): 180

Ordering cost (Co)**:** ₹381

Holding cost (Ch)**:** ₹38.1

EOQ = $\sqrt{\frac{2DCo}{Ch}}$

= $\sqrt{\frac{2x180x381}{38.1}}$

EOQ = 60

4. Bend 87.5 110mm (Item 4):

Demand (D): 144

Ordering cost (Co)**:** ₹190.6

Holding cost (Ch)**:** ₹19.06

EOQ = $\sqrt{\frac{2DCo}{Ch}}$

= $\sqrt{\frac{2x144x190.6}{19.06}}$

EOQ = 53.66

6.3 Estimated Bill Samples

Sample 1:

To,			
M/S Patil Developer & Builder,			**Invoice no: SB/0693/22-23 Dt: 19-May-22**

Bhusawal							
Mobile no: 9766602779			**E-way bill: 281431835399**				
Email:			**LR/Vehicle No: MH19S9980**				
GST TIN: 27BMVPP9642R1ZK			**DC No:**				
PAN No:			**Place of Supply: Maharashtra (Code: 27)**				
Sr.	**Particulars**	**HSN**	**GST**	**Quantity**	**Rate**	**Disc %**	**Amount**
1	SS 110mm x 3mtr SWR PIPE	39172390	18	20	1070	46	11556
2	SS 75mm x 3mtr SWR PIPE	39172390	18	28	596	46	9011.52
3	S 50mm x 3mtr Pvc Pipe	39172390	18	15	381	35	3714.75
4	Bend 87.5 110mm	39172400	18	12	190.6	42	1326.576
5	Plain T 110mm	39172400	18	2	253.1	42	293.596
6	Door T 110mm	39172400	18	8	314.1	42	1457.424
7	Bend 45 110mm	39172400	18	10	160.5	42	930.9
8	Pipe Clip 110mm	39172400	18	100	33.1	42	1919.8
9	Vent Cowl 110mm	39172400	18	2	39.9	42	46.284
10	Door T 75mm	39172400	18	8	164.1	42	761.424
11	Bend 87.5 75mm	39172400	18	10	94.4	42	547.52
12	Plain T 75mm	39172400	18	5	139.8	42	405.42
13	Bend 45* 75mm	39172400	18	10	74.1	42	429.78
14	Bend 45* 75mm	39172400	18	8	74.1	42	343.824
15	Vent cowl 75 mm	39172400	18	3	26.4	42	45.936
16	Bend 87.5* 75mm	39172400	18	5	94.4	42	273.76
17	Single Y 75mm	39172400	18	6	167.3	42	582.204
18	Door Bend 75mm	39172400	18	6	117.3	42	408.204
19	Pipe Clip 75mm	39172400	18	120	22.9	42	1593.84
20	Bend 87.5-110mm	39172400	18	6	190.6	42	663.288
21	S 40mm x 3mt Pvc Pipe	39172400	18	3	256	35	499.2
22	40mm ELBOW	39172400	18	14	28.3	25	297.15
23	50mm ELBOW	39172400	18	50	35.8	25	1342.5
24	Bend 45*50mm	39172400	18	10	35.8	25	268.5
25	CEMENT SOLVENT 250ML	39172400	18	3	46.6		139.8
26	LUBRICANT 250GM	39172400	18	5	34		170
27	50mm TEE	39172400	18	5	52.9	25	198.375
28	CPVC 40mm (1 112") x 3mt PIPE SDR 13.5	39172400	18	15	806.1	36	7738.56
29	CPVC 25mm (1") x 3mt PIPE SDR 13.5	39172400	18	17	393	36	4275.84

30	CPVC 20mm (3\4") x 3mt PIPE SDR 13.5	39172400	18	110	284.1	36	20000.64
31	CPVC RTEE 40 x 25mm (1 1\2 x 1")	39172400	18	2	159.8	30	223.72
32	CPVC END CAP 40mm (1 1/2")	39172400	18	5	49	30	171.5
33	CPVC METAL CLIP 1 112"	39172400	18	100	13.1	25	982.5
34	CPVC TEE 40mm (1 1/2")	39172400	18	5	141	30	493.5
35	CPVC BALL VALVE 40mm (1 1/2")	39172400	18	3	658.4	30	1382.64
36	CPVC ELBOW 90° 25mm (1")	39172400	18	40	29	30	812
37	CPVC TEE 25mm (1")	39172400	18	50	37.5	30	1312.5
38	CPVC RBUSH 25 x 20mm (1 x 3/4")	39172400	18	15	15.7	30	164.85
39	CPVC MTA 25mm (1")	39172400	18	15	26	30	273
40	CBVC RED ELBOW 25 x 20mm (1 x 3\4")	39172400	18	15	38.9	30	408.45
						Total amount	77467.275

Sample 2:

To,							
M/S Patil Developer & Builder, Bhusawal			**Invoice no:** **Dt:**				
Mobile no: 9766602779			**E-way bill:**				
Email:			**LR/Vehicle No: MH19S9980**				
GST TIN: 27BMVPP9642R1ZK			**DC No:**				
PAN No:			**Place of Supply: Maharashtra (Code: 27)**				
Sr.	**Particulars**	**HSN**	**GST**	**Quantity**	**Weight**	**Rate**	**Amount**
1	G.P. COILS	72104900	18		217.000	76	16492
2	SHAPE & SECTION	72169100	18		133.000	71	9443
3	U SECTION	72163100	18		203.000	72	14616
4	M.S. SPRING WIRE	73201019	18		98.000	78	7644
5	G.P. SHEETS	72104900	18		264.59	81	21431.79
						Total amount	69626.79

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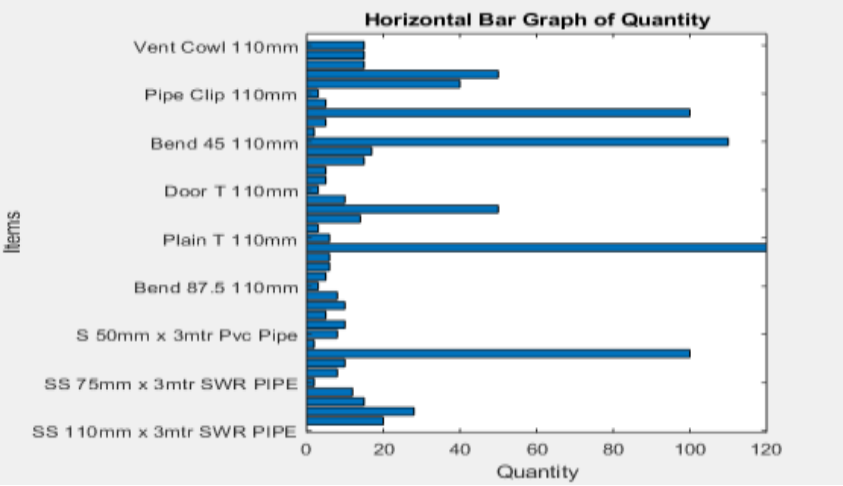
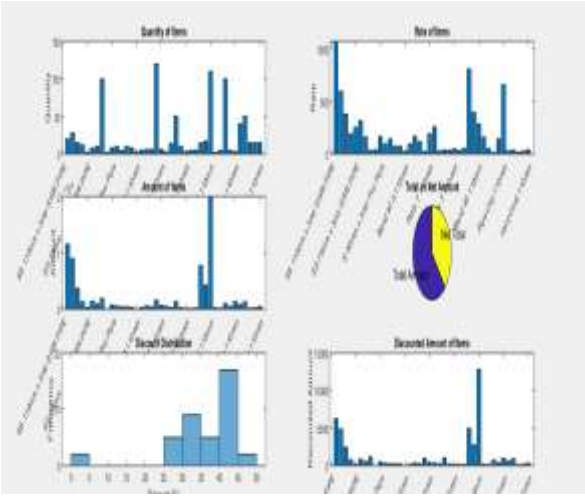
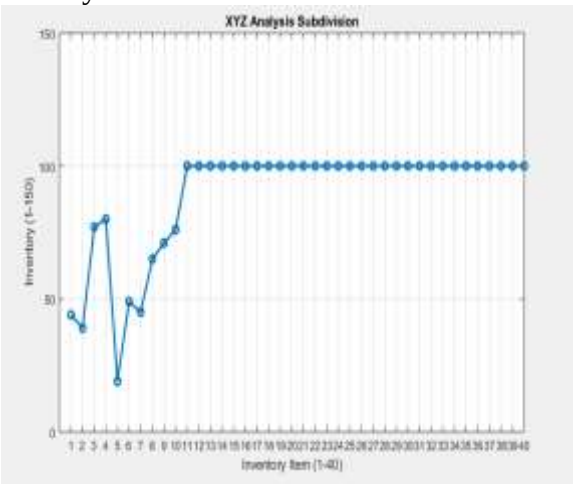




- **XYZ Analysis Method Results**

XYZ analysis is one of the most common methods used to organize spare parts in inventory. XYZ analysis is a format that focuses on the quantitative movement of the inventory parts. This analysis is based on clear foundations for leadership in this subject in terms of the nature of their disparity. There is a clear ease in organizing elements of similar patterns and applying appropriate strategies to each group differently. Below figure shows the division method of the inventory according to this analysis where the (X) represents about 20% percent of the inventory and 80% of the inventory value. The (Y) parts represent about 30% of the inventory and about 15% of the inventory value. The (Z) parts make up about half of the inventory and about 5% of the inventory value.



6.4 Active Items

Managing warehouse inventory efficiently is crucial for optimizing operations and reducing costs. With ERP software like Zoho, businesses can streamline their inventory management processes, ensuring real-time tracking of stock levels, item availability, and accurate pricing. For instance, the active items in the system include various piping components such as SS 110mm x 3mtr SWR pipes (HSN 39172390, GST 18%, Quantity 20, Rate ₹1070), and smaller components like CPVC metal clips 1 1/2" (HSN 39172400, GST 18%, Quantity 100, Rate ₹13.1).

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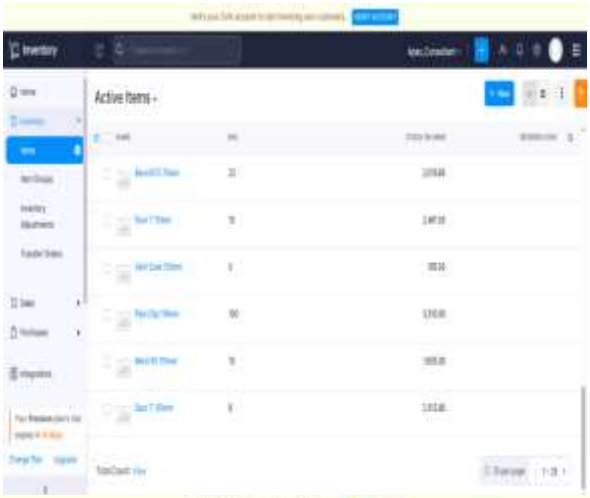

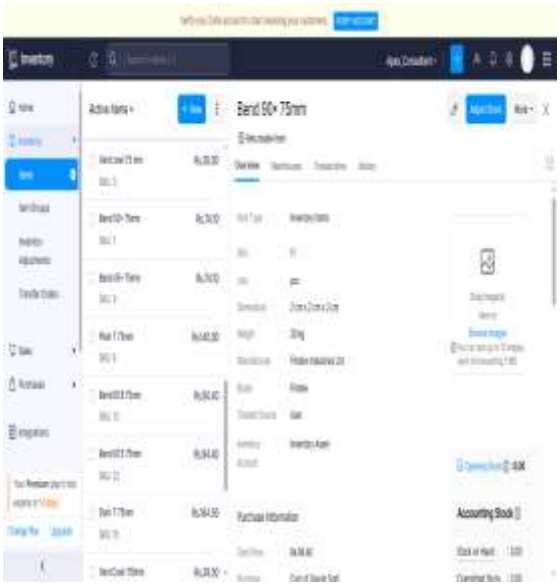

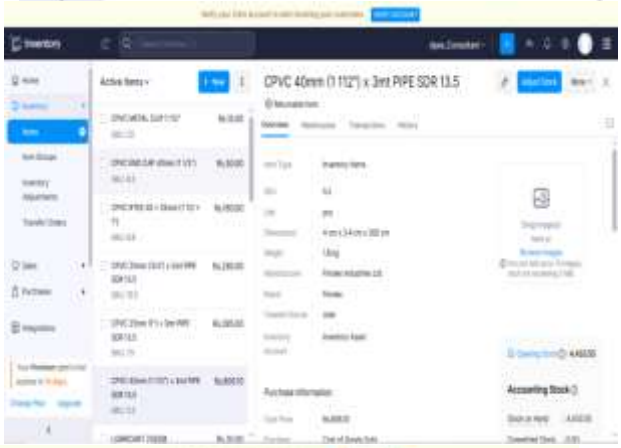

6.5 All Item Groups

Effective inventory management is crucial for ensuring that materials are available when needed and that the warehouse operates efficiently. By utilizing ERP software like Zoho, businesses can streamline their inventory management process, including tracking, ordering, and replenishing stock levels. For example, in a warehouse handling plumbing materials like CPVC pipes and fittings, Zoho ERP software provides a comprehensive overview of each item group. For CPVC 40 mm pipes, the warehouse stocks several items such as CPVC 40mm x 3m pipes (Rate: ₹806.1, Quantity: 15), CPVC Tee 40mm (Rate: ₹141, Quantity: 5), and CPVC Elbow 90° 25mm (Rate: ₹29, Quantity: 40), along with other related items like bends, tees, and clips. Each item is categorized with its HSN code (39172400), GST (18%), quantity, and rate to ensure accurate billing and taxation. This data, updated in real-time, enhances decision-making and ensures optimal stock levels.

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6.6 New Composite Item

In the context of inventory management, utilizing ERP software such as Zoho allows for efficient tracking and management of composite items like CPVC pipes and related components. For instance, the new composite item of CPVC 40mm (1 ½") x 3mt PIPE SDR 13.5 (HSN 39172400) comes with a GST rate of 18%, and the warehouse holds 15 units, each priced at ₹806.1. Other related items include CPVC 25mm pipes, CPVC TEE, CPVC Elbows, and ball valves, all categorized under the same HSN code and tax rate. The quantities for these items vary, such as 17 units of CPVC 25mm x 3mt pipes priced at ₹393 per unit and 5 units of CPVC TEE 40mm at ₹141 each. By integrating these items into Zoho ERP, businesses can automate stock updates, monitor product movement, and ensure timely procurement.

6.7 All Composite Item

For effective inventory management, ERP software like ZOHO helps streamline warehouse operations, providing accurate real-time tracking of stock levels. For instance, with an opening stock of 32,106 units of CPVC 40 mm pipes and a current stock on hand of 23,425 units, ZOHO helps maintain transparency in the stock status, ensuring that supply chain demands are met efficiently. This data-driven system tracks various items, such as CPVC 40mm pipes with HSN 39172400, taxed at 18% GST. The item rates and quantities are also monitored, including CPVC TEE 40mm pipes priced at ₹141 per unit and CPVC Elbow 90° 25mm priced at ₹29 per unit. The ERP software assists in managing these diverse items, reducing stock discrepancies, and providing insights for better purchase and replenishment planning. This ensures that businesses avoid overstocking or stockouts while optimizing warehouse space and resources efficiently.

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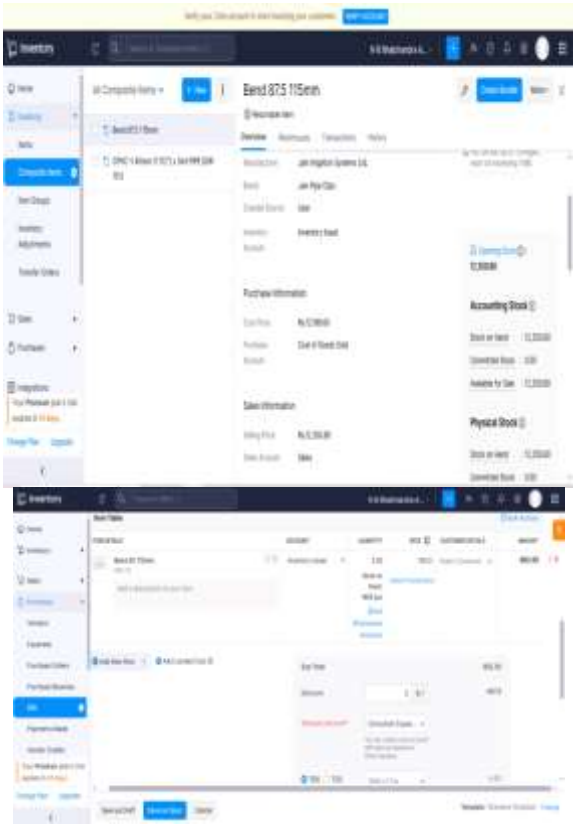

The above image shows a screen from an ERP inventory management system, specifically the Purchasessection, under the Bills tab. The item being processed is "Bend 45 110mm," with a quantity of 5 units, priced at ₹160.5 per unit, resulting in a total of ₹802.50. The current stock on hand for this item is 160 units. A discount of 5% (₹40.13) is applied, and the subtotal reflects the adjusted amount. The system provides options to add landed costs or new rows, and it allows users to choose tax settings like TDS/TCS. The bill can be saved as a draft or opened for further processing.

The image displays a bill for N B Bhalchandra Akashvan from Patil Developers. The bill is numbered 001, with a total balance due of ₹762.37. The order includes one item: Bend 45 110mm, with a quantity of 5 pieces at a rate of ₹160.50 per piece, amounting to ₹802.50**.** A discount of 5% is applied, reducing the total by ₹40.13, resulting in the final payable amount of ₹762.37. The bill is dated 25/09/2024 with the same due date, and the payment terms are listed as "Due on Receipt."

6.8 All Transfer Order

Transfer order in an ERP system for N B Bhalchandra Akashvan, transferring an item to Patil Developers. The transfer order number is 123, and it is currently marked as in Transit. The order was created on 25/09/2024, and the item being transferred is Bend 45 110mm, with a quantity of 10 units totaling ₹1,606.00. The source warehouse is listed as N B Bhalchandra Akashvan in Maharashtra, and the destination warehouse is Pride Purple Square in Pune, Maharashtra. The total amount in words is displayed as Indian Rupee One Thousand Six Hundred Six Only.

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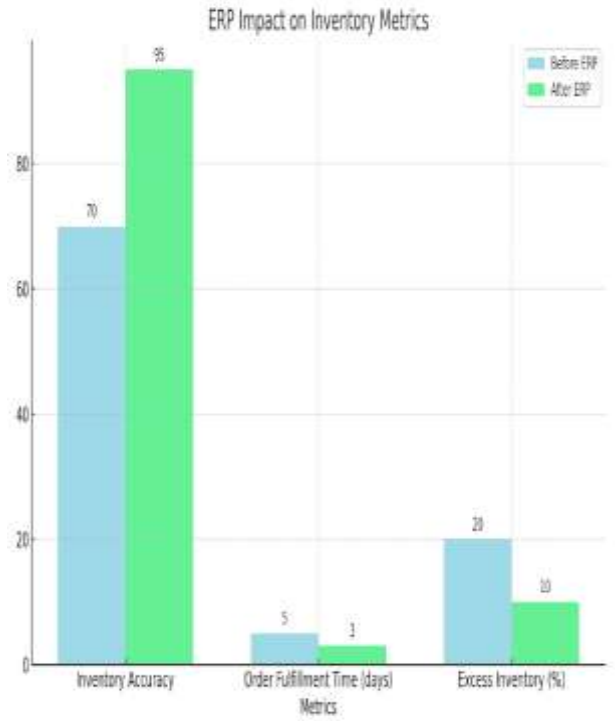
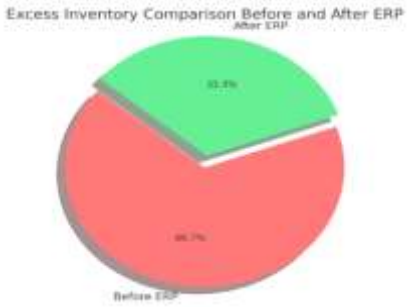
Inventory Management Metrics Before and After ERP Implementation

Metric	Before ERP	After ERP
Inventory Accuracy	70%	95%
Order Fulfillment Time	5 days	3 days
Excess Inventory	20% of total stock	10% of total stock





As show Above Figure significant improvements in inventory management metrics following the implementation of an Enterprise Resource Planning (ERP) system. Inventory accuracy rose dramatically from 70% to 95%, indicating that the ERP system has enhanced the ability to track and manage stock levels accurately. This increase likely leads to fewer discrepancies and improved decision-making. Order fulfillment time decreased from 5 days to 3 days, reflecting a more efficient order processing system that enables faster delivery to customers. This reduction can enhance customer satisfaction and strengthen business relationships. The reduction of excess inventory from 20% to 10% of total stock suggests improved inventory turnover and reduced holding costs. This change indicates a more effective alignment between supply and demand, allowing the organization to optimize its inventory levels. Overall, these metrics demonstrate the positive impact of ERP implementation on operational efficiency and effectiveness in inventory management.

7CONCLUSION AND FUTURE SCOPE

7.1 Conclusion

The integration of Enterprise Resource Planning (ERP) software into warehouse inventory management has proven to be a transformative approach for organizations aiming to enhance operational efficiency and accuracy. The use of such systems streamlines various processes, from real-time inventory tracking to improved decision-making capabilities. Through a detailed analysis of inventory management metrics before and after ERP implementation, the positive impacts of these systems become evident. The findings illustrate not only significant improvements in key performance indicators but also highlight areas where organizations can further optimize their inventory management practices.

In the case study of Patil Developer & Builder, the implementation of an ERP system resulted in marked enhancements in inventory accuracy, order fulfillment time, and excess inventory

reduction. Before ERP, the inventory accuracy was around 70%, leading to frequent stockouts and inefficiencies. Post-implementation, accuracy soared to an impressive 95%. This shift is indicative of the powerful tracking capabilities provided by ERP systems, ensuring that businesses can manage their stock levels effectively and efficiently. Furthermore, the reduction in order fulfillment time from 5 days to 3 days enhances customer satisfaction and strengthens business relationships. Additionally, the decrease in excess inventory from 20% to 10% of total stock signifies a more balanced alignment between supply and demand, optimizing inventory turnover and minimizing holding costs.

The analysis also reveals key insights into the effectiveness of the Economic Order Quantity (EOQ) model within the context of ERP software. Users displayed varying levels of understanding and utilization of EOQ principles, which are essential for minimizing order and holding costs. A focus on improving familiarity with the EOQ model can lead to better inventory management outcomes, enhancing both efficiency and cost-effectiveness.

Moreover, the statistical data collected regarding user engagement with the ERP software provides valuable insights into how different roles within the organization interact with inventory management processes. The majority of respondents indicated strong familiarity and consistent usage of the ERP system, highlighting its integration into their daily operations. This familiarity is crucial for leveraging the software's features to their fullest potential, further emphasizing the importance of ongoing training and support.

- Enhanced Inventory Accuracy: Inventory accuracy increased from 70% to 95%, demonstrating improved tracking capabilities with ERP software.
- Reduced Order Fulfillment Time: The time required to fulfill orders decreased from 5 days to 3 days, enhancing overall efficiency.
- Lower Excess Inventory Levels: Excess inventory was reduced from 20% to 10%, optimizing stock levels and reducing holding costs.
- Positive User Experience: A significant majority of users (52%) have over 5 years of experience with the ERP software, indicating high customer retention.
- Diverse Inventory Management: Users manage a variety of inventory types, with 48% categorized as "Other," suggesting a need for tailored inventory strategies.
- Frequent Software Usage: 48% of respondents utilize the software weekly, reflecting a solid engagement level with the ERP system.
- Understanding of EOQ Model: Limited familiarity with the EOQ model (mean score of 2.16) highlights an area for improvement in inventory management training.
- Role Distribution Insights: Operations Managers represent the largest segment of respondents (58%), underscoring the importance of operational oversight in inventory management.
- Statistical Reliability: Cronbach Alpha values ranging from 0.698 to 0.823 confirm good internal consistency in user responses regarding inventory management practices.
- Need for Training and Resources: The findings suggest the necessity for enhanced training programs focusing on EOQ and inventory strategies for improved operational efficiency.
- Diverse Usage Patterns: User frequency of ERP software varies, with 2% daily and 28% occasionally, indicating a diverse approach to inventory management.
- Continuous Improvement Opportunities: Ongoing evaluation of ERP system effectiveness and user training can further optimize inventory management practices.

Overall, the successful implementation of ERP software significantly contributes to

improving inventory management efficiency, providing organizations with the tools needed to adapt to changing market demands and enhance operational performance. By focusing on continuous improvement and user training, businesses can fully leverage the potential of ERP systems to achieve their inventory management goals.

7.2 Future Scope

4 Future developments may include integrating IoT sensors for real-time inventory tracking, improving accuracy and reducing human error.

5 Leveraging AI algorithms can enhance demand forecasting, optimizing stock levels and minimizing excess inventory, leading to cost savings.

6 Expanding mobile functionalities will allow warehouse managers to access inventory data on-the-go, facilitating quicker decision-making and improved responsiveness.

7 Future versions may offer advanced data visualization tools, enabling more intuitive analysis of inventory trends and performance metrics.

8 Incorporating sustainability metrics within the ERP system can help organizations monitor and reduce their carbon footprint in warehouse operations.

REFERENCES :

[1] L. R. A. Cunha, A. P. S. Delfino, K. A. Dos Reis, and A. Leiras, "Economic production quantity (EPQ) model with partial backordering and a discount for imperfect quality batches," *Int. J. Prod. Res.*, vol. 56, no. 18, pp. 6279–6293, Sep. 2018, doi: 10.1080/00207543.2018.1445878.

[2] A. Mukhopadhyay and A. Goswami, "Economic Production Quantity (EPQ) model for three type imperfect items with rework and learning in setup," *Int. J. Optim. Control Theor. Appl. IJOCTA*, vol. 4, no. 1, pp. 57–65, Nov. 2013, doi: 10.11121/ijocta.01.2014.00170.

[3] R. W. Hall, "On the integration of production and distribution: Economic order and production quantity implications," *Transp. Res. Part B Methodol.*, vol. 30, no. 5, pp. 387–403, Oct. 1996, doi: 10.1016/0191-2615(96)00002-1.

[4] N. A. Karim, A. Nawawi, and A. S. A. P. Salin, "Inventory management effectiveness of a manufacturing company – Malaysian evidence," *Int. J. Law Manag.*, vol. 60, no. 5, pp. 1163–1178, Sep. 2018, doi: 10.1108/IJLMA-04-2017-0094.

[5] D. Atnafu and A. Balda, "The impact of inventory management practice on firms' competitiveness and organizational performance: Empirical evidence from micro and small enterprises in Ethiopia," *Cogent Bus. Manag.*, vol. 5, no. 1, p. 1503219, Jan. 2018, doi: 10.1080/23311975.2018.1503219.

[6] Irene Omari Mbugi, Sr. Dr Deusdedita Lutego, "[No title found]," *Int. J. Eng. Bus. Manag.*, vol. 6, no. 2, 2022.

[7] A. M. Atieh *et al.*, "Performance Improvement of Inventory Management System Processes by an Automated Warehouse Management System," *Procedia CIRP*, vol. 41, pp. 568–572, 2016, doi: 10.1016/j.procir.2015.12.122.

[8] F. D. Utami, W. Puspitasari, and M. Saputra, "Design of planning model for ERP system in warehouse management: an empirical study of public hospital in Indonesia," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 909, no. 1, p. 012061, Dec. 2020, doi: 10.1088/1757-899X/909/1/012061.

[9] A. Rizzi and R. Zamboni, "Efficiency improvement in manual warehouses through ERP systems implementation and redesign of the logistics processes," *Logist. Inf. Manag.*, vol. 12, no. 5, pp. 367–377, Oct. 1999, doi: 10.1108/09576059910295805.

[10] M. Gupta and A. Kohli, "Enterprise resource planning systems and its implications for operations function," *Technovation*, vol. 26, no. 5–6, pp. 687–696, May 2006, doi: 10.1016/j.technovation.2004.10.005.

[11] B. Zhao and C. Tu, "Research and Development of Inventory Management and Human Resource Management in ERP," *Wirel. Commun. Mob. Comput.*, vol. 2021, no. 1, p. 3132062, Jan. 2021, doi: 10.1155/2021/3132062.

[12] M. Lubis, S. Tasia, A. Ridho Lubis, and A.-K. Al-Khowarizmi, "Enterprise Resource Planning (ERP) System Customization with the Inventory Management Module: Case Study of Rumah Yatim," in *The 4th International Conference on Electronics, Communications and Control Engineering*, Seoul Republic of Korea: ACM, Apr. 2021, pp. 7–12. doi: 10.1145/3462676.3462678.

[13] S. Zheng, D. C. Yen, and J. M. Tarn, "The New Spectrum of the Cross-Enterprise Solution: The Integration of Supply Chain Management and Enterprise Resources Planning Systems," *J. Comput. Inf. Syst.*, vol. 41, no. 1, pp. 84–93, Sep. 2000, doi: 10.1080/08874417.2000.11646980.

[14] J. Nugra, M. Wiyarta, and Y. Kurniawan, "The Evaluation of Inventory Management Module of Enterprise Resource Planning System (A Case Study Approach)," in *Proceedings of the 2018 1st International Conference on Internet and e-Business*, Singapore Singapore: ACM, Apr. 2018, pp. 79–83. doi: 10.1145/3230348.3230359.

[15] X. Fang and H.-C. Chen, "Using vendor management inventory system for goods inventory management in IoT manufacturing," *Enterp. Inf. Syst.*, vol. 16, no. 7, p. 1885743, Jul. 2022, doi: 10.1080/17517575.2021.1885743.

[16] X. Fang and H.-C. Chen, "Using vendor management inventory system for goods inventory management in IoT manufacturing," *Enterp. Inf. Syst.*, vol. 16, no. 7, p. 1885743, Jul. 2022, doi: 10.1080/17517575.2021.1885743.

[17] D. M. Bahssas, A. M. AlBar, and Md. R. Hoque, "Enterprise Resource Planning (ERP) Systems: Design, Trends and Deployment," *Int. Technol. Manag. Rev.*, vol. 5, no. 2, p. 72, 2015, doi: 10.2991/itmr.2015.5.2.2.

[18] K. E. Kurbel, *Enterprise Resource Planning and Supply Chain Management: Functions, Business Processes and Software for Manufacturing Companies*. in Progress in IS. Berlin, Heidelberg: Springer Berlin Heidelberg, 2013. doi: 10.1007/978-3-642-31573-2.

[19] Dr. V. Grover, Dr. B. B. Balusamy, Dr. M. Milanova, and Dr. A. Y. Felix, Eds., *Blockchain, IoT, and AI Technologies for Supply Chain Management: Apply Emerging Technologies to Address and Improve Supply Chain Management*. Berkeley, CA: Apress, 2024. doi: 10.1007/979-8-8688-0315-4.

[20] P. Rajagopal, "An innovation—diffusion view of implementation of enterprise resource planning (ERP) systems and development of a research model," *Inf. Manage.*, vol. 40, no. 2, pp. 87–114, Dec. 2002, doi: 10.1016/S0378-7206(01)00135-5.

[21] A. Rizzi and R. Zamboni, "Efficiency improvement in manual warehouses through ERP systems implementation and redesign of the logistics processes," *Logist. Inf. Manag.*, vol. 12, no. 5, pp. 367–377, Oct. 1999, doi: 10.1108/09576059910295805.

[22] A. Vaz and S. Mansori, "Target Days versus Actual Days of Finished Goods Inventory in Fast Moving Consumer Goods," *Int. Bus. Res.*, vol. 10, no. 6, p. 19, May 2017, doi: 10.5539/ibr.v10n6p19.

[23] I. Nishad, "Analysis of Inventory Management by Using Economic Order

Quantity Model - A Case Study," *Int. J. Res. Appl. Sci. Eng. Technol.*, vol. 6, no. 6, pp. 309–315, Jun. 2018, doi: 10.22214/ijraset.2018.6049.

[24] C. Saha, D. K. Jana, and A. Duary, "Enhancing production inventory management for imperfect items using fuzzy optimization strategies and Differential Evolution (DE) algorithms," *Frankl. Open*, vol. 5, p. 100051, Dec. 2023, doi: 10.1016/j.fraope.2023.100051.

[25] L. E. Cárdenas-Barrón, "The derivation of EOQ/EPQ inventory models with two backorders costs using analytic geometry and algebra," *Appl. Math. Model.*, vol. 35, no. 5, pp. 2394–2407, May 2011, doi: 10.1016/j.apm.2010.11.053.

[26] M. Mehdizadeh, "Integrating ABC analysis and rough set theory to control the inventories of distributor in the supply chain of auto spare parts," *Comput. Ind. Eng.*, vol. 139, p. 105673, Jan. 2020, doi: 10.1016/j.cie.2019.01.047.

[27] D. López-Soto, F. Angel-Bello, S. Yacout, and A. Alvarez, "A multi-start algorithm to design a multi-class classifier for a multi-criteria ABC inventory classification problem," *Expert Syst. Appl.*, vol. 81, pp. 12–21, Sep. 2017, doi: 10.1016/j.eswa.2017.02.048.

[28] Z. El Haouat, S. Essalih, F. Bennouna, M. Ramadany, and D. Amegouz, "Environmental optimization and operational efficiency: Analysing the integration of life cycle assessment (LCA) into ERP systems in Moroccan companies," *Results Eng.*, vol. 22, p. 102131, Jun. 2024, doi: 10.1016/j.rineng.2024.102131.

[29] F. Sunmola and G. L. Lawrence, "Key Success Factors for Integration of Blockchain and ERP Systems: A Systematic Literature Review," *Procedia Comput. Sci.*, vol. 232, pp. 775–782, 2024, doi: 10.1016/j.procs.2024.01.077.

[30] M. Gagnon Elian-Gabriel and L. Mihai-Valentin-Cătălin, "THE IMPORTANCE OF USING ERP SYSTEMS IN HUMAN CAPITAL REPORTING," no. 3, 2023.

[31] N. Nalgozhina, A. Razaque, U. Raissa, and J. Yoo, "Developing Robotic Process Automation to Efficiently Integrate Long-Term Business Process Management," *Technologies*, vol. 11, no. 6, p. 164, Nov. 2023, doi: 10.3390/technologies11060164.

[32] I. Ferretti and B. Marchi, "Q-Learning for Inventory Management: an application case," *Procedia Comput. Sci.*, vol. 232, pp. 2431–2439, 2024, doi: 10.1016/j.procs.2024.02.062.