
Managing stockouts in a health care manufacturing factory

Name - Utkarsh Balooni

Roll No. - 22ds1000021

1. Executive Summary:

Inventory management is one of the most crucial aspects of any business model. It involves ordering, storing, using, and selling a company's inventory. The goal of inventory management is to have the right products in the right place at the right time. It deals with the optimization of inventory levels by providing high level of customer service without accumulating excess investment in inventory in order to maximize profits.

This project aims to devise feasible strategies to minimize stockouts and optimize inventory levels for a factory manufacturing pharmaceutical products. It uses basic analysis techniques like ABC, VED to segregate the products and then applies advanced analysis techniques like safety stock analysis on the most “important” products. This involves collecting data pertaining to sales and lead time followed by accurate demand forecasting for the product. Subsequently, reorder point and safety stock for the products is calculated.

Most of the analysis carried out during the project is an extension of the “Ace Gears” case study of the BDM course.

2. Organization Background:

Ved Lifesavers (VLS) is a WHO-GMP and ISO certified factory engaged in manufacturing & marketing of health care products. It is located in Sara Industrial Estate, Selaqui, Dehradun (U.K.). It was established in 2012 and has an annual turnover of 5-10 cr. It is a B2B organization and caters to the contract manufacturing requirement of many reputed domestic and overseas pharmaceutical companies. Some of their major clients include Zydus Healthcare Ltd., Leeford Healthcare Ltd. and Lincoln Pharma. The primary product manufactured in the factory is tablets but they also produce capsules on demand.

Website- <https://www.vedlifesavers.com/>

3. Problem Statement:

- Identify the products (raw materials and packing materials) which are most valuable for profitability. We will be analysing only these products.
- Estimate the future demand for these products using previous sales data.
- Compute lead time for the products.
- Calculate safety stock and reorder point for these products.
- Adjust the value of safety stock for raw materials in accordance with their shelf life. (If required)

4. Background of the problem:

Ved Lifesavers have been experiencing a decline in overall net worth and EBITDA over the past year. It is mainly attributed to the fact that the functioning of the Production Planning & Inventory Control section of the organization has been disrupted due to employee attrition. This has led to mismanagement in planning and eventual delay in the shipment of orders which has negatively impacted the financial health of the company.

Although several problems were arising because of this, the primary concern of the owner was unavailability of raw materials and packing materials when required. This was causing a significant amount of reduction in the planned production hours.

Pharma manufacturing is a highly competitive sector. There are more than 10 factories located within 4 km radius of Ved Lifesavers. Since the number of buyers is limited, reputation among the buyers becomes crucial for acquiring purchase orders. Hence, delayed shipment of goods is extremely detrimental to the profitability of the company.

5. Problem solving approach:

5.1 Methods Used:

1. There are more than 300 raw materials and over 1000 packing materials used in the factory. In order to select the most valuable products we will use a combination of ABC (always better control) and VED (vital, essential, and desirable) analysis. We will be performing the rest of the analysis only on these products.
2. Next, we will forecast the weekly demand for these products using time series forecasting techniques like ARIMA and machine learning models like XGBRegressor. This is required for calculating safety stock and reorder point for these products.
3. Then we estimate the order lead time for these products using PO data.
4. Finally, we calculate the safety stock using the formula:

$$\text{Safety Stock} = Z \times \sigma_{demand} \times \sqrt{L}$$

Z – number of standard deviations required to achieve the desired service level. Can be found in a Standard Normal distribution table.

σ_{demand} – Standard Deviation of demand during lead time.

L – Lead time in appropriate units.

5. Further, safety stock is used to calculate the reorder point for the products using the formula:

$$\text{Reorder Point} = (\text{Average demand} \times \text{Lead time}) + \text{Safety Stock}$$

5.2 Intended data collection:

The factory uses an Enterprise Resource Planning software called Proman Erp to manage its database. For the purpose of our analysis, we will be collecting:

1. Data regarding the total issue quantity and rate of raw materials and packing materials. This will be used for ABC-VED analysis.
2. Data regarding daily issue quantity of the shortlisted raw materials and packing materials. This will be used for demand forecasting.
3. Data containing the date of purchase order (rm and pm order date), and materials receiving date for the corresponding purchase order. This will be used to calculate lead time.

All data will be collected for a time period of 2 years (Jan-2021 to Dec-2022).

5.3 Analysis tools:

MS Excel – Raw data collected will be in the form of excel sheets. Basic data pre-processing and visualization will be carried out in excel. ABC-VED analysis and lead time calculation will also be done in excel.

Python (Jupyter Notebook) – This will be used primarily for demand forecasting. Python has built-in libraries and functions for this task. Rest of the analysis (safety stock and reorder time) will also be carried out in python.

6. Work Breakdown Structure:

1. Initiation

- 1.1 Talks with the owner
- 1.2 Identifying business problem
2. Data Collection
 - 2.1 Meetings with HR
3. Data Pre-processing
 - 3.1 Cleaning the data
 - 3.2 Descriptive statistics and data visualization
4. Analysis
 - 4.1 Demand Forecasting and lead time calculation
 - 4.2 Safety stock analysis
 - 4.3 Reorder point calculation
5. Report findings
 - 5.1 Providing insights based on analysis
 - 5.2 Identifying shortcomings of the analysis

7. Gantt Chart:

Task Name	Start Date	End Date	Duration
Initiation	27/01/2023	3/03/2023	35 days
Data Collection	14/03/2023	19/03/2023	5 days
Data Pre-Processing	20/03/2023	24/03/2023	4 days
Analysis	25/03/2023	3/04/2023	9 days
Report Findings	10/04/2023	13/04/2023	3 days

8. Expected Outcome:

- Provide insights on the fast-moving raw materials and packing materials in the factory.
- Provide an estimate for the future demand of products using precise graphical depictions.
- Report a reasonable value of safety stock and reorder point for the products to help streamline the manufacturing process.