Optimizing Inventory Management with the use of different Inventory Models: A Study on Mitigating Obsolete Inventory

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Masters in Business Administration in Finance

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Date: 3rd May 2024

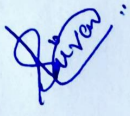
Examined by: 03/05/2024

Seal of School

DECLARATION

I hereby declare that the data presented in this Internship report entitled, **"Optimizing Inventory Management with the use of different Inventory Models: A Study on Mitigating Obsolete Inventory"** is based on the results of investigations carried out by me in the **Finance Department** at the **Goa Business School, Goa University**, under the mentorship of **Prof. Nilesh A. Borde** and the same has not been submitted elsewhere for the award of a degree or diploma by me. Further, I understand that Goa University or its authorities will be not be responsible for the correctness of observations experimental or other findings given the internship report/work.

I hereby authorize the University authorities to upload this dissertation on the dissertation repository or anywhere else as the UGC regulations demand and make it available to any one as needed.



Date: 3rd May 2024
Place: Goa University

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COMPLETION CERTIFICATE

This is to certify that the internship report **"Optimizing Inventory Management with the use of different Inventory Models: A Study on Mitigating Obsolete Inventory"** is a bonafide work carried out by **Ms. Shivani Sanganagouda Patil** under my mentorship in partial fulfilment of the requirements for the award of the degree of Masters in Business Administration in the Finance Department at the Goa Business School, Goa University.

3/05/2024

Date: 3rd May 2024

Prof. Nilesh A. Borde
Management Studies

Dr. Jyoti Pawar
Dean,
Goa Business School
Date: 3rd May 2024
Place: Goa University

Goa Business School
Goa University

School Stamp

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Abbott

04th May 2024

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Ms Shivani Patil. Student of master's in business administration, Studying in Goa Business School, Goa University Taleigao Goa, has undergone Industrial Training from 15th January 2024 to 04th May 2024 at our Goa Plant in Finance Department.

We wish her Best of Luck in all her Future endeavours.

For Abbott India Ltd.

Sneakhare
4/5/24

Sneha Wakhare

Sr. Manager BHR

ABBOTT INDIA LTD. VERNA-GOA

ACKNWOLEDGEMENT

I am writing this acknowledgement to express my sincere gratitude to Sir Bhupendra Patil for providing me with the opportunity to intern and work on the project at Abbott India Ltd as a part of my academic curriculum. I would like to extend my heartfelt thanks to the Dean Prof. Jyoti Pawar of our institution for giving me the permission and support to pursue this internship.

I would also like to express my sincere gratitude to my mentor, Prof. Nilesh Borde, for being an incredible guide throughout my internship. Their support and guidance helped me to gain invaluable knowledge and hands-on experience in the field of Finance. I have learned a lot under their supervision, and I will always be grateful for their time and efforts in helping me develop my skills.

I also wish to thank the entire team at Abbott India Ltd for providing me with an excellent learning experience. Working with such a professional team of experts has been a great privilege, and I am grateful for the knowledge and insights they shared with me.

Once again, thank you for giving me this incredible opportunity. I will always cherish the experience I gained during my internship, and I look forward to applying the knowledge and skills I acquired during my internship in my future endeavours.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Abbott India Ltd, established in 2007 in Verna, Goa, stands as a cornerstone of Abbott Laboratories' global healthcare operations, playing a vital role in India's pharmaceutical market. With a commitment to quality manufacturing and a workforce of 550 employees, the facility produces a diverse range of pharmaceutical products. The company's vision of helping people live their best lives aligns with its mission to deliver high-quality healthcare solutions. Operating in a monopolistic market structure, Abbott India faces competition from both domestic and international pharmaceutical companies. However, its differentiated product portfolio and emphasis on quality manufacturing serve as competitive advantages. The production process follows a continuous method, ensuring efficiency and flexibility to meet market demands. The research findings provide a comprehensive understanding of inventory management within the pharmaceutical sector, focusing on optimizing inventory levels to mitigate the risk of obsolete inventory. Through ABC, XYZ, and FSN analyses, inventory items were categorized based on their value contribution, demand variability, and consumption patterns. The integration of these analyses facilitated the development of targeted inventory management strategies tailored to the specific characteristics of each inventory category. By prioritizing inventory control measures and making informed procurement decisions, pharmaceutical companies can optimize resource allocation and minimize the financial impact of obsolete inventory. The matrix of ABC and XYZ analyses offered a transformative approach to raw material management, enabling companies to align raw material classification with demand dynamics and enhance operational efficiency. Leveraging insights from diverse inventory models allows firms to enhance forecasting accuracy, mitigate stockouts, and drive sustainable growth in an ever-evolving healthcare landscape. By leveraging insights from production schedules and analytical tools, informed decision-making is

fostered, driving efficiency and resilience in inventory management practices. The project provided valuable learnings in applying theoretical knowledge to real-life scenarios, honing analytical skills, and gaining industry insights.

COMPANY PROFILE:

Established in 1888 by Dr. Wallace Calvin Abbott Laboratories, headquartered in Abbott Park, Illinois, has evolved into renowned multinational corporation serving the healthcare, medical devices and pharmaceutical industries. Driven by Wallace Abbott innovative vision, the company emerged from his background as a practicing physician and drug store owner. Abbott's commitment is encapsulated in its tagline, "Life to the fullest" reflecting a century- long dedication to translating scientific advancements into enduring contributions to health.

Established on August 22, 1944, under the companies Act, 1931, as Boots Pure Drug Company India Limited, the company underwent several name changes over the years. It transitioned to The Boots Company Limited on November 1, 1971, then to Boots Pharmaceuticals Limited on January 1, 1991. Subsequently, the company adopted the name Knoll Pharmaceuticals Limited on October 31, 1995, before ultimately becoming Abbott India Limited on July 1, 2002. Operating under its current name, the company reflects a dynamic history of evolution and adaption within the pharmaceutical industry.

Abbott Laboratories, a prominent player in the healthcare industry, engages in comprehensive activities encompassing research, development, production, and marketing of a diverse array of medical supplies. Its operations are structured into four distinct segments: medical devices, established pharmaceutical products, diagnostic products, and nutritional products. The Established Pharmaceutical Products category includes offerings in gastroenterology, women's health, cardiovascular and metabolic health, pain and central nervous system management, respiratory medications, and vaccines. Within Diagnostic Devices, Abbott provides point-of-care systems, rapid diagnostics, informatics, automation solutions, and core laboratory systems spanning immunoassay, clinical chemistry, hematology, and transfusion medicine. The nutritional product segment encompasses a range of adult and pediatric nutritional goods, infant formula, and follow-on formula, showcasing the company's multifaceted commitment to advancing healthcare.

Abbott India limited operates as a public limited company. Its shares are actively traded on the Bombay Stock Exchange and are also available on the National Stock Exchange within the permitted category. The corporate headquarters of Abbott India Limited is located at 3, Corporate Park, Sion Trombay Road, Mumbai- 400 071, India. It was established and incorporated within the Indian jurisdiction, adhering to the Companies Act 1913. It operates strategically through two domestics plants in Baddi, Himachal Pradesh, and Verna, Goa, to address the majority of its product requirements in India. It collaborates with various independent contract or third- party manufacturers throughout the nation. Primarily focusing independent contract or third-party manufacturers throughout the nation. Primarily focusing on the Indian market, Abbott India Limited distributes its products via independent distributors.

The Abbott India Ltd situated at 18, Verna Industrial Estate, Verna, Goa 403710 is a facility established in 2007, stands as a vital component within Abbott Laboratories global healthcare operations. Located in the state of Goa, India, this facility is instrumental in the manufacturing and supply or diverse range of pharmaceutical products, playing a pivotal role in the Indian pharmaceutical market. The company's state-of-the-art manufacturing facility located in Goa underscores its commitment to producing pharmaceuticals of the highest Caliber with 550 employees in the plant. This facility serves as a cornerstone in delivering world-class quality products, setting the company apart and giving it a competitive advantage. With approximately 20.1% of its net sales originating from the Goa plant, it not only signifies a significant portion of the company's manufacturing output but also symbolizes its dedication to maintaining trust-based relationships with healthcare professionals and patients. This emphasis on quality manufacturing acts as a key differentiator, reinforcing the company's reputation for reliability and excellence in the pharmaceutical industry.

i. Vision & Mission Statement

Vision: “Live your best life, now and in the future.”

Mission: “Helping you live your best possible life through power of health”

ii. Core Values

Pioneering

Achieving

Caring

Enduring

Our identity is built upon our core values, shaping our operations and how we cater to our stakeholders. It is crucial to align our organization with these values to effectively fulfill our mission and attain our business objectives.

iii. Products Manufactured at Verna, Goa:

A. Tablets

- Digene Tablets

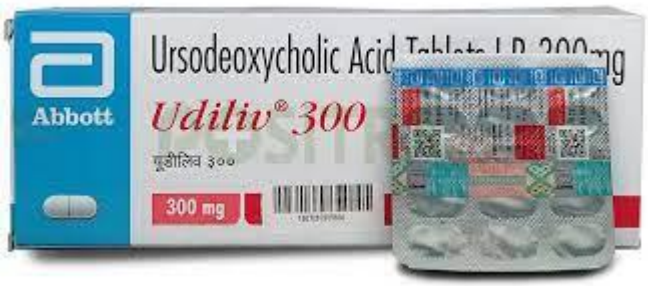
→The Digene Tablets are manufactured in three different flavors- Mint, Orange and Mixed fruit. This product is commonly utilised for addressing issues related to heartburn, acid indigestion, and discomfort caused by excessive gas. These products are frequently employed for diagnostic and therapeutic purposes in managing gastrointestinal conditions.

- Brufen Tablet

→Brufen Tablet used in the treatment of pain relief and fever. It is Manufactured in three different dosages- 200 mg, 400 mg, 600 mg.

- Udiliv Tablet

→Udiliv 300 tablet is a medication specifically designed for the dissolution of cholesterol gallstones. Additionally, it is employed in the treatment of diverse liver-related disorders, showcasing its therapeutic applications. It is Manufactured in three different dosages-150 mg, 300 mg, 600mg.

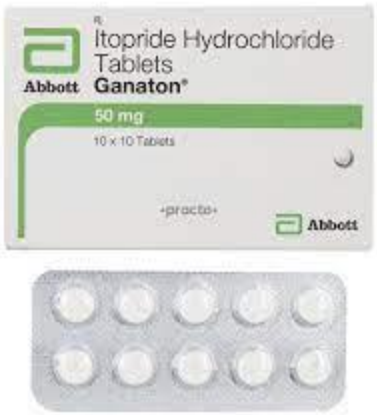


- Cremalax Tablet

→Cremalax Tablet is a medication prescribed for the management of constipation. As a laxative, it facilitates bowel movements, aiding in the evacuation of the bowels to alleviate symptoms associated with constipation.

- GanatonTablet

  →Ganaton tablet is prescribed to address stomach and intestinal issues resulting from decreased movement in the digestive system. It helps relieve symptoms such as a sense of fullness, upper abdominal pain, reduced appetite, heartburn, and nausea/vomiting in conditions like non-ulcer dyspepsia (indigestion) or chronic inflammation of the stomach lining.



B. Liquids

- Cremaffin Syrup

→Cremaffin Syrup is commonly used for the diagnosis or treatment of Stool softener, acidity, indigestion, ulcers, constipation. It is manufactured in two different flavors- Mint and Mixed Fruit.

- Cremaffin Plus Syrup

→Cremaffin Plus Syrup is used as a laxative that stimulates bowel movements.

- Duphalac Syrup

→Duphalac Syrup is used to treat chronic constipation.

iv. Customers:

Pharmacies and Hospitals & healthcare institutions.

The following procedure is followed after the manufacturing of the products:

Dispatch planner → Carrying and forwarding (institutional business) → Storage Hub→ Stockist → Distributors → Different Pharmacies, Hospitals & Healthcare Institutes.

After the manufacturing of the products, the distribution process involves several critical stages to ensure that the products reach their end customers, such as pharmacies, hospitals, and other healthcare institutions, efficiently and safely. The procedure is as follows:

Dispatch Planning

This initial stage involves strategizing and organizing the dispatch of the manufactured goods. This involves coordinating the movement of goods from the manufacturing facility or storage hub to various destinations, such as pharmacies and hospitals.

Carrying and Forwarding (Institutional Business)

At this stage, specialized carrying and forwarding agents (C&F agents) come into play, especially for institutional business that involves large volume transactions directly with hospitals and healthcare institutions. These agents are responsible for the initial collection and temporary storage of products from the manufacturing site.

Storage Hub

The storage hub serves as a central facility where pharmaceutical products are stored before being further distributed. This facility ensures proper storage conditions, including temperature control and security, to maintain the integrity of the medications.

Stockist

Stockists or wholesalers receive the products from the storage hubs. They hold the inventory in larger quantities and are responsible for the distribution to smaller entities such as distributors.

Distributors

Distributors work closely with stockists to acquire pharmaceutical products and distribute them to the final points of sale, including pharmacies, hospitals, and healthcare institutions.

Pharmacies, Hospitals & Healthcare Institutes

The final step in the distribution process involves the delivery of pharmaceutical products to various pharmacies, hospitals, and healthcare institutions. These entities then sell or administer the medications to patients, completing the supply chain cycle. The effectiveness of the entire distribution process ensures that healthcare providers and patients have timely access to essential pharmaceutical products.

V. Production Process

Based on One Month scheduling

Raw materials → Production raises process order → Process order given to stores → Dispensing of RM → Production → Manufacturing → Semi- finished goods → Testing → Filling (liquid)/ Coating (Tablets) → Packaging → Batch is released for Quality Control→ Quality Assurance → Dispatch to C & F location.

1. Raw Materials Procurement:

The company begins by sourcing raw materials required for manufacturing pharmaceutical products. These raw materials include active pharmaceutical ingredients (APIs), excipients, packaging materials, etc. Raw materials are typically sourced from approved suppliers who meet quality standards.

2. Production Raises Process Order:

Once the raw materials are available, a production order is raised specifying the quantity and type of product to be manufactured.

3. Process Order Given to Stores:

The production order is then forwarded to the inventory department responsible for managing raw materials. This department ensures that the required raw materials are available in the necessary quantities and are properly stored until they are needed for production.

4. Dispensing of Raw Materials:

Upon receipt of the production order, the stores department dispenses the required raw materials based on the formulation and quantities specified in the order.

5. Production:

The dispensed raw materials are transferred to the production area where the manufacturing process takes place.

6. Manufacturing:

During manufacturing, the raw materials are processed according to specific protocols and standard operating procedures (SOPs) to ensure consistency and quality.

7. Semi-finished Goods:

After the initial manufacturing steps, the product reaches a semi-finished state.

8. Testing:

Semi-finished and finished products undergo rigorous testing to ensure they meet quality standards and specifications.

9. Filling (Liquid) and Coating (Tablets):

Depending on the dosage form, the final product undergoes additional processes such as filling into bottles for liquids and coating tablets to improve appearance, taste, or stability.

10. Batch Released for Quality Control:

After packaging, a batch of products is released for quality control inspection. This involves sampling from the batch and conducting various tests to ensure that the products meet quality standards and specifications.

11. Quality Assurance:

The quality assurance team oversees the entire production process to ensure compliance with regulatory requirements and company standards. They review documentation, audit procedures, and ensure that corrective actions are taken if any deviations or issues arise.

12. Packaging:

Once the product is finalized, it is packaged into its final presentation form. This involves placing the product into appropriate packaging materials such as bottles and strips and labelling them with necessary information such as product name, dosage strength, expiry date, etc.

13. Dispatch to C & F Location:

Once the batch passes quality control and is deemed acceptable, it is dispatched to the company's designated distribution centers or to contracted Carrying and Forwarding (C & F) agents. From there, the products are distributed to wholesalers, pharmacies, hospitals, and other customers.

v. Production Method Used:

Continuous Production Method is employed by the unit where the manufacturing process operates 24/7, except for maintenance or unforeseen shutdowns. This method is suited to products with high demand, allowing for a constant flow of production to meet market needs efficiently. The continuous production is facilitated through daily wise scheduling based on forecasting. Production schedules are then created and adjusted on a daily basis to align with these forecasts, ensuring that the manufacturing process is both flexible and responsive to demand fluctuations.

The continuous production method benefits the company by maximizing equipment utilization and labor efficiency. It also enables a steady supply of products, reducing the risk of stockouts and

ensuring that pharmacies, hospitals, and healthcare institutions have consistent access to necessary medications.

vi. Departments in the organisations and their respective Department Heads:

Departments	**Department Heads**
Information Technology	Mr. Rajesh Naik
Quality Control & Quality Assurance	Mrs. Pradnya Deshpande
Supply Chain	Mr. Bhupendra Patil
Finance	Mr. Suhas Gaintonde
Human Resource	Mrs. Sneha Wakhare
Environmental Health & safety and Engineering	Mr. Amit Sharma
Business Excellence	Mrs. Jaya Valyan
Manufacturing Science & Technology (MS&T) / Technical Development	Mr. Ganpat Vaglo
Production • Tablet	• Vacant

- Liquid
- L.B. Singh

vii. Functions of different departments:

Information Technology (IT)

The IT department ensures the reliability and security of the network and information systems across the entire plant. They implement and maintain the technological infrastructure, enabling efficient operations in manufacturing plants and throughout the organization. This includes managing software applications, data storage, cybersecurity measures, and providing support to ensure that all departments have the necessary technological resources to operate effectively.

Quality Control (QC)

The Quality Control department is responsible for maintaining the integrity of the pharmaceutical products from raw materials to finished goods. They conduct rigorous testing and analysis of raw materials to ensure they meet specified standards before approval for use. Similarly, QC tests semi-finished prodand finished products to guarantee they are safe, effective, and meet regulatory standards. This continuous monitoring ensures the quality and reliability of products before they reach the market.

Quality Assurance (QA)

Quality Assurance works across all departments to ensure compliance with quality standards and regulatory requirements. They oversee the adherence to Standard Operating Procedures (SOPs), conduct documentations and validations of processes, and ensure that manufacturing practices meet both internal and external quality benchmarks. QA plays a crucial role in maintaining the credibility and safety of the pharmaceutical products by preventing errors and ensuring continuous improvement.

Supply Chain

The Supply Chain department oversees the entire lifecycle of a product, from initial demand forecasting through to the procurement of raw materials, storage, and the efficient production of goods. They ensure that production schedules are aligned with market demand, manage inventory levels, and coordinate logistics to distribute products timely and efficiently. This department is pivotal in balancing supply with demand, minimizing costs, and ensuring that products are available where and when needed.

Finance

The Finance department manages the plant’s financial health, including budgeting, record-keeping, and monitoring expenses. They analyse financial data to support strategic decisions, oversee financial transactions, and ensure that the organization's financial practices are transparent and compliant with regulations. Their role is critical in managing costs, optimizing investments, and ensuring the financial sustainability of the company.

Human Resources (HR)

Human Resources is responsible for recruiting, training, and managing the workforce. They ensure that the company has the skilled personnel needed for various functions, foster employee engagement, and oversee welfare programs. HR policies and practices aim to create a productive, motivated, and satisfied workforce that can meet the organization's goals.

Environment, Health, & Safety (EHS)

The EHS department ensures a safe working environment for employees and minimizes the company's environmental impact. They implement safety protocols, conduct regular health and safety audits, manage waste disposal responsibly, and ensure compliance with environmental laws and regulations. Their work protects employees, the community, and the environment from potential harm associated with pharmaceutical manufacturing.

Engineering

The Engineering department ensures the optimal functioning of machinery and utilities within the manufacturing environment. They are responsible for the installation, qualification, and maintenance of equipment, overseeing water systems, and ensuring all machinery operates within specified parameters. Their work is crucial for minimizing downtime, extending the lifespan of equipment, and ensuring consistent production quality.

Business Excellence

This department focuses on enhancing operational efficiency and productivity across the plant. They employ methodologies like Lean Six Sigma to identify areas of improvement, streamline

processes, and reduce waste. Their goal is to drive sustainable growth and competitiveness by fostering a culture of continuous improvement.

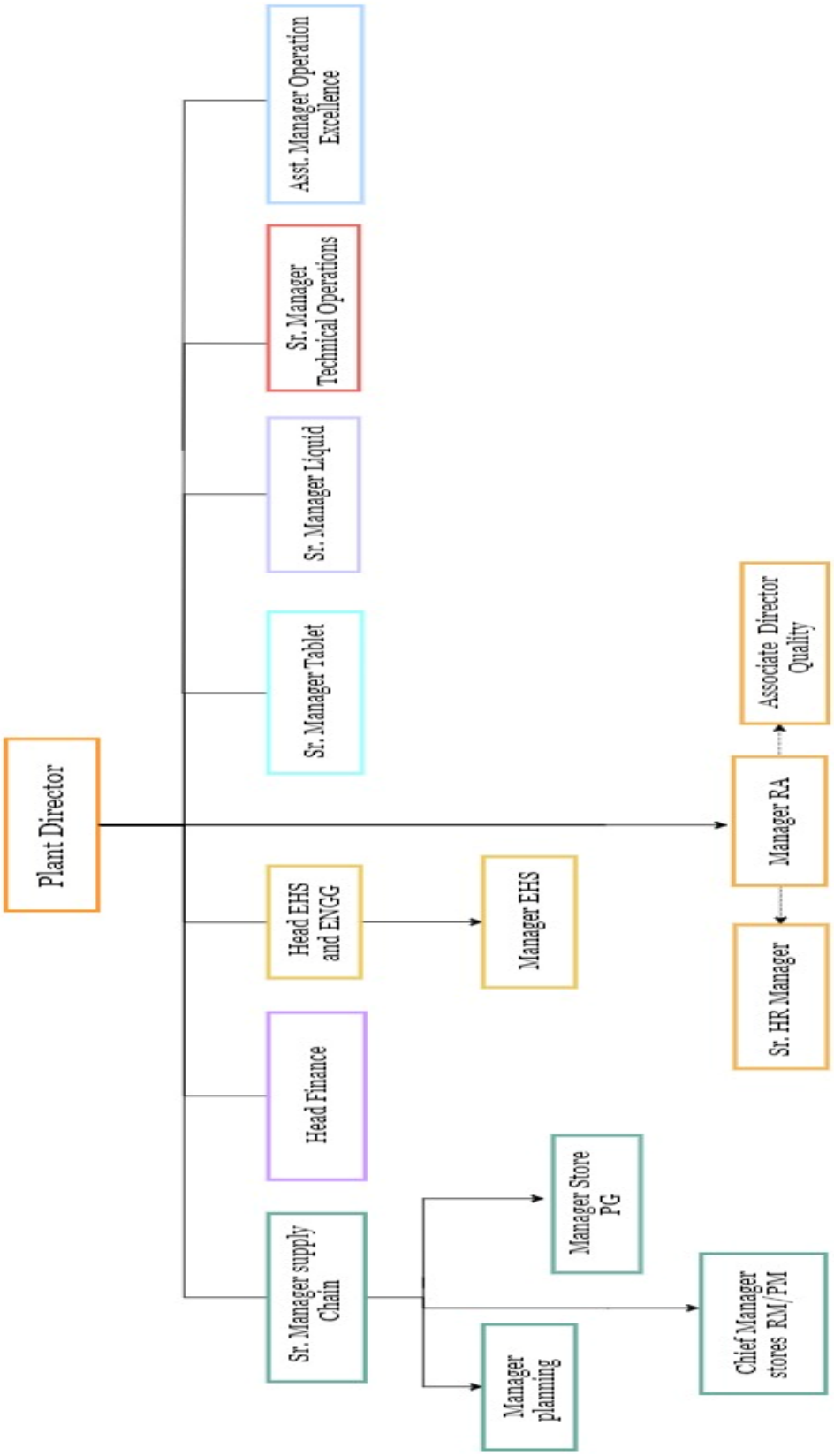
Manufacturing Science & Technology (MS&T) / Technical Development

MS&T is involved in the development and optimization of manufacturing processes. They design these processes, troubleshoot production issues, and implement technological advancements to improve yield, efficiency, and product quality. Their work is critical in scaling up production from research and development to full-scale manufacturing, ensuring processes are robust, cost-effective, and compliant with quality standards.

Production

The Production department plays a vital role in manufacturing, transforming raw materials into finished pharmaceutical products. They oversee the day-to-day operations on the production floor, manage production schedules, and ensure that manufacturing processes are conducted efficiently, safely, and in compliance with quality standards. Their primary goal is to produce high-quality products in the quantities needed to meet market demand, utilizing resources effectively to minimize costs and maximize productivity.

viii. Organisational Hierarchy:


Plant Director
Asst. Manager Operation Excellence
Sr. Manager Technical Operations
Sr. Manager Liquid
Sr. Manager Tablet
Head EHS and ENGG
Manager EHS
Head Finance
Sr. Manager supply Chain
Manager Store PG
Manager planning
Chief Manager stores RM/PM
Manager RA
Associate Director Quality
Sr. HR Manager

INDUSTRY ANALYSIS

The pharmaceutical industry in India, as reported by the Indian Brand Equity Foundation, occupies the third position globally in terms of production volume. This sector has demonstrated significant growth, with a Compound Annual Growth Rate (CAGR) of 9.43 % across the previous nine years. The industry's broad spectrum includes critical areas such as generic medications, over the counter (OTC) products, bulk drugs, vaccines, contract manufacturing and research, biosimilars, and biologics. Notably, India leads internationally in the number of pharmaceutical production facilities that adhere to the stringent regulations of the US Food and Drug Administration (USFDA). The country also boasts 500 producers of Active Pharmaceutical Ingredients (APIs), making up approximately 8% of the global API market. Within its borders, the Indian Pharmaceutical Sector is supported by an extensive network comprising about 3000 drug companies and 10,500 manufacturing units, underscoring its significant role in the global pharmaceutical landscape.

According to the India Brand Equity Foundation, India has established itself as the worlds leading supplier of generic medications, catering to over 200 countries globally. It is renowned for its significant contributions to affordable vaccines and generic drugs, supplying more than half of the worlds demand for various vaccines. Furthermore, Indian pharmaceuticals account for 40% of the generic drug supply in the United States and 25% of all medicines in the United Kingdom, solidifying its position as the global pharmacy. Between the fiscal years 2013-14 and 2021-22,

India’s pharmaceutical exports saw a remarkable increase of 138%, soaring from Rs. 37, 987.68 crores to Rs. 90,324.23 crores.

As reported by IQVIA, the Indian Pharmaceutical Market (IPM) was values at Rs. 2,21,922 crores in 2023, marketing a 9.5% growth compared to the 6.6% growth in 2022. In the domestic market, branded generics dominate the prescription segment, comprising approximately 80% of the market’s value. Despite ongoing efforts to enhance regulatory standards, a company’s brand and reputation continue to be key indicators of product quality. The market is poised for further expansion, with projections indicating a Compound Annual Growth Rate (CAGR) of 8.8% from 2022 to 2027. This growth, expected to reach Rs. 3,08,329 crores by 2027, will be fuelled by economic advancement, broader health insurance coverage and increased investment in the private sector.

i. Market Structure

Abbott India Limited operates within a Monopolistic market structure.

Large number of sellers

There are many pharmaceutical companies in India, both domestic and multinational. The company faces competition from both domestic and international pharmaceutical companies operating in India. Major competitors include Sun Pharmaceutical Industries Ltd, Cipla Ltd, Lupin Ltd, and other multinational pharmaceutical companies.

Differentiated products

Pharmaceutical companies differentiate their products through branding, quality, research and development, and effectiveness of drugs. The company offers a diverse portfolio of pharmaceutical products across various therapeutic categories such as women's health, gastroenterology, cardiovascular, diabetes care, and central nervous system disorders. Product differentiation plays a crucial role in the company's competitive strategy, as it allows Abbott India Ltd to cater to different market segments and meet the specific needs of healthcare professionals and patients.

Some control over prices

Companies in monopolistic competition have some control over their prices because their products are differentiated. However, this control is limited by the presence of other competitors and the availability of substitutes. Abbott India can set prices for its medications, but must consider what competing drugs cost.

Freedom of entry and exit

There are few barriers to entry and exit in the pharmaceutical industry. New companies can develop and market new drugs, and existing companies can choose to leave the market if they are not profitable.

ii. Pestle Analysis

POLITICAL

The company has an impact of government policies and regulations with respect to pricing controls, licensing and approvals. The trade policies can also affect the company's ability to import raw materials and export finished products. Various Government policies in health and welfare sector also plays a role. Upcoming elections or changes in government leadership can lead to policy uncertainty. This can affect Abbott India's long-term planning and investments, especially if new policies prioritize different healthcare goals or focus on promoting local competition. Some government programs like Ayushman Bharat which is aimed to expand the healthcare access will have growing demand for pharmaceuticals products. According to Union Budget 2024, the pharmaceutical industry will actively promote increased funding in research and the adoption of sustainable manufacturing practices. (Prakash, P. (2024, February 6). Union Budget 2024: Pharma industry advocating investments in research, sustainable manufacturing. *ETHealthworld.com)*

ECONOMICAL

The economic factors such as GDP growth, inflation rates and currency exchanges impact Abbott India. News reports in late 2023 might mention rising costs of chemicals or packaging materials impacting the pharmaceutical industry, which could affect Abbott India's production costs. Factor such as increase in inflation can lower the demand for the pharmaceutical products. A stronger Rupee compared to USD can make imports of raw materials cheaper, potentially increasing profit margins. However, it could also decrease the profitability of exports. A weaker Rupee can make imports costlier, potentially squeezing margins. However, it could make Abbott India's exports more competitive in the global market.

SOCIAL

The lifestyle trends have heightened awareness of health among the population which has increased utilisation of healthcare products. Changes in dietary habits and lifestyles can affect the gastrointestinal issues, which in result can drive demand for antacid medicines. Factors such as spicy food consumption, irregular eating habits, and stress levels can impact the incidence of acidity and heartburn. India's aging population creates a growing demand for geriatric healthcare products and services. Abbott India can benefit by expanding its product portfolio in areas like adult nutrition, chronic disease management devices, and diagnostic tools for age-related conditions.

TECHNOLOGICAL

The pharmaceutical sector is in a state of transformation, characterized by the continual emergence of novel technologies. The digital transformation of the healthcare sector is creating new opportunities for pharma companies. Pharma companies can use digital technologies to improve their efficiency, customer service, and product development. The new medical technologies which are emerging all the time can create opportunities for Abbott India Ltd to develop new products and services and adapt the new advanced technology. The healthcare industry is also becoming increasingly digitalised, which is creating new opportunities for the company. Technological innovations in telemedicine, mobile health apps and digital diagnostics may influence how consumers manage their digestive health.

LEGAL

The Indian government has introduced various drug pricing regulations, including those established by the NPPA (National Pharmaceutical Pricing Authority), with the aim of enhancing

the affordability of medications for patients. As per India Brand Equity Foundation, the National Pharmaceutical Pricing Authority (NPPA) had brought as many as 384 formulations under price control in 2023 and has now additionally fixed the ceiling price of 93 essential formulations including pain killers and drugs used to treat cancer, rheumatoid arthritis, heart disease, bacterial infections, pneumonia, tuberculosis, thyroid, epilepsy and urinary tract infections. Additional downward pressure could come from Trade Margin Rationalization to more non-scheduled drugs used for the long-term treatment of chronic conditions. The company also follows stringent labour law regulations. Adherence to strict regulatory standards and compliance with health and safety regulations is imperative in the pharmaceutical industry. Legal changes related to product approvals, labelling, and advertising can affect operations. The OTC sector in India has been growing at a healthy rate driven by increased access to information and an evolving, and more informed consumer. The Drugs Technical Advisory Board (DTAB) approved a new OTC regulation policy in January 2022 to create an explicit OTC category and remove ambiguity from the current OTC definition. Post acceptance of the proposed amendment to the Drugs and Cosmetics Act, up to 100 drugs currently dispensed under a prescription can be shifted to the OTC category. (*Annual reports: Abbott India Limited*. Annual Reports | Abbott India Limited. (n.d.). https://www.abbott.co.in/investor-relations/financials/annual-reports.html)

ENVIRONMENTAL

The Indian government has implemented a number of environmental regulations, such as the Air and Water (prevention and control of pollution) Act, 1981. These regulations are designed to protect the environment and public health. Pharma companies need to ensure that they are in

compliance with these regulations. The company needs to follow environmental regulations which consist of waste disposal practices and pollution control. These regulations are followed from the state as well as the central Government. During the year 2023, Goa plant received the prestigious Abbott Global EHS Excellence award for upgrading occupational health and fire protection facilities at site. Site Safety Committee is formed at the plant having representation from both supervisory and non-supervisory staff. Committee meets at regular frequency to discuss and resolve EHS issue. 99.3% Hazardous waste generated at Goa Plant is sent for incineration with energy recovery. The Goa plant retains its certification of Zero Waste to Landfill (ZWL) which means no waste is disposed of through landfilling, protecting the environment from degradation.

iii. Poter's 5 forces Analysis

RIVALRY AMONG COMPETING SELLERS - HIGH

The Indian pharmaceutical industry is highly fragmented, with most companies of similar size and capacity, we have Sun Pharma with a market share of 9.23%, Dr. Reddys Labs with 7.52%, Cipla with 7.00%, Abbott laboratories with 5.75% share and a large number of domestic players with similar to 5% or lesser market share.

The domestic market is competitive with a large number of players and characterized by various market segments: pure generics, branded generics, and formulations in different combinations among large and small players. A large portion of the Indian pharmaceutical firms are manufacturers of generic medicines with a few manufacturing branded drugs thus forming the basics of competition.

Abbott India ltd has a lot of competitors in the market, with both domestic and international players. Competition from Indian generics manufacturers like Cipla and Sun Pharma in the pharmaceuticals segment directly challenges Abbott India market share and profitability.

THE THREAT OF NEW ENTRANTS- LOW

The threat of new entrants to the pharmaceutical industry is low. The industry has established companies with well-set-up infrastructure and distribution channels allowing economies of scale, and access to long-standing relationships with distributors and retailers making it difficult to compete in price.

The pharmaceutical industry is also heavily regulated with strict requirements for clinical trial product development and manufacturing which makes it difficult and costly for new entrants to comply with all the necessary regulations.

Entering the Indian healthcare market requires significant resources, regulatory approvals, and established distribution networks

COMPETITIVE PRESSURES FROM SELLERS OF SUBSTITUTE PRODUCTS- MODERATE

The threat of substitutes for the pharmaceutical industry in India is considered moderate. Despite the availability of substitutes synthetic pharmaceutical products have a command over the market, India ranks third globally in pharmaceutical production by volume and is the largest supplier of generic medicine and manufacturer of low-cost vaccines. India is termed as the "pharmacy of the world" with a global preference associated with low prices and high-quality pharmaceutical

products manufactured in India. Generic drugs can substitute for branded pharmaceuticals, putting pressure on Abbott India's pricing and market share in that segment.

COMPETITIVE PRESSURE FROM BUYERS BARGAINING POWER- MODERATE

Buyers of pharmaceutical products are patients who are usually influenced by doctors-prescribed medication and cannot bargain a price while buyers in the case of hospitals and healthcare organizations are well informed about the seller's product description and price which give them more bargaining power to lower the prices as they purchase the products in bulk.

For patients with multiple medications or chronic conditions, it is difficult to switch brands or products easily giving the pharmaceutical companies power over the price. Additionally, being a price-sensitive country families with poor financial conditions tend to delay purchases if the price of medication is high. To provide equal access to all the price of basic drugs is regulated under the National Pharmaceutical Pricing Authority and hence buyers cannot completely bargain a price. Therefore, the bargaining power of buyers for the pharmaceutical industry in India is considered moderate. Meanwhile Government hospitals and bulk procurement schemes can negotiate lower prices for essential drugs and diagnostics impacting Abbott India Ltd.

COMPETITIVE PRESSURE FROM SUPPLIERS BARGAINING POWER- MODERATE TO HIGH

Raw materials that include chemicals constitute a major portion of a pharmaceutical firm's expense. Abbott India Ltd relies on various suppliers for raw materials, components, and manufacturing services. Some suppliers, like those for specialized components or API (Active

Pharmaceutical Ingredients), might have significant bargaining power due to limited alternatives. Thus, the supplier bargaining power for the pharmaceutical industry is moderate to high.

iv. Future Growth of the Pharmaceutical Industry

On January 24, 2024, Kiran Mazumdar-Shaw, the executive chairperson of Biocon, emphasized the potential for India's pharmaceutical industry to reach a value of USD 200 billion by 2030 through incentives aimed at fostering research for innovative drugs. Currently standing at approximately USD 65 billion, the size of India's pharmaceutical sector presents significant growth opportunities. Mazumdar-Shaw highlighted the necessity for this growth to extend beyond generics and biosimilars, emphasizing the pivotal role of drug innovation in driving the industry's expansion.

The Indian pharmaceutical industry commands a prominent share of more than 20 per cent in the global medical supply chain. By 2024, the Indian pharmaceuticals industry is expected to reach USD 65 billion. The government has also significantly increased the expenditure outlay for the production-linked incentive (PLI) schemes related to manufacturing in the pharmaceuticals sector. Outlay allocation for PLI schemes in the pharmaceutical industry increased to Rs. 21.4 billion in 2024-25 from Rs. 16.9 billion in 2023-24 period.

Around 48% pharmaceutical and healthcare companies surveyed are prepared to integrate first gen-AI solutions within one year, according to an EY report. It added that the shift in significant in the industry, which has been traditionally conservating in adopting digital technologies.

Export Improvements:

Drugs & pharmaceuticals exports are likely to improve in the ongoing financial year. The growth in exports will be aided by drug shortages in the United States (US) and trade agreements. Drugs & pharmaceuticals exports are set to increase in 2023-24 after remaining flat in 2021-22 and increasing by a minimal 3.2 per cent in 2022-23. In 2020-21, growth in drug exports increased by 18 per cent from eight per cent in 2019-20. This strong growth in drug exports was due to a surge in demand for drugs in the global market for the treatment of Covid-19. Nations all over the world turned to India to meet the rise in demand in the midst of the Covid-19 pandemic, which in many parts of the world caused lockdowns and production disruptions. India exported over 115 million doses of vaccines to 97 countries, according to the ministry of commerce and industry.

The pharmaceutical industry was unable to maintain the growth momentum during 2021-22. In 2021-22, growth in drug exports was flat due to the high base of the preceding year, drop in demand for Covid related medicines and decline in exports to the US. The drugs & pharmaceuticals exports to the US declined by eight per cent in 2021-22. Exports were sluggish because of intense pricing pressures in the US. The impact of pricing pressure was exacerbated by lower abbreviated new drug application (ANDA) approvals and fewer new drug launches.

In 2022-23, drug exports rose by 3.2 per cent. Drug exports increased due to depreciation in Indian rupee. The Indian rupee depreciated by 7.3 per cent in 2022-23. Exports also rose due to a strong

demand in the US market. Drug exports to US rose by 14.5 per cent in 2022-23. Drug exports grew in spite of a drop in demand for Covid-related medicines and the Russia-Ukraine war. Russia is one of the important export markets for drugs and pharmaceuticals. Drug exports to Russia declined by 3.9 per cent during 2022-23.

Drug exports are expected to increase by 5.8 per cent in 2023-24. Drug exports are likely to increase in the current financial year due to a shortage of drugs in the US. US is a major export destination for the industry. It accounts for nearly 28-32 per cent of the total drugs and pharmaceutical exports. The shortage is more pronounced in cancer drugs, particularly chemotherapy drugs for breast, bladder, and ovarian cancers. This would benefit Indian drug exporters.

Trade agreements signed by India with other nations are also likely to support drug exports. India signed trade agreements with Australia and the United Arab Emirates (UAE), which will give enhanced access to Indian pharmaceutical products to these markets. The Comprehensive Economic Partnership Agreement (CEPA) with the UAE came into force on 1 May 2022. The trade agreement signed by India and UAE has resulted in an increase in pharmaceutical exports to the UAE and is likely to support exports in the future. UAE accounts for around 1.3 per cent of the drug exports. Drug exports to UAE increased by 6.8 per cent during May 2022-September 2023, compared to the year-ago period. (*Economic outlook*. Economic Outlook. (n.d.). https://economicoutlook.cmie.com/)

COMPANY ANALYSIS

i. Swot Analysis

STRENGTH

- The company drafts and follows rigorous Standard Operating Procedures which ensures consistency, compliance and high-quality standards through its operations.
- The company invests heavily in research and development which helps in innovative products to cater to evolving market needs. It spent around 0.88 crores on Research and Development which constituted to 0.02% of their total turnover in 2022-23
- The has a widespread distribution network and market presence, ensuring its products are widely accessible across various regions of Goa and in India. This extensive reach enhances the company's ability to cater to diverse consumer needs. The company has 8,100 plus stockists enabling them to reach a wide customer base.
- The gastroenterology portfolio showed strong growth in 2022-23. It further strengthened its success with the first-to-market launch of Cremagel-L, Duphalac, Cremaffin Plus and Cremaffin as their leading brands in the laxative category. They have a 38% market share and significant growth that is superior to Respective Participated Market. The Gastroenterology portfolio showed a robust growth of 10.5%.

WEAKNESS

- Lack of automation and advanced technology at this plant.
- The market is highly competitive, featuring numerous key players, including Sun Pharma, Cipla, and Dr. Reddy's Laboratories, with market capitalizations of Rs. 378,627 crores, Rs. 118,044 crores, and Rs. 103,879 crores, respectively. In comparison, Abbott India Ltd has a market capitalization of Rs. 57,679 crores.
- The company operates in a highly regulated industry and any significant regulatory changes, related to price controls affects the company’s profitability.

OPPORTUNITIES

- Ayushman Bharat Digital mission already implemented by “Global a;care program which aligned with ABDM. The company can implement more digital initiatives by Indian Government.
- In 2022, the market for online pharmacies was worth 25.50 billion. It is anticipated to expand at a compound annual growth rate (CAGR) of 22.20% from 2022 to 2027. This will increase access to organized pharmacies across the country and consequently drive increased demand and healthy competition.
- Pharma Traceability system (PTS) launched by the department of Pharmaceuticals, this initiative aims to tract and trace medicines throughout the supply chain to combat counterfeiting and ensure patient safety. This will provide additional transparency and compliance benefits.
- Uniform Code of Pharmaceuticals Marketing Practices, while currently voluntary, could become mandatory in the future. A mandatory code would require ethical marketing

practices to be followed by all Companies. Given that the Company has a strong compliance process in place, it would be well positioned under a strict enforcement of UCPMP.

THREATS

- Availability of Grey products in the market (Goods sold outside the authorized distribution channels by entities which may have no relationship with the producer of the goods).
- Presence of intense competition in the market with competitors like Sun Pharma, Dr Reddy's lab, Cipla.
- Any disruptions in supply chain due to unforeseen reasons can affect the production and distribution of the products.
- The Indian pharmaceutical industry operates under a highly regulated environment. Tighter norms for clinical trials as well as for development of new drugs and treatment may impact the industry growth, but are beneficial in the long run. Growing competition from generic medicines, dependence on imports for Active Pharma Ingredients (API), supply chain disruption due to geopolitical incidents, pose challenges to the industry and the Company. The Company remains at the forefront of these challenges and continue to develop new products at an affordable price point to meet evolving patient needs.

ii. VRIN Analysis

Impact on Competitive Advantage	V	R	I	N
	VALUE	RARE	INIMITABLE	NON-SUBSTITUTE
Efficient Manufacturing Practices	YES	NO	NO	NO
Rapid Innovation in R&D	YES	NO	NO	YES
Extensive supply chain distribution	YES	YES	NO	YES
High Quality Products	YES	YES	YES	NO

VALUE

The company provides value to the customers as it offers high quality products. The company's commitment and continuous investments in the research and development has contributed to its overall proposition by introducing new drugs and creating future growth potential. The company also possess strong brand recognition in India. AWACS Udiliv takes the spotlight as the pinnacle of excellence in the Acute Category, earning the prestigious title of Best Brand of the Year. The company has a strong relationship with their suppliers which is a valuable resource for the company. Approximately 27% of the materials were purchased from local suppliers at Goa. The percentage of input material (inputs to total inputs by value) sourced directly from MSMEs/ Small producer by 21% and directly from within the district and neighbouring districts at 17%.

RARITY

The company has a strong distribution network which helps the products to be accessible across different pharmacies and hospitals. The company's possession of exclusive patents for certain medical formulations can be considered rare. These patents provide the company with a competitive edge by offering unique products that are not easily replicated by the competitors. The company has also won several external recognitions for its brands, marketing initiatives and other innovations. Abbott India Ltd invests heavily in Research and Development, creating innovative products and solutions. This focus on innovation helps them to stay ahead of the curve and differentiate themselves. The company also maintains high standards for regulatory compliance which ensures product quality and safety.

INIMITABLITY

The raw materials of the products cannot be duplicated as they are Vendor qualified. There is rigorous quality assurance and control taken place which cannot be imitated by the competitors easily. It is also very difficult for the competitors to adapt their different formulations and the recipes. Since the company possess advanced manufacturing capabilities and expertise, it allows them to produce high-quality products. The company also has extensive collaborations with healthcare professionals and research institutes which cannot be easily imitated. The company also invests in employee training and development which fosters a culture of continuous learning. Throughout their training initiatives, the company has embraced a Phygital approach, combining both face-to-face and digital methods. Maximizing the efficiency and productivity of

manufacturing operations through process upgrades and responsible collaborations with local manufacturers, resulting in cost reduction and adherence to high-quality standards.

NON-SUBSTITUTABLE

Abbott India's well-established distribution network and long-term relationships with healthcare providers create a non-substitutable advantage. Competitors would find it challenging to replicate a similar network quickly, giving the company a unique position in reaching consumers effectively. The company also adheres to high standards of corporate governance, ensuring transparency and accountability.

PROJECT INTRODUCTION

Efficient inventory management is a strategic imperative for manufacturing firms, playing a pivotal role in enhancing operational efficiency and competitiveness. At its core, the task of determining optimal order quantities and inventory levels is fundamental to all operational decision-making. As a key element in the business cycle, inventory management directly influences cash flow dynamics. The balance struck in inventory levels is delicate, as excessive stock can strain a business's cash resources, while insufficient inventory may lead to sales losses and customer delays. Mastering inventory management is not merely a logistical challenge, but a

strategic necessity, where precision in balancing supply and demand contributes significantly to a firm's overall financial health and market competitiveness.

Effective pharmaceutical inventory management is a critical component of the healthcare delivery system, with far-reaching implications for both clinical and financial outcomes. This multifaceted process involves the development and supervision of pharmaceutical inventory levels, ensuring the availability of sufficient supplies while minimizing the financial impact of overstock or understock situations.

The pharmaceutical inventory management framework encompasses three key elements: basic stock to meet average demand, and safety stock to account for fluctuations in demand. The primary objective is to maintain a consistent pharmaceutical supply to operational units, striking a delicate balance between avoiding stockouts and preventing overstocks, which can compromise patient care, lead to pharmaceutical wastage, and incur financial losses.

Effective pharmaceutical inventory management serves as a safeguard against uncertainties in demand and order cycles, acting as a buffer within the supply chain. Poor management, on the other hand, could potentially lead to interruptions in pharmaceutical supplies, underscoring the critical role it plays in sustaining healthcare services.

This research embarks on comparative analysis of diverse inventory models, ranging from classic methods ABC analysis, XYZ Analysis, FSN analysis, matrix ABC and XYZ analysis. By delving into the strengths, limitations and applicability of each model, this study aims to unearth insights

that can guide supply chain practitioners in their strategic decision-making processes. Furthermore, it explores the nuanced factors that influence the effectiveness of these models within the pharmaceutical sector.

RESEARCH TOPIC

"Optimizing inventory management with the use of different inventory models: A study on mitigating obsolete inventory."

RESEARCH QUESTIONS

Q. How do different inventory management models aids in the overall management of inventory?

Q. In what ways do these inventory management models assist in identifying obsolete inventory?

Q. What are the strategies that can be implemented to minimize obsolete inventory and improve inventory management?

RESEARCH OBJECTIVES

1. To find how different inventory management models aids in the management of inventory.
2. To classify inventory into ABC Analysis and XYZ Analysis.
3. To classify inventory into Fast- Moving, Slow- Moving and Non-Moving inventory.
4. To carry out combined analysis of ABC analysis and XYZ analysis.

RESEARCH METHODOLOGY

The study relies on secondary data collection approach that is obtained from the databases within the organisation. Additionally, interactions with key personnel within the organizations, further supplement the data collection process. These interactions provide invaluable insights into inventory management.

The data gathered consists of the production quantity needed for a duration of 12 months, spanning from January 2024 to December 2024. Additionally, it includes price of raw materials. Furthermore, the dataset encompasses information regarding the opening stock for the initial four months—January 2024, February 2024, March 2024, and April 2024. The names of material descriptions are withheld to maintain confidentiality. Instead, they have been substituted with alternative terms for the purpose of anonymity.

DATA ANALYSIS & RESULTS

https://docs.google.com/spreadsheets/d/14s4tw-95VXIiHQhBP4cqf1-XEv-79TsU2pNsAtIBhvQ/edit?usp=sharing (Excel Calculations for the Analysis)

i. ABC Analysis

ABC Analysis stands as a cornerstone in inventory management, offering businesses a strategic framework to prioritize their inventory items effectively. This technique categorizes inventory into three main groups based on their value and importance, namely A, B, and C items.

In essence, A items represent the most critical and high-value inventory, typically constituting a small percentage of the total items but accounting for a significant portion of the overall inventory value. These items are often characterized by high demand, high-value, or criticality in production processes. Prioritizing the management of A items ensures that businesses maintain adequate stock levels to meet customer demand and prevent stockouts, thereby safeguarding revenue streams and enhancing customer satisfaction.

Conversely, B items occupy a middle ground, comprising moderate-value inventory that requires regular monitoring and management attention. While not as critical as A items, B items still contribute to overall sales and operational efficiency. By applying appropriate inventory control measures to B items, businesses can strike a balance between minimizing carrying costs and ensuring sufficient stock availability to meet demand fluctuations.

Finally, C items encompass low-value inventory items that contribute minimally to overall revenue or operational processes. Although individually less significant, the cumulative value of C items can still be substantial. Effective management of C items involves adopting cost-efficient stocking strategies, such as bulk ordering or vendor-managed inventory, to minimize handling and storage costs while ensuring adequate availability for occasional demand.

ABC analysis classifies inventory items into three categories based on their annual consumption significance. This helps prioritize inventory control efforts and optimize resource allocation. Here's a breakdown of the categories:

- **A-items (High Priority):** These are the most critical raw materials, constituting 0% to 80% of the total consumption**.** Given their high impact, A-items warrant tight controls and frequent monitoring.
- **B-items (Moderate Priority):** These raw materials hold moderate importance, representing 80% to 95%. They require less stringent controls than A-items, but maintaining good records and implementing a balance between inventory levels and ordering costs is crucial.
- **C-items (Low Priority):** These are the least critical raw materials, accounting for 95% to 100% of the total consumption. C-items typically have a lower value and can be managed with simpler controls and minimal record-keeping.

Calculations:

- **Step 1: Annual Demand:** Calculated the total demand for each raw material by summing the amount used each month over a year.
- **Step 2: Annual Value:** Multiplied the annual demand quantity for each material by its unit cost to find the total annual cost of that material.

  *Annual Value =Total Demand * Cost per unit*
- **Step 3: Cumulative Consumption Value:**
  - Order all materials by their total annual value (from least expensive to most expensive).
  - Add the annual value of each material sequentially to create a running total.
  - This running total represents the cumulative consumption value.
- **Step 4: Percentage Contribution:** Calculate the percentage contribution of each material to the total consumption value. This is done by dividing each material's annual value by the total consumption value (from step 3) and multiplying by 100%.

  Percentage contribution= Cumulative consumption/ Total of annual consumption

Finally, based on these percentages, the raw materials were categorized into three groups using the ABC classification method:

A-items: These are the top 0-80% of raw materials in terms of cumulative consumption value.

B-items: This category comprises raw materials that fall within the range of 80% to 95% of the cumulative consumption value.

C-items: These are the raw materials that account for the remaining 5% to 100% of the cumulative consumption value.

Table 1:

Type	Quantity	Value (in rs)	% of quantity	% of value
A	4960449.8	₹ 2,95,37,73,527.30	4%	79%
B	100773374	₹ 58,66,65,360.80	84%	16%
C	14701015	₹ 19,49,24,524.56	12%	5%
Total	**120434838**	**₹ 3,73,53,63,412.66**	**100%**	**100%**

The table presents the ABC analysis of raw materials constituting 105 items based on their quantity and value.

Graphical Representation:

(Values and Quantities are expressed in lakhs)

Figure 1:

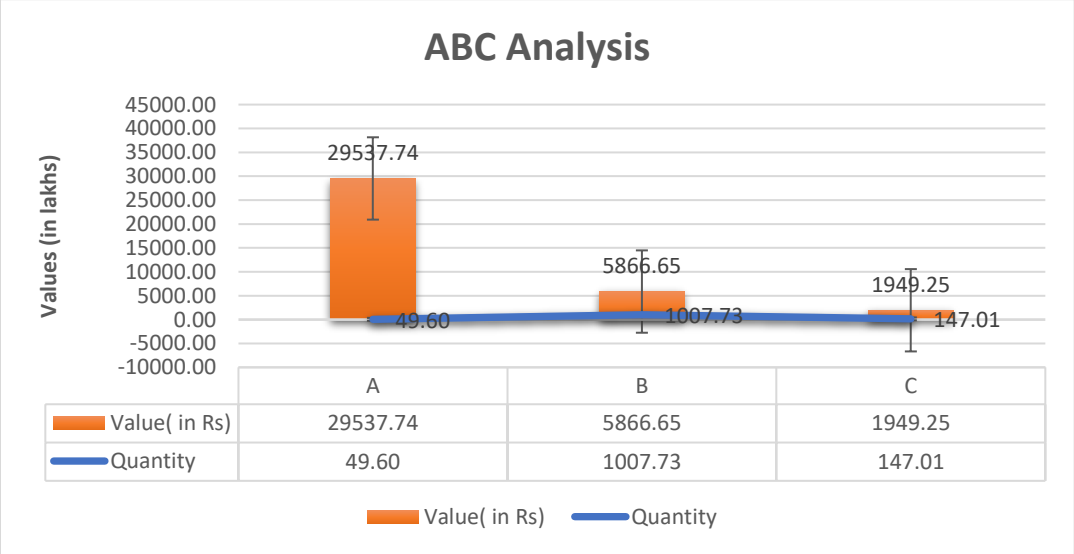
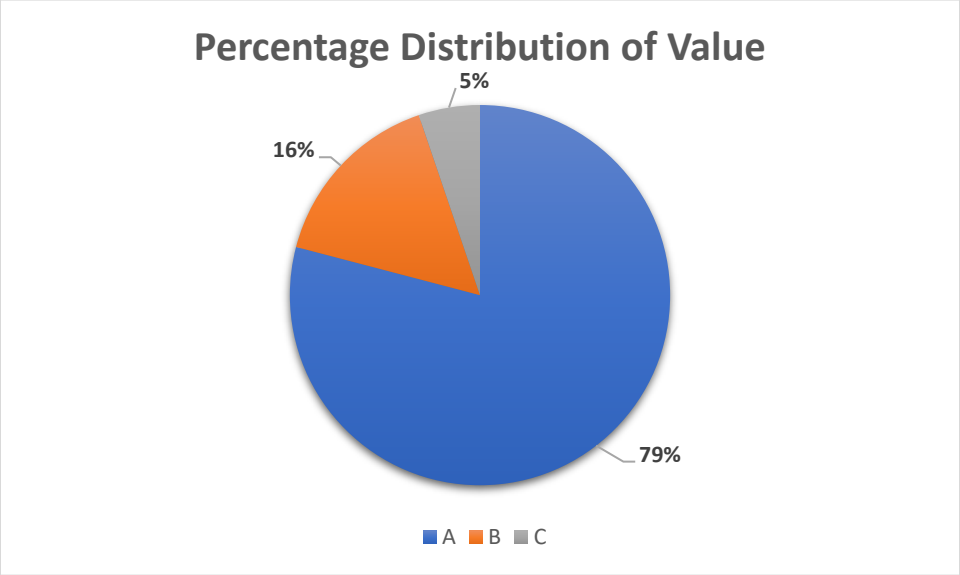


Figure 2:



Interpretation:

Category A: The A-items category represents a substantial portion of the inventory, totalling 4,960,449.8 units with a value of ₹2,95,37,73,527.30. It represents the top 4% of raw materials in terms of quantity, but they contribute significantly to the total value, accounting for 79%. This indicates that although these materials are consumed in smaller quantities, they are high-value items critical to the production process.

Category B: The B-items category represents a substantial portion of the inventory, totalling 100773374 units with a value of ₹ 58,66,65,360.80. It constitutes a large portion that is, 84% of the total quantity of raw materials consumed. However, their contribution to the total value is relatively lower at 16%. These materials are consumed in moderate quantities and have moderate value implications for the business.

Category C: The C-items category represents a substantial portion of the inventory, totalling 14701015 units with a value of ₹19,49,24,524.56. It makes up 12% of the total quantity of raw materials consumed but contribute only 5% to the total value. These materials are consumed in relatively lower quantities and have lower value implications compared to A and B items.

The analysis can tackle obsolete inventory in the companies by using the following approach:

- **Prioritizing Control for High-Value (A-Class) materials:**
    - A-class drugs, despite being fewer, contribute significantly to the total inventory cost. ABC analysis identifies them and allows for stricter controls to minimize obsolescence risks.
- **Optimizing Stock Management for B & C Class Drugs:**
    - B and C class drugs have lower individual costs and contribute less to the overall value. ABC analysis helps manage these by:
        - **Reduced stock levels:** Lower stock minimizes storage costs and the risk of expiration, reducing the amount of potentially obsolete inventory held.
        - **Improved forecasting focus:** By focusing forecasting efforts on high-value A-class drugs with potentially higher demand variability, companies ensure they have adequate stock of critical medications.

By implementing strategies based on ABC classification, the companies can significantly reduce the risk of holding obsolete inventory. They achieve this by:

- Prioritizing tight controls and accurate forecasting for high-value drugs most susceptible to financial losses from obsolescence.
- Minimizing storage costs and expiration risks for lower-value drugs.
- Identifying slow-moving drugs early and taking proactive steps to prevent obsolescence.

ii. XYZ Analysis

XYZ Analysis provides a strategic framework for categorizing inventory items based on their demand variability, thereby aiding in the optimization of inventory management processes. This analysis divides items into three distinct categories: X, Y, and Z.

X items represent inventory with the lowest demand variability, indicating stable and predictable consumption patterns. These items typically have consistent usage rates and are essential for maintaining core operations within manufacturing facilities. Y items exhibit a moderate level of demand variability, often attributed to known factors such as seasonal fluctuations, promotional activities, or specific patient needs. While not as stable as X items, Y items still demonstrate a degree of predictability, enabling supply chain teams to implement tailored planning strategies.

Z items, on the other hand, have the highest demand variability, making them the most challenging to forecast accurately. These items may experience erratic demand patterns due to factors such as changing market dynamics, regulatory changes, or unpredictable patient demand.

By categorizing inventory items into X, Y, and Z categories based on demand variability, pharmaceutical companies can develop tailored inventory management strategies for each category.

In the XYZ categorization system, which was applied to classify 106 diverse raw materials into three groups, each group represents different usage rates and consumption variability (CV):

Group X: This group comprises raw materials with a high usage rate. Materials in this category have a coefficient of variation (CV) of less than 35%. The coefficient of variation is a measure of relative variability, calculated as the ratio of the standard deviation to the mean. In this case, a CV of less than 35% indicates that the consumption of these materials is relatively stable and consistent over time. These materials are typically consumed at a steady and frequent pace, making them crucial for the continuous operation of the business.

Group Y: Raw materials classified into Group Y have an average usage rate. These materials have a coefficient of variation (CV) that falls between 35% and 60%. A CV within this range suggests moderate variability in consumption. While not as stable as Group X materials, items in Group Y are still consumed regularly, albeit with some fluctuations in demand. These materials are important for maintaining production levels but may require slightly more flexible inventory management strategies to accommodate variations in demand.

Group Z: This group consists of raw materials with a low usage rate, often consumed only occasionally. Materials in this category have a coefficient of variation (CV) exceeding 60%. A CV greater than 60% indicates significant variability in consumption, with sporadic or infrequent usage patterns. These materials may be niche or specialized items required for specific projects or situations. Due to their low and irregular consumption, inventory management for Group Z

materials may focus on maintaining sufficient stock levels to meet occasional demand while minimizing excess inventory carrying costs.

Calculations:

- **Annual Demand:** Sum the quantities of raw materials required for each month across the year to find the total amount needed. This considers seasonal or other variations in demand.
- **Value of Demand:** Multiplied the annual demand quantity for each raw material by its unit price. This gives the total cost of raw materials needed for the year.

Value of demand = Annual Demand Cost per unit*

- **Standard Deviation:** This statistic measures how spread out the monthly demand quantities are from the average monthly demand. A higher standard deviation indicates larger variations in demand throughout the year.

  Standard Deviation = Stdev.p of all 12 months

- **Coefficient of Variation:** This is a relative measure of variability, calculated by dividing the standard deviation by the average monthly demand. It shows the degree of fluctuation in demand compared to the average, expressed as a percentage.

  Coefficient of Variation = Stdev.p of all 12 months / Average of 12 months

Table 2:

Type	Quantity	Value (in rs)	% of quantity	% of value
X	3628289.172	₹ 28,82,88,825.91	3%	8%

Y	71220549.02	₹ 1,88,69,32,728.87	59%	51%
Z	45586000.08	₹ 1,56,01,41,857.88	38%	42%
Total	**120434838.3**	**₹ 3,73,53,63,412.66**	**100%**	**100%**

Figure 3:

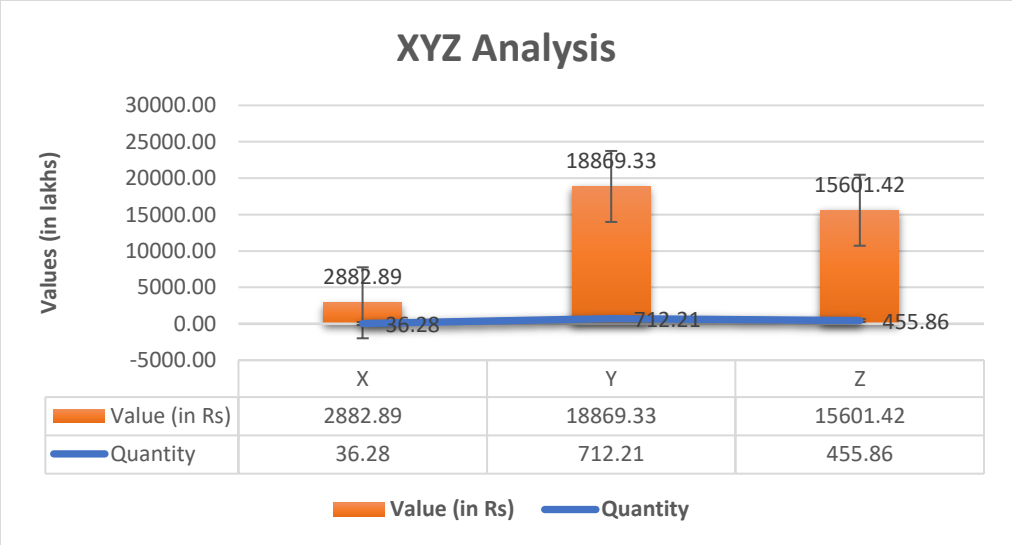
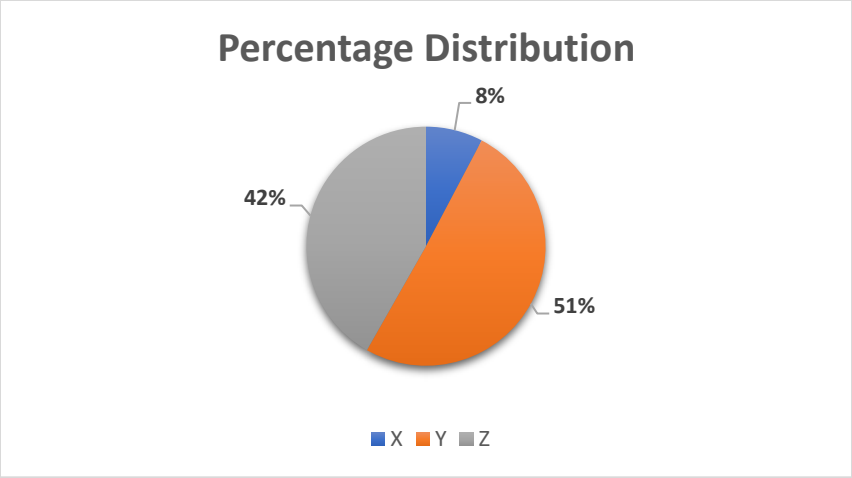


Figure 4:



Group X: The X-items category represents a substantial portion of the inventory, totalling 3628289.172. units with a value of ₹ 28,82,88,825.91. This category comprises items with a low quantity of 3% and a low value contribution of 8%. Group X materials are characterized by a low usage rate and low value, indicating that they are consumed infrequently and contribute relatively little to the total value of raw materials consumed.

Group Y: The Y-items category represents a substantial portion of the inventory, totalling 71220549.02 units with a value of ₹ 1,88,69,32,728.87. The raw materials classified into Group Y constitute a significant portion of the total quantity consumed, accounting for 59%. However, their contribution to the total value is higher at 51%. Group Y materials have a moderate usage rate and represent a substantial portion of the inventory's value. They are consumed regularly but may experience some variability in demand

Group Z: The Z-items category represents a substantial portion of the inventory, totalling 45586000.08 units with a value of ₹ 1,56,01,41,857.88. This category comprises items with a relatively high quantity of 38% and a significant value contribution of 42%. Group Z materials have a high usage rate and contribute significantly to the total value of raw materials consumed. Despite their lower quantity compared to Group Y, Group Z materials command a higher value, indicating their importance despite their irregular consumption patterns.

The analysis can tackle obsolete inventory in the companies by using the following approach:

- Since the analysis categorises, the materials based on their demand variability, it identifies the materials which are prone to unpredictable consumption patterns. By identifying these materials in an early stage through XYZ analysis, the companies can prioritize their management and prevent overstocking and obsolescence.
- The analysis helps in identifying slow moving inventory. Category Z (erratic demand) often includes slow-moving items. These might become obsolete if not managed closely.
- By highlighting potential slow-moving items, the company can focus on reduced order quantities and shorter lead time from the suppliers.

iii. Fast-Moving, Slow-Moving and Non-Moving Analysis

FSN analysis, a widely used inventory management technique in pharmaceutical companies, categorizes raw materials into fast-moving, slow-moving, and non-moving groups based on their consumption rates and storage durations. By conducting FSN analysis, pharmaceutical firms can

effectively identify dead stock/obsolete, optimize procurement decisions, and manage warehouse space efficiently. Fast-moving raw materials require frequent replenishment to maintain production continuity, while slow-moving or non-moving materials can be stored strategically to minimize holding costs. This approach minimizes the risk of stockouts for critical raw materials, improves inventory turnover rates, and ensures better alignment with customer demand. Ultimately, leveraging FSN analysis insights enables pharmaceutical companies to mitigate obsolescence risks, enhance operational efficiency, and optimize resource utilization across the supply chain.

Calculations:

- The analysis begins with collecting data on the opening raw materials inventory for a specific period, typically spanning four months.
- To assess the consumption patterns, the average consumption rate of raw materials over the four-month period is calculated.

  Consumption Rate = Average of 4 months opening stock
- This average consumption rate provides insight into the typical usage level of each raw material. Next, the cumulative consumption rate is determined by summing up the individual consumption rates of raw materials. This cumulative rate represents the total consumption activity observed across all raw materials over the four-month period. The percentage of cumulative consumption is then calculated for each raw material. This percentage indicates the contribution of each raw material to the total consumption activity observed during the four-month period.

- Raw materials with a percentage less than 60% are classified as fast-moving. These materials contribute significantly to the overall consumption and are consumed at a relatively rapid rate.
- Raw materials with a percentage between 60% and 99% are classified as slow-moving. While they contribute to consumption, their rate of consumption is slower compared to fast-moving items.
- Raw materials with a percentage exceeding 99% are classified as non-moving. These materials contribute minimally to consumption during the four-month period, indicating low usage or potentially obsolete inventory.

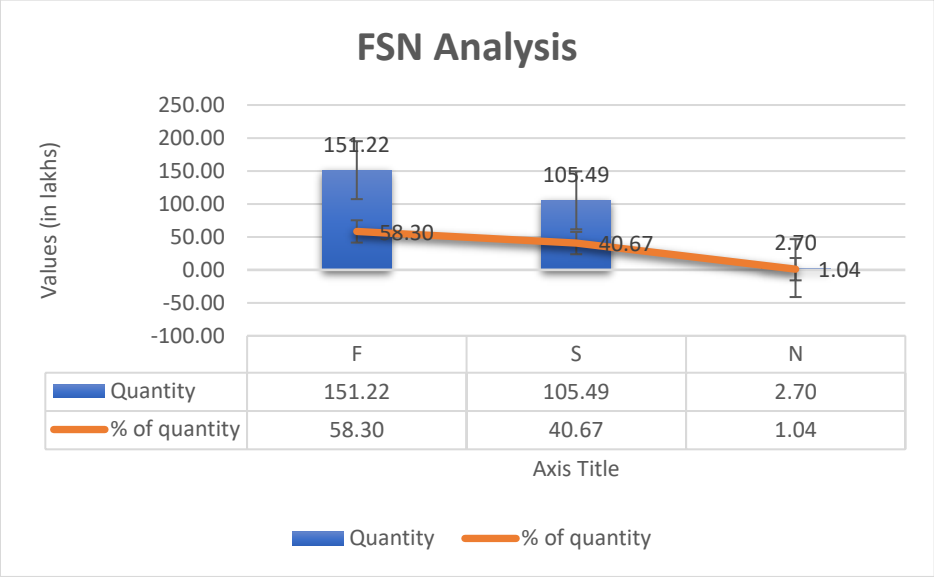
By categorizing raw materials into fast-moving, slow-moving, and non-moving groups based on their percentage of cumulative consumption, company can prioritize inventory management efforts and make informed decisions regarding procurement, stocking levels, and inventory optimization strategies.

Table 3:

Type	Quantity	% of quantity
Fast-Moving	15122052	58%
Slow-Moving	10548982.22	41%
Non-Moving	269504.554	1%

Total	25940538.78	100%

Figure 5:



Fast-moving (F):

Fast-moving raw materials comprise 58% of the total quantity constituting of 15122052 units, indicating that they are consumed at a rapid pace within the inventory cycle. These materials are crucial for maintaining regular production operations as they are frequently used. While they constitute a significant portion of the inventory in terms of quantity, their individual value contribution may be relatively lower compared to other categories.

Slow-moving (S):

Slow-moving raw materials represent 41% of the total quantity constituting of 10548982.22 units, indicating that they are consumed less frequently compared to fast-moving items but still make up a substantial portion of the inventory. These materials may have a longer inventory turnover cycle and are typically consumed in smaller quantities or less frequently than fast-moving items.

Non-moving (N):

Non-moving raw materials account for only 1% of the total quantity constituting 269504.554 units, indicating that they are consumed rarely, if at all, within the inventory period. These materials may have very low demand or may be obsolete items that are no longer used in production. Managing non-moving items is critical to prevent excess inventory buildup, reduce storage costs, and minimize the risk of inventory obsolescence.

Strategies which can be used:

- By identifying slow-moving drugs and non-moving, FSN analysis allows for:
    - Reduced stock levels: Holding lower quantities minimizes storage costs and the risk of expiration for these drugs.
    - Reduce order quantities: Order smaller, more frequent batches to minimize holding excess material.
    - FSN analysis, combined with historical usage data, helps forecast demand for raw materials. This allows for better planning of purchases, reducing the risk of overstocking materials with a high chance of obsolescence.

iv. Matrix of ABC & XYZ Analysis

The integration of ABC and XYZ analyses into an automated process presents a transformative approach to raw material management. Departing from the conventional three-category system, the integration of ABC/XYZ analysis expands the classification spectrum to nine categories, offering a more intricate understanding of raw materials, goods, and consumption patterns. This amalgamated analysis emerges as a pivotal tool for achieving enduring inventory optimization within pharmaceutical material management.

This method affords a nuanced depiction of a company's raw material portfolio, enabling tailored responses to market demands. It facilitates swift identification of raw materials with unforeseen usage patterns, empowering timely adjustments to inventory levels. Leveraging precise analysis, companies can proactively adapt to shifting market dynamics, ensuring optimal inventory levels while sidestepping excessive capital investments and write-offs. The synergistic application of ABC and XYZ analyses serves as an effective rationalization mechanism, establishing an optimal ordering rhythm for raw materials and mitigating both financial risks and inventory losses.

The convergence of ABC and XYZ analyses establishes a crucial link between the value contribution of individual raw materials and their temporal demand or consumption patterns. This correlation furnishes invaluable insights for future raw material assortment planning, guiding decisions on inventory stocking levels and procurement strategies. By aligning raw material

classification with demand dynamics, pharmaceutical companies can enhance operational efficiency, optimize resource allocation, and adeptly respond to the evolving needs of the market.

The matrix of ABC and XYZ analysis combines both classification systems to provide a comprehensive view of inventory items. Each item is assigned a category based on both its importance to the business (ABC) and its consumption pattern (XYZ).

Table 4:

Class	A	B	C
X	High Value, Continuous Demand	Medium Value, Continuous Demand	Low Value, Continuous Demand
Y	High Value, Fluctuating Demand	Medium Value, Fluctuating Demand	Low Value, Fluctuating Demand
Z	High Value, Irregular Demand	Medium Value, Irregular Demand	Low Value, Irregular Demand

The table you provided combines the ABC classification system (A, B, and C) with factors influencing inventory management: demand consistency (continuous or fluctuating) and demand frequency (regular or irregular). Here's a breakdown of each section (X, Y, and Z) to elaborate on how these factors affect inventory control strategies:

Section X (Continuous Demand):

This section focuses on raw materials with consistent demand throughout the year. Here's how the ABC classification applies:

- **A Items (High Value, Continuous Demand):** These are the most critical materials with both high value and steady demand. They require the most stringent controls, potentially including forecasting techniques and just-in-time inventory strategies to optimize costs.
- **B Items (Medium Value, Continuous Demand):** These materials have moderate value and consistent demand. They warrant good record-keeping and regular monitoring, but control measures can be less stringent than A-items.
- **C Items (Low Value, Continuous Demand):** Since these materials have low value and consistent demand, simpler controls and minimal record-keeping can suffice.

Section Y (Fluctuating Demand):

This section deals with raw materials where demand varies throughout the year. Here's how the ABC classification interacts with fluctuating demand:

- **A Items (High Value, Fluctuating Demand):** These are critical materials with high value and variable demand. They require close monitoring, potentially with safety stock levels to buffer against demand spikes, and forecasting techniques to anticipate fluctuations.
- **B Items (Medium Value, Fluctuating Demand):** Balancing inventory levels with ordering costs becomes even more crucial for these materials. While controls should be stricter than C-items, they might not be as tight as A-items. Implementing forecasting and buffer stock strategies can be beneficial.

- **C Items (Low Value, Fluctuating Demand):** Since these materials have low value and variable demand, simpler controls are still appropriate. However, maintaining some minimum stock levels might be necessary to avoid stockouts during demand peaks.

Section Z (Irregular Demand):

This section deals with raw materials with unpredictable demand patterns. Here's how the ABC classification is applied in such cases:

- **A Items (High Value, Irregular Demand):** These are critical materials with unpredictable demand and high value. Forecasting becomes challenging, so maintaining higher safety stock levels and exploring alternative suppliers (to ensure availability) might be necessary.
- **B Items (Medium Value, Irregular Demand):** Balancing cost and availability becomes crucial. Implementing techniques like vendor-managed inventory (VMI) or consignment stock can be helpful. Here, the supplier manages inventory levels based on agreed-upon triggers.
- **C Items (Low Value, Irregular Demand):** For these materials, keeping some minimal stock and exploring alternative suppliers when needed might be sufficient.

Raw Materials Distribution

Table 5:

Class	A	B	C
X	1	1	2

Y	3	7	12
Z	9	11	59

This part of the table provides the distribution of raw materials across the ABC and XYZ categories.

There is 1 raw material classified as A-X, indicating it is of high value with continuous demand.

There are 12 raw materials classified as B-Y, suggesting they have medium value with fluctuating demand.

There are 59 raw materials classified as C-Z, implying they have low value with irregular demand.

Breakdown of the ABC and XYZ classification:

Table 6:

Material Description	ABC	Value (in Rs)	XYZ	Value (in Rs)	ABC & XYZ
RM22	A	147418950	X	147418950	AX

This combination represents items that are high in value and have stable, predictable demand patterns. RM22 is critical and require careful management to ensure optimal inventory levels and availability while minimizing excess stock.

Table 7:

Material Description	ABC	Value (in Rs)	XYZ	Value (in Rs)	ABC & XYZ
RM124	A	1627923375	Y	1627923375	AY

AY items are high in value but have moderate demand variability. While they are important to the business, their demand patterns may exhibit some fluctuations. RM124 falls into that category

Table 8:

Material Description	ABC	Value (in Rs)	XYZ	Value (in Rs)	ABC & XYZ
RM175	A	1077767562	Z	1077767562	AZ
RM268	A	100663640	Z	100663640	AZ

RM175 & RM268 represents high-value items with highly erratic and unpredictable demand patterns.

Table 9:

Material Description	ABC	Value (in Rs)	XYZ	Value (in Rs)	ABC & XYZ
RM69	B	30284595.84	X	30284595.84	BX
RM79	B	24594623.17	X	24594623.17	BX
RM77	B	15563251.89	X	15563251.89	BX

RM69, RM79 & R77 have moderate value and stable, predictable demand patterns. While they are not as critical as Class A items, they still require regular monitoring and management to ensure efficient inventory control and customer service.

Table 10:

Material Description	ABC	Value (in Rs)	XYZ	Value (in Rs)	ABC & XYZ
RM217	B	57096000	Y	57096000	BY
RM126	B	37612102.35	Y	37612102.35	BY
RM221	B	23634000	Y	23634000	BY
RM224	B	21664833.3	Y	21664833.3	BY
RM219	B	21600205.6	Y	21600205.6	BY
RM215	B	20392897.14	Y	20392897.14	BY
RM75	B	19927085.3	Y	19927085.3	BY

Items in this category have moderate value and moderate demand variability. They require ongoing attention to balance inventory levels and customer demand.

Table 11:

Material Description	ABC	Value (in Rs)	XYZ	Value (in Rs)	ABC & XYZ
RM228	B	64381044	Z	64381044	BZ
RM288	B	53867340	Z	53867340	BZ

RM289	B	36262691.9	Z	36262691.9	BZ
RM256	B	26979494.8	Z	26979494.8	BZ
RM185	B	18769945.34	Z	18769945.34	BZ
RM290	B	17483895	Z	17483895	BZ
RM127	B	16250000	Z	16250000	BZ
RM132	B	15697500	Z	15697500	BZ
RM294	B	14933520	Z	14933520	BZ
RM292	B	13866840	Z	13866840	BZ
RM312	B	12329043	Z	12329043	BZ
RM314	B	12329043	Z	12329043	BZ

These items represent moderate-value items with highly erratic and unpredictable demand patterns.

Table 12:

Material Description	ABC	Value (in Rs)	XYZ	Value (in Rs)	ABC & XYZ
RM68	C	8508627.521	X	8508627.521	CX
RM71	C	4516380.613	X	4516380.613	CX
RM160	C	3948123.283	X	3948123.283	CX
RM67	C	3605309.07	X	3605309.07	CX
RM82	C	3305101.437	X	3305101.437	CX
RM72	C	2504228.467	X	2504228.467	CX
RM208	C	1828928.667	X	1828928.667	CX

RM209	C	1625948.867	X	1625948.867	CX
RM83	C	1526127.37	X	1526127.37	CX

These items are low in value and have stable, predictable demand patterns. While individually they may not be significant, collectively they contribute to the overall inventory and require basic inventory management to ensure availability without excessive investment.

Table 13:

Material Description	ABC	Value (in Rs)	XYZ	Value (in Rs)	ABC & XYZ
RM223	C	9749025	Y	9749025	CY
RM218	C	9230520	Y	9230520	CY
RM80	C	6112604.937	Y	6112604.937	CY
RM87	C	5907558.299	Y	5907558.299	CY
RM225	C	5244283.6	Y	5244283.6	CY
RM88	C	4819141.982	Y	4819141.982	CY
RM81	C	4768473.033	Y	4768473.033	CY
RM222	C	4145797.5	Y	4145797.5	CY
RM78	C	2952850.833	Y	2952850.833	CY
RM85	C	2557769.788	Y	2557769.788	CY
RM125	C	1054790	Y	1054790	CY

Items in this category are low in value but have moderate demand variability. They require basic management to ensure adequate stock levels while avoiding stockouts.

Table 14:

Material Description	ABC	Value (in Rs)	XYZ	Value (in Rs)	ABC & XYZ
RM216	C	6265899.09	Z	6265899.09	CZ
RM311	C	5911185	Z	5911185	CZ
RM313	C	5066730	Z	5066730	CZ
RM317	C	4749680.4	Z	4749680.4	CZ
RM183	C	4583880	Z	4583880	CZ
RM129	C	4225000	Z	4225000	CZ
RM245	C	3597738.144	Z	3597738.144	CZ
RM296	C	3591236.8	Z	3591236.8	CZ
RM130	C	3185000	Z	3185000	CZ
RM229	C	2870420	Z	2870420	CZ
RM286	C	2679840	Z	2679840	CZ
RM76	C	2394163.961	Z	2394163.961	CZ
RM182	C	2180039.4	Z	2180039.4	CZ
RM179	C	1713600	Z	1713600	CZ
RM131	C	1543845	Z	1543845	CZ
RM184	C	1375587.72	Z	1375587.72	CZ
RM230	C	1364431.875	Z	1364431.875	CZ
RM227	C	1157100	Z	1157100	CZ
RM297	C	942976	Z	942976	CZ
RM307	C	866677.5	Z	866677.5	CZ

RM177	C	821205	Z	821205	CZ
RM261	C	752444	Z	752444	CZ
RM269	C	751023	Z	751023	CZ
RM260	C	659745.8	Z	659745.8	CZ
RM180	C	656343	Z	656343	CZ
RM178	C	594000	Z	594000	CZ
RM259	C	458227	Z	458227	CZ
RM316	C	405084.8235	Z	405084.8235	CZ
RM205	C	368200	Z	368200	CZ
RM319	C	348604.5588	Z	348604.5588	CZ
RM181	C	341653.14	Z	341653.14	CZ
RM270	C	324606.849	Z	324606.849	CZ
RM308	C	288892.5	Z	288892.5	CZ
RM315	C	282639.0588	Z	282639.0588	CZ
RM231	C	279756	Z	279756	CZ
RM120	C	275998.0518	Z	275998.0518	CZ
RM262	C	259644	Z	259644	CZ
RM287	C	240149	Z	240149	CZ
RM121	C	237982.3201	Z	237982.3201	CZ
RM267	C	227360	Z	227360	CZ
RM128	C	195000	Z	195000	CZ
RM204	C	160882.36	Z	160882.36	CZ
RM318	C	128697.3971	Z	128697.3971	CZ
RM244	C	113305.5	Z	113305.5	CZ

RM257	C	112749	Z	112749	CZ
RM176	C	110214	Z	110214	CZ
RM258	C	97650	Z	97650	CZ
RM203	C	77628.83333	Z	77628.83333	CZ
RM197	C	76000	Z	76000	CZ
RM161	C	63321.32664	Z	63321.32664	CZ
RM200	C	44296.21333	Z	44296.21333	CZ
RM198	C	36000	Z	36000	CZ
RM196	C	34585.6	Z	34585.6	CZ
RM263	C	17955	Z	17955	CZ
RM195	C	15044.4	Z	15044.4	CZ
RM199	C	5683.2	Z	5683.2	CZ
RM202	C	3460.641667	Z	3460.641667	CZ
RM194	C	323.2	Z	323.2	CZ
RM201	C	173.1416667	Z	173.1416667	CZ

The items in this combination represents low-value items (Class C) with highly erratic and unpredictable demand patterns (Class Z). While individually these items may have minimal impact, collectively they can still pose challenges in inventory management due to their variability, requiring flexible strategies to maintain availability while minimizing costs.

Percentage Distribution

Table 15:

Class	A	B	C
X	1%	1%	2%
Y	3%	7%	11%
Z	9%	10%	56%

This part shows the percentage distribution of raw materials within each ABC and XYZ category. For instance:

1% of the raw materials fall under A-X, indicating that they are highly valuable with continuous demand.

56% of the raw materials fall under C-Z, suggesting they are of low value with irregular demand, constituting the majority of the items.

By combining these classifications into a matrix, we get a clearer insight of the inventory:

- **High-Value, Steady Demand (AX):** These are critical medications with constant usage. The focus here is on maintaining optimal stock levels through:
    - **Strict controls:** Cycle counting, minimum/maximum stock levels, and automated reordering to minimize the risk of stockouts and ensure patient care is not disrupted.
    - **Accurate forecasting:** Since demand is predictable, forecasting becomes more reliable, allowing for efficient stock management.
- **High-Value, Fluctuating Demand (AY):** These are most valuable with variable demand. Here, the strategy involves:
    - **Closer monitoring:** More frequent demand monitoring and adjustments to ordering schedules to avoid overstocking during low-demand periods.

    - **Safety stock:** Maintaining a buffer stock to handle unexpected demand surges and prevent stockouts.
- **High-Value, Erratic Demand (AZ):** These are the valuable materials with an unpredictable usage. Managing these requires:
    - **Safety stock with flexibility:** Maintaining a buffer stock while being adaptable to adjust stock levels based on real-time demand data.
    - **Supplier collaboration:** Exploring options for quick replenishment or returns with suppliers to minimize risk.
- **Lower-Value Categories (BX, BY, BZ; CX, CY, CZ):** These categories (combinations of B & C value with X, Y, Z demand) represent materials with lower financial risk of obsolescence. Strategies can include:
    - **Reduced stock levels:** Minimize storage costs and expiration risks by holding lower quantities.
    - **Demand-based ordering:** Order these medications based on actual usage patterns, potentially using just-in-time approaches for some items.

Benefits of the Matrix Approach:

- **Targeted Strategies:** Tailored inventory management practices for each category based on cost and demand characteristics, leading to more efficient use of resources and reduced risk of obsolescence across the entire inventory.
- **Improved Decision-Making:** The matrix provides valuable insights for negotiating with suppliers, optimizing ordering processes, and allocating resources for different drug categories.

Limitations to Consider:

- **Data Accuracy:** Both ABC and XYZ analyses rely on accurate data (cost, demand). Inaccurate data can lead to suboptimal inventory management decisions.
- **Complexity:** Managing a matrix can be complex, requiring ongoing monitoring and adjustments. Software can help streamline this process.

RESEARCH FINDINGS:

ABC Analysis:

A substantial portion of the inventory (4% of items) constitutes high-value A-items, contributing significantly to the total value (79%). These items are critical for production processes and require tight controls to minimize the risk of stockouts.

B-items, although constituting a larger portion of the inventory (84% of items), contribute less to the total value (16%). These items require regular monitoring but may not necessitate as stringent controls as A-items.

C-items, while comprising a smaller portion of the inventory (12% of items), contribute minimally to the total value (5%). Managing these items involves cost-efficient stocking strategies to minimize handling and storage costs.

XYZ Analysis:

Group X materials, characterized by low demand variability, are consumed steadily and frequently. They constitute a significant portion of the inventory by quantity but contribute less to the total value compared to other groups. Items have low quantity (3%) and low value contribution (8%), indicating infrequent consumption and minimal contribution to total raw material value.

Group Y items constitute a significant portion of total quantity consumed (59%) but have a higher contribution to total value (51%), suggesting regular consumption with moderate variability in demand. They are consumed regularly but may experience fluctuations in demand.

Group Z materials, with high demand variability, are consumed irregularly and command a significant portion of the total value despite their lower quantity. Managing these materials poses challenges due to their unpredictable consumption patterns. Group Z items have a relatively high quantity (38%) and significant value contribution (42%), indicating high usage rate and substantial contribution to total raw material value despite irregular consumption patterns.

FSN Analysis:

Fast-moving raw materials constitute a significant portion of the inventory by quantity (58%) and are crucial for maintaining production continuity due to their rapid consumption rates.

Slow-moving raw materials frequently than fast-moving items., while comprising a smaller portion of the inventory (41%), are still important but are consumed less

Non-moving raw materials, though minimal in quantity (1%), may pose a risk of obsolescence as they are rarely consumed within the inventory period.

Matrix of ABC & XYZ Analysis:

The integration of ABC and XYZ analyses into a matrix offers a comprehensive understanding of inventory items based on both their value contribution and demand patterns.

High-value, steady-demand items (AX) require strict controls and accurate forecasting to ensure optimal stock levels. High-value, fluctuating-demand items (AY) necessitate closer monitoring and safety stock to manage variable demand patterns effectively. High-value, erratic-demand items (AZ) present challenges in forecasting and may require flexible stock management strategies to mitigate risks.

Benefits and Limitations:

Targeted inventory management strategies tailored to the characteristics of each inventory category can lead to more efficient resource allocation and reduced risk of obsolescence.

However, accurate data and ongoing monitoring are essential for effective implementation, and the complexity of managing a matrix approach may require dedicated software tools for streamlined operations.

Overall, the research findings highlight the importance of adopting a multifaceted approach to inventory management, considering both the value contribution and demand dynamics of raw materials to optimize resource utilization and minimize the risk of obsolescence.

CONCLUSION

In conclusion, the research embarked on a comprehensive exploration of inventory management within the pharmaceutical sector, focusing on the optimization of inventory levels through the utilization of various inventory models. Throughout the study, emphasis was placed on mitigating obsolete inventory, a critical concern for pharmaceutical firms aiming to enhance operational efficiency and financial outcomes.

The adoption of ABC Analysis provided a strategic framework for prioritizing inventory items based on their value and significance, facilitating nuanced inventory control measures tailored to the specific characteristics of each item. By categorizing raw materials into A, B, and C items, companies could allocate resources more effectively, minimizing the risk of holding excessive stock and mitigating the financial impact of obsolete inventory.

Similarly, the integration of XYZ Analysis offered valuable insights into demand variability, enabling pharmaceutical companies to develop tailored inventory management strategies for items with stable, moderate, or erratic demand patterns. This approach empowered supply chain teams

to optimize procurement decisions, minimize stockouts, and mitigate the risk of inventory obsolescence.

Furthermore, the implementation of FSN Analysis facilitated the categorization of raw materials into fast-moving, slow-moving, and non-moving groups based on consumption rates and storage durations. By prioritizing inventory management efforts and making informed procurement decisions, pharmaceutical firms could mitigate the risk of holding obsolete inventory, optimize warehouse space utilization, and enhance operational efficiency.

The matrix of ABC and XYZ Analysis represented a transformative approach to raw material management, offering a nuanced understanding of inventory items based on their value contribution and demand characteristics. By aligning raw material classification with demand dynamics, pharmaceutical companies could enhance operational efficiency, optimize resource allocation, and adeptly respond to evolving market needs.

In essence, the research underscored the critical role of efficient inventory management in sustaining pharmaceutical operations, enhancing competitiveness, and safeguarding financial health. By leveraging insights from diverse inventory models and adopting tailored inventory management strategies, pharmaceutical firms can navigate the complexities of inventory optimization, mitigate the risk of obsolete inventory, and drive sustainable growth in an ever-evolving healthcare landscape.

MANAGERIAL IMPLICATIONS

The strategic inventory segmentations can help the managers use the different analysis conducted to strategically segment inventory based on value, demand and variability and consumption patterns. This segmentation can guide decisions related to inventory stocking levels, reorder points, and allocation of resources.

Managing inventory effectively requires ongoing monitoring and adjustment to changing market dynamics. Pharmaceutical companies must establish robust monitoring mechanisms to track inventory levels, demand patterns, and market trends, allowing for timely adjustments to inventory management strategies and proactive risk mitigation measures against obsolete inventory

The research also helps in the development to mitigate obsolete inventory. Managers can easily identify Fast moving, slow moving and non-moving inventory with the help of the analysis conducted and take corrective measures to minimize the same.

Leveraging insights from diverse inventory models allows pharmaceutical firms to enhance forecasting accuracy and planning processes. By integrating historical consumption data with demand variability assessments, companies can anticipate future demand trends more effectively, reducing the risk of overstocking or understocking and mitigating the financial impact of obsolete inventory.

The insight from the research also helps in refining inventory policies if necessary. Managers can establish appropriate inventory control parameters such as safety stock levels, lead times and order quantities tailored to company's needs.

TASKS HANDLED

Conducting various analysis utilizing opening stock data and material requirement planning, various analyses were conducted to categorize inventory into fast-moving, slow-moving, and non-moving items. By scrutinizing production plans and demand projections, identified raw materials susceptible to obsolescence or distress. This rigorous analysis provided a understanding of inventory dynamics.

Performed Material Requirement Planning by aligning production plans with inventory analysis. By leveraging insights from production schedules, they ensured that inventory levels were synchronized with anticipated demand. This approach allowed for the optimization of inventory management strategies, minimizing the risk of overstocking or understocking.

To facilitate effective communication and decision-making, visual dashboards were crafted as interactive tools. These dashboards served as dynamic platforms for presenting complex data in a clear and intuitive manner. Through customizable views and interactive features, fostering informed decision-making.

LEARNINGS

The project provided an invaluable opportunity to apply theoretical knowledge in a real-life setting, bridging the gap between classroom learning and practical skills in the workplace. Through hands-on experience, I gained a deep understanding of how concepts learned in academic settings translate to the complexities of real-world scenarios.

One of the key aspects of the project was handling complex data, where I extracted meaningful insights, identified trends, and patterns to inform decision-making by leveraging analytical tools and techniques. This process not only honed my analytical skills but also allowed me to derive actionable insights that drove informed business decisions.

Moreover, the project provided valuable industry insights by exposing me to emerging technologies and best practices in the field. I gained firsthand experience in leveraging advanced analytics tools and methodologies to address complex challenges within the industry. This exposure not only enhanced my technical proficiency but also equipped me with a nuanced understanding of industry trends and dynamics.

The project served as a platform for me to integrate theoretical knowledge with practical skills, enabling me to navigate of real-world data analysis and industry practices effectively. By immersing myself in hands-on experience, I cultivated a comprehensive skill set that is invaluable in today's dynamic and data-driven business landscape.

CHALLENGES

- Time management between the internship and project.
- Dealing with large and complex data.

Appendix I (Samples of work done)

The company prohibited including the completed tasks in the report

Appendix II (Photo while at work)

Photography at the plant is prohibited by the company.

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