Strengthening Inventory Resilience: By enhancing Supplier Dynamics and Sales Volatility in Pharmacy Retail

A Mid Term report for the BDM capstone Project

Submitted by

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Contents

Declaration Statement

I am working on a Project Title "**Strengthening Inventory Resilience: Enhancing Supplier Dynamics and Sales Volatility in Pharmacy Retail**". I extend my appreciation to Shree Chendur Medicals, for providing the necessary resources that enabled me to conduct my project.

I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered through primary sources and carefully analyzed to assure its reliability.

Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through thorough analytical procedures.

I am dedicated to adhering to the information of academic honesty and integrity, and I am receptive to any additional examination or validation of the data contained in this project report.

I understand that the execution of this project is intended for individual completion and is not to be undertaken collectively. I thus affirm that I am not engaged in any form of collaboration with other individuals, and that all the work undertaken has been solely conducted by me. In the event that plagiarism is detected in the report at any stage of the project's completion, I am fully aware and prepared to accept disciplinary measures imposed by the relevant authority.

I agree that all the recommendations are business-specific and limited to this project exclusively, and cannot be utilized for any other purpose with an IIT Madras tag. I understand that IIT Madras does not endorse this.

Signature of Candidate: Sivakumar P

Name: Sivakumar P

Date: 07/03/2025

1 Executive Summary

The analysis of inventory, sales, and procurement data for Shree Chendur Medical Center, Srirangam, Trichy, covering April 2023 to May 2024, reveals key insights into stock management, sales performance, and purchasing efficiency. By examining three datasets—Consolidated Closing Stock, Daywise Sales, and Purchase Bills—this study highlights sales trends, profit fluctuations, and stock movement over the financial year. The data was extracted from PDF sources using Python automation, cleaned, and structured for analysis in Tableau, enabling a comprehensive review of financial and operational performance.

Key findings indicate that sales peaked between November and January, with December showing the highest profit margins due to a favorable mix of high-margin products and lower procurement costs. Conversely, the first quarter of the financial year experienced lower sales and profit margins, largely influenced by high purchase costs and low-margin products. The weekday sales analysis further revealed that Mondays had the highest sales volume, while Saturdays recorded the lowest, highlighting potential optimization opportunities in staffing and inventory management.

The profit distribution analysis uncovered that a small number of high-performing companies, such as Biomaxx Life Sciences and Glaxo SmithKline, contributed disproportionately to overall profits, reinforcing the Pareto principle. The quadrant analysis of profit vs. inventory turnover further categorized products into strategic segments, guiding procurement strategies for maximizing profitability. These insights provide actionable recommendations for optimizing stock procurement, enhancing sales strategies, and improving overall financial efficiency in the medical center's operations.

2 Proof of originality of the Data

The link provided below contains the attached images, letter from and video for originality.
Gdrive : link

figure 1.1

Shree Chedur Medical Center

figure 1.2

Inside look in the business

3 Meta Data

This analysis is based on three key datasets—"Consolidated Closing Stock", "Daywise Sales", and "Purchase bill"—from Shree Chendur Medical center, Srirangam, Trichy, covering the financial year from April 2023 to May 2024. These datasets provide valuable insights into inventory management, sales performance, and procurement efficiency.

Raw Data: link
Cleaned Data : link

3.1 Consolidated Closing Stock

The "Consolidated Closing Stock" dataset contains company-wise inventory details, where each row represents a company with values for opening stock, closing stock, sales, and profit. This dataset is essential for understanding stock movement, identifying shortages or excess inventory, and assessing profitability at a company level.

Columns:
COMPANY NAME (String) – Name of the company. Each row represents a unique company.
OPENING (Float) – Opening stock value at the beginning of the month.
PURCHASE (Float) – Total stock purchased during the month.
SALES (Float) – Total stock sold during the month.
CLOSING (Float) – Closing stock value at the end of the month.
Month (String/Date) – The corresponding month for the recorded data (e.g., "Jan-24", "Feb-24").
Profit (Float) – The profit generated from sales during the month.

3.2 Daywise Sales

The "Daywise Sales" dataset captures daily sales transactions, showing how much stock is being sold each day in terms of value. This dataset helps in identifying sales trends, peak demand periods, and seasonal fluctuations. By analyzing sales data over time, businesses can make informed decisions about restocking and demand forecasting.

Columns:
BILL DATE (Date) – The date when the transaction was recorded.
no. of BILL NUMBER (Integer) – The count of unique bill numbers for that date.
BILL NUMBERS (String) – A list or reference to the unique bill numbers associated with that date.
DISC.AMT (Float) – The total discount amount applied to sales transactions on that date.
CASH SALES (Float) – The total value of sales made through cash payments.
CR.SALES (Float) – The total value of sales made on credit.
TOTAL SALES (Float) – The total value of all sales transactions (cash + credit) for that date.
Month (String/Date) – The corresponding month for the recorded data (e.g., "Jan-24", "Feb-24").

3.2 Purchase bill

The "Purchase bill" dataset tracks daily purchase transactions, detailing procurement activities and stock inflows. By comparing purchase data with sales and inventory levels, this dataset enables an assessment of purchasing efficiency, potential overstocking or understocking issues, and supplier performance. Together, these datasets offer a comprehensive view of stock movement, sales trends, and procurement strategies, forming the foundation for data-driven decision-making.

Columns:
Date (Date) – The date of the purchase transaction.
Bill No. (String) – The unique bill number associated with the purchase.
GST No. (String) – The GST identification number of the supplier.
Amount (Float) – The total value of the purchase transaction.
Supplier Name (String) – The name of the supplier from whom the purchase was made.

4 Descriptive Statistics

4.1 Consolidated Closing Stock

This dataset contains 1,616 records (with 1,612 valid entries for the "CLOSING" column) across seven key fields: Company Name, Opening, Purchase, Sales, Closing, Month, and Profit. For instance, the "COMPANY NAME" field includes 166 unique companies with "JOHNSON & JOHNS" emerging as the most frequent name (appearing 24 times). Similarly, the numeric fields such as Opening, Purchase, Sales, and Closing display a high degree of variability with over 700 to 1,100 unique entries each, although the value 0 is notably the most common in these columns—with Purchase showing 0 in 749 instances and Sales in 445 cases. The Profit column, with 1,233 unique values, also has 0.00 as its most frequent figure (occurring 21 times), suggesting many records report no profit.

The "month" field, which features 12 unique entries, indicates that the dataset spans a complete year of activity. Notably, "Feb-24" stands out as the top month with 142 occurrences, potentially signaling a period of increased transactions or reporting emphasis. Overall, while the dataset reveals a broad range of numeric values, the recurrence of 0 in multiple key financial metrics may imply periods of inactivity or a standard baseline across transactions, underscoring variability in company performance and transactional activity over the recorded period.

4.2 Daywise Sale

The "no. of BILL NUMBER" field, with 311 observations, has an average of about 18.21 bills per record and ranges from a minimum of 1 to a maximum of 86, with the interquartile range (IQR) spanning from 13 (25th percentile) to 23 (75th percentile). The "DISC.AMT" column, available in 293 records, shows an average discount of approximately 446.01, with values ranging from -96.70 to 1677.68. The negative minimum suggests that there may be occasional reversals or adjustments in discounts. The quartile distribution for discount amounts—207.12 at the 25th percentile, 378.98 at the median, and 612.11 at the 75th percentile—indicates that most discounts are on the lower end of the range, albeit with a few outlier values.

In the sales data, the "CASH SALES" column reports 311 observations with an average sale of around 7680.09 and a standard deviation of approximately 4436.91. Notably, the "CR.SALES" (credit sales) column consistently records 0.0 across all entries, meaning that every sale in this dataset was made in cash. Consequently, the "TOTAL SALES" mirrors the cash sales figures exactly. The sales figures range from -281 (possibly reflecting returns or adjustments) to 36465, with the 25th, 50th, and 75th percentiles being 4760, 6982, and 9801.5 respectively. This distribution suggests a right-skewed pattern where the majority of sales transactions are below 10,000, but there are occasional high-value transactions that elevate the average sales figure.

4.3 Purchase bill

The amount column has across 1,219 observations. The average amount is approximately 1,369, with a standard deviation of about 974, which indicates a moderate level of dispersion around the mean. The minimum recorded value is 64, and the maximum reaches 9,744, highlighting a broad range in the dataset and suggesting the presence of some outlier values or high-value transactions.

The distribution details further reveal that the first quartile (25th percentile) is at 692, while the median (50th percentile) is 1,097. The third quartile (75th percentile) is 1,743, meaning that 75% of the amounts are below this threshold. This spread points to a right-skewed distribution, where most values are concentrated towards the lower end, with a tail extending towards significantly higher amounts.

5 Detailed Explanation of Analysis Process/Method

Data Cleaning:
The raw data for this project was received in PDF, consisting of twelve individual files—one for each month of the year. This unstructured format required transformation into a machine-readable structure for analysis. To accomplish this, I utilized the PDF Plumber and Regular Expressions (RE) libraries in Python. PDF Plumber enabled the extraction of text and tabular content from the PDFs, while RE facilitated the identification of specific data points through pattern matching, ensuring accurate and consistent data capture across all files.

To streamline the processing of multiple PDFs, I implemented an automated workflow using Python's OS library, which allowed for programmatic iteration over the files in a directory. For each PDF, the extracted data was organized into a Pandas DataFrame, with a "month" column added to retain temporal context, derived from file names or metadata. These DataFrames were then consolidated into a single dataset using Pandas' concatenation features and exported as a CSV file. This efficient, scalable process produced a unified, structured dataset ready for subsequent analysis.

Analysis:
After cleaning the data and organizing the CSV file, I implemented the following Analysis:

Combined Bar and Line Graph (Sales vs. Purchases)

The Combined Bar and Line Graph is crafted by importing data from Excel into Tableau, creating a visualization where green bars represent sales and a red line denotes purchases, both plotted over a shared time axis. This method reveals that most months surpass the average sales line, suggesting a generally robust sales performance. The justification for this integrated approach lies in its ability to offer immediate, side-by-side comparisons, making discrepancies between sales and purchases both clear and actionable for decision-makers.

Bar Graph (Profit per Month)

The Bar Graph for monthly profits is generated by computing profit figures in Excel and then visualizing them as a bar graph in Tableau. This visualization highlights seasonal peaks in gross

profit during June, November, and December, contrasted by notable drops in July, August, and February. The use of a bar graph is justified because it excels at displaying continuous trends, enabling easy identification of performance peaks, troughs, and overarching patterns across the year.

Box Plots (Weekly Profit Data by Day)

Box Plots are employed to analyze weekly profit data by day, with daily sales data aggregated in Excel and visualized in Tableau as box plots for each weekday. The insights show a stable median profit across the week, with greater variability on days like Monday and Saturday, pointing to sporadic sales surges. This method is justified by the box plot's ability to provide a clear statistical summary—median, interquartile range (IQR), and outliers—facilitating the detection of anomalies and day-specific performance differences.

Pareto Chart (Top 20% Products Contributing to Profit)

The Pareto Chart is constructed by filtering profit data from Excel in Tableau to spotlight the top 20% of products contributing to profit. This analysis demonstrates that a small group of products, such as those from Biomaxx Life Sciences and Glaxo SmithKline, drives the majority of the profit, highlighting both dependency risks and opportunities for a focused strategy. The Pareto chart's value lies in its efficiency at prioritizing high-impact areas, guiding strategic decisions by pinpointing where most profit originates.

Tree Map (Profit Distribution by Company)

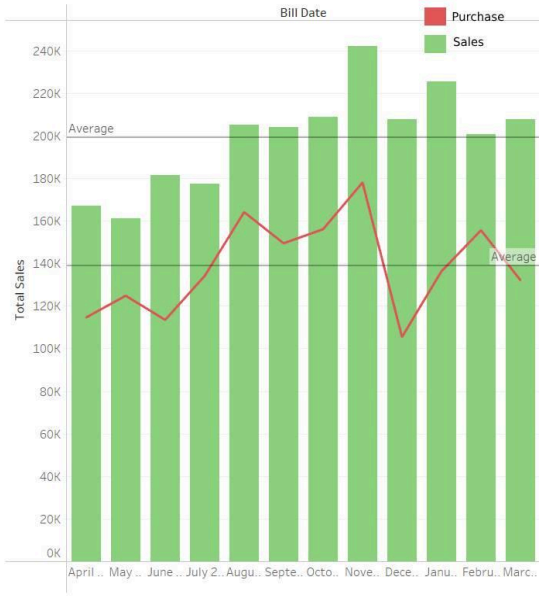
The Tree Map for profit distribution by company is created by visualizing company-level profit data from Excel in Tableau as a tree map. This approach clearly distinguishes top performers, such as BIOMAXX LIFE SC and GLAXO SMITHKLIN, from underperformers, supporting informed resource allocation decisions. Tree maps are justified here for their effectiveness in displaying hierarchical and proportional data, offering a compact yet comprehensive overview of profit distribution across companies.

Scatter Plot with Quadrant Segmentation (Profit vs. Inventory Turnover)

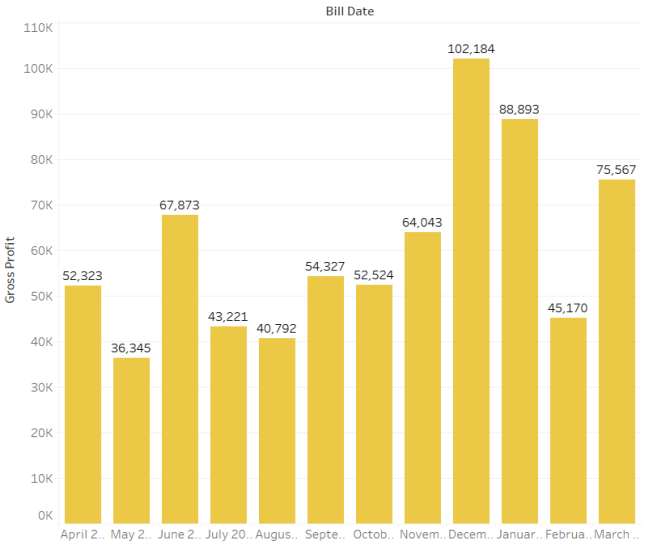
The Scatter Plot with Quadrant Segmentation is developed by plotting profit and inventory turnover data from Excel in Tableau, segmented into four quadrants: *Priority Procurement* (high turnover, high profit), *Strategic Procurement* (high profit, low turnover), *Procurement Avoidance* (low profit, low turnover), and an implied fourth quadrant (low profit, high turnover). This method enables the categorization of products for targeted procurement strategies. The scatter plot is ideal for analyzing relationships between two quantitative variables, and the quadrant segmentation simplifies strategic decision-making by clearly classifying products based on their performance metrics.

6 Results and Findings

6.1 Combined Bar and Line Graph (Sales vs. Purchases)



Sales vs Profit
figure 1.3

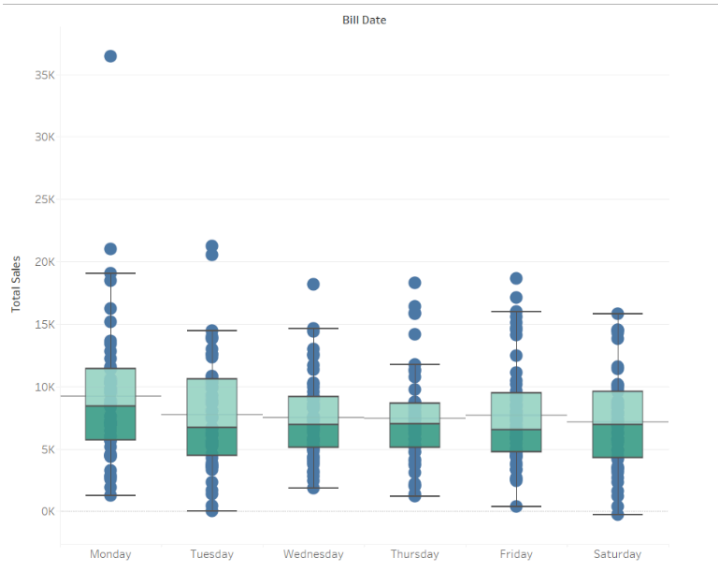


Gross Profit
figure 1.4

During the months of November, December, and January, total sales experienced a significant surge(>205k), leading to a corresponding increase in profit. However, December stood out with an exceptionally high profit spike(~100K), not just due to increased sales but also because of lower purchase costs and a higher profit margin. This indicates that December had a strong presence of high-margin products, contributing to its outstanding financial performance. The strategy might focus on premium-priced or high-margin goods during this period resulting in significantly better profitability compared to other months.

On the other hand, the first four months of the financial year experienced slower sales(~165k), while purchase costs remained relatively high(~120k). This combination led to lower overall profit margins, as the revenue generated was not sufficient to offset the expenses effectively. Additionally, these months were likely dominated by low-margin products, which further contributed to restrained profit growth. However, as the year progressed, a shift in product strategy and improved market conditions helped boost profitability, setting the stage for stronger financial performance in the later months.

6.3 Box Plots (Weekly Profit Data by Day)



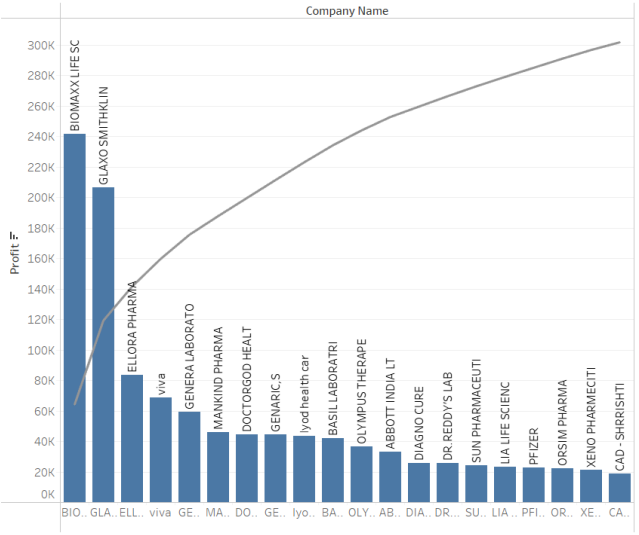
Week Day wise Sales Box plot
figure 1.5

The box plot provides a comprehensive visualization of weekly sales distribution, capturing variations in total sales across different weekdays. The analysis reveals that while the median sales remain largely stable throughout the week, variations in sales trends emerge on specific days.

Monday emerges as the standout day with the highest total sales, featuring a significant outlier reaching approximately 36k, far exceeding the median sales of 8k observed on other weekdays. The broader range of sales, indicated by the whiskers and outliers, suggests greater variability and potential for high-value transactions on this day, possibly driven by increased customer traffic and stronger demand. With a robust median and the highest peak, Monday presents an opportunity for businesses to capitalize on this peak performance by optimizing staffing, inventory.

Saturday stands out in the provided boxplot data as the day with the lowest median total sales, hovering around 7k, compared to the relatively consistent midweek figures of 8k.The range of sales on Saturday is also narrower, with fewer outliers and a tighter interquartile range, indicating less variability and potentially fewer high-value transactions. This suggests that customer activity or purchasing behavior may decline on Saturdays, possibly due reduced foot traffic, or differing weekend habits.

6.4 Pareto Chart (Top 20% Products Contributing to Profit)

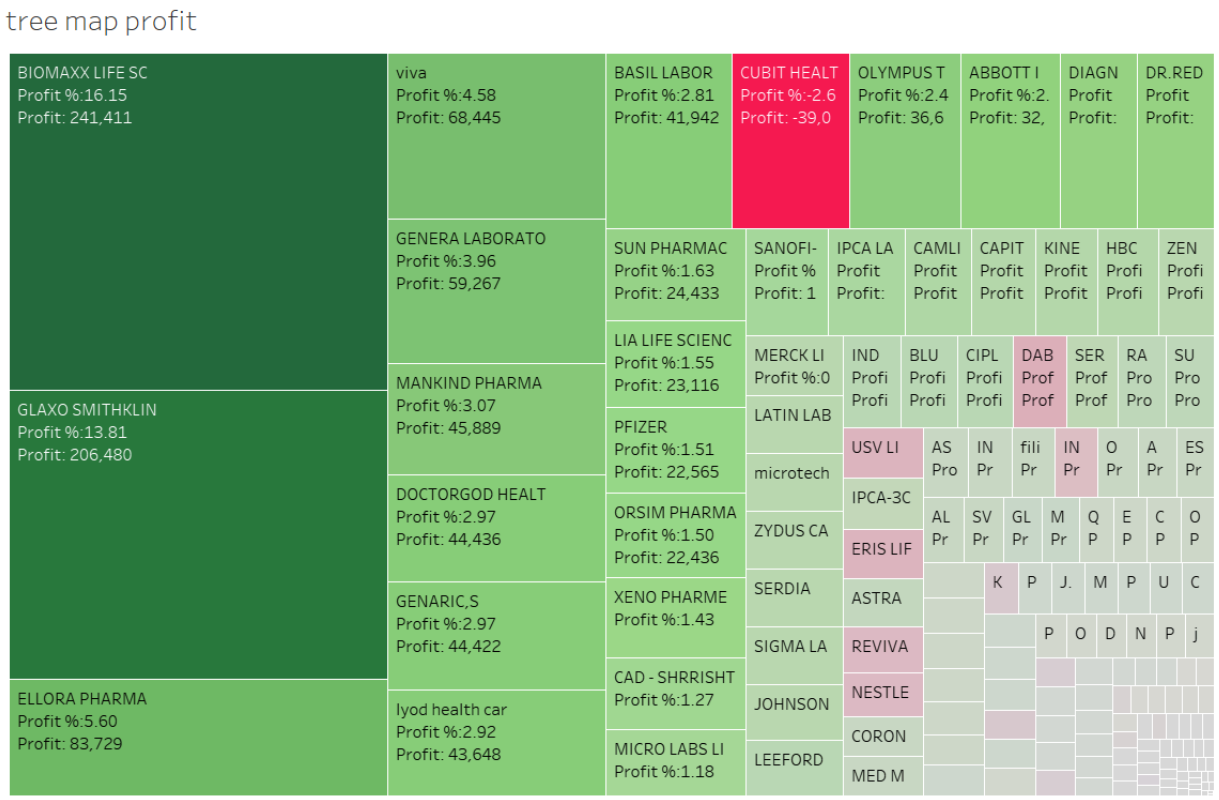


Pareto Chart
figure 1.6

Together, the top five businesses—Biomaxx Life Sciences, Glaxo SmithKline, Ellora Pharma, Viva, and General Laborato—contribute more than half of the ₹1,494,995.96 yearly profit, with Biomaxx Life Sciences and Glaxo SmithKline alone accounting for nearly 30%. This indicates a strong reliance on a few key suppliers, making their stability crucial for long-term business success. While these suppliers drive a significant portion of profitability, this dependence also presents risks. Any disruption in their supply chains, pricing fluctuations, or operational challenges could severely impact overall business performance.

To mitigate these risks, diversifying the supplier base is essential to reduce potential vulnerabilities. Strengthening partnerships with lower-tier businesses and improving their profitability can help create a more balanced revenue distribution. Additionally, optimizing procurement strategies by securing favorable pricing, negotiating better volume-based discounts, and aligning stock levels with demand patterns will further enhance financial stability. By strategically managing supplier relationships, businesses can ensure sustained growth, minimize disruptions, and maximize long-term profitability.

6.5 Tree Map (Profit Distribution by Company)

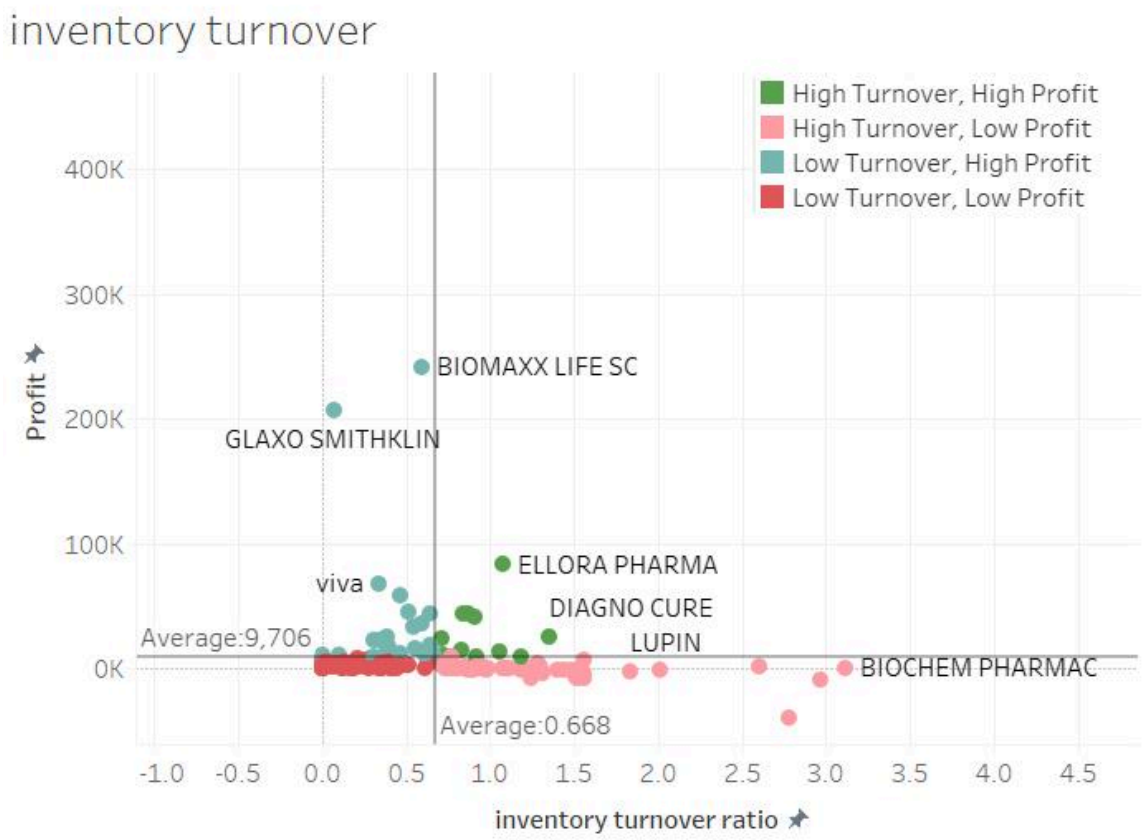


Tree Graph
figure 1.7

The tree map profit visualization highlights the profit distribution across various pharmaceutical companies. BIOMAXX LIFE SC and GLAXO SMITHKLIN are the top performers, contributing significantly to overall profitability with 16.15% and 13.81% profit margins, respectively. Ellora Pharma follows with 5.60% profit. Several mid-tier companies, such as Viva, Mankind Pharma, and Genera Laborato, show moderate profits ranging from 2% to 5%.

However, CUBIT HEALT is the only company incurring a significant loss (-2.6% profit, -39,000), highlighted in red. Some companies, such as Sanofi, Merck, and others , have minimal or neutral profits. The Pareto Principle applies here, as a few companies drive most of the profitability while many contribute marginally or remain neutral. This data suggests a concentration of profitability in a few key players, while a large number of smaller entities add minimal value. Strategies should focus on boosting underperforming brands and mitigating losses.

6.6 Scatter Plot with Quadrant Segmentation (Profit vs. Inventory Turnover)



Profit vs. Inventory Turnover
figure 1.8

Optimizing Procurement for Enhanced Stock Efficiency and Financial Performance

To enhance stock efficiency and financial performance, procurement decisions must be optimized based on a detailed analysis of inventory turnover and profitability. Companies can be segmented into three distinct categories to inform tailored procurement strategies, ensuring a balance between stock availability, cash flow optimization, and cost reduction.

Priority Procurement (High Turnover, High Profit - Green Category)

Companies such as **Ellora Pharm**, **Doctorgod Health**, **Genaric**, **Basil Laboratri**, and **Diagno Cure** fall into this category, characterized by high inventory turnover and strong profitability.

Their products move quickly through inventory and contribute significantly to overall revenue, making them critical to financial success. The action plan for these companies is to **increase procurement** to ensure consistent stock availability and meet demand without risking shortages, thereby capitalizing on their rapid sales cycles and revenue potential.

Strategic Procurement (High Profit, Low Turnover - Blue Category)

This group includes **Biomaxx Life Sc**, **Glaxo SmithKline**, **Viva**, **Genera Laborato**, **Mankind Pharma**, **Lyod Health Car**, **Olympus Therape**, and **Abbott India Ltd**. These companies generate substantial profit margins, yet their products exhibit lower inventory turnover, indicating slower sales compared to the green category. To maintain profitability while avoiding overstocking, the action plan is to **procure in controlled quantities**. This approach optimizes cash flow and prevents excessive stock accumulation, aligning procurement with the slower pace of demand.

Procurement Avoidance (Low Profit, Low Turnover - High Risk)

Companies like **Sarabhai-Pirama**, **Veritaz Healthc**, **Elder Healthcar**, **Cadia Pharmaceu**, **BTL Pharma**, **SmithKline Beec**, **GuardeEver Life**, and **Maneesh Healthc** are marked by low profitability and slow-moving products. These entities contribute minimally to financial performance and increase holding costs due to stagnant inventory. The recommended action plan is to **limit or discontinue procurement** unless specific demand or strategic requirements justify continued engagement, thereby reducing unnecessary financial burdens.

A balanced procurement strategy is essential for maximizing efficiency and profitability. By prioritizing high-turnover, high-profit products from the green category, optimizing procurement of slow-moving yet profitable stock in the blue category, and minimizing investment in low-performing inventory from the high-risk group, businesses can achieve optimal stock efficiency and financial outcomes. This approach ensures resources are allocated effectively, focusing on companies that drive revenue while managing risks associated with underperforming suppliers.