

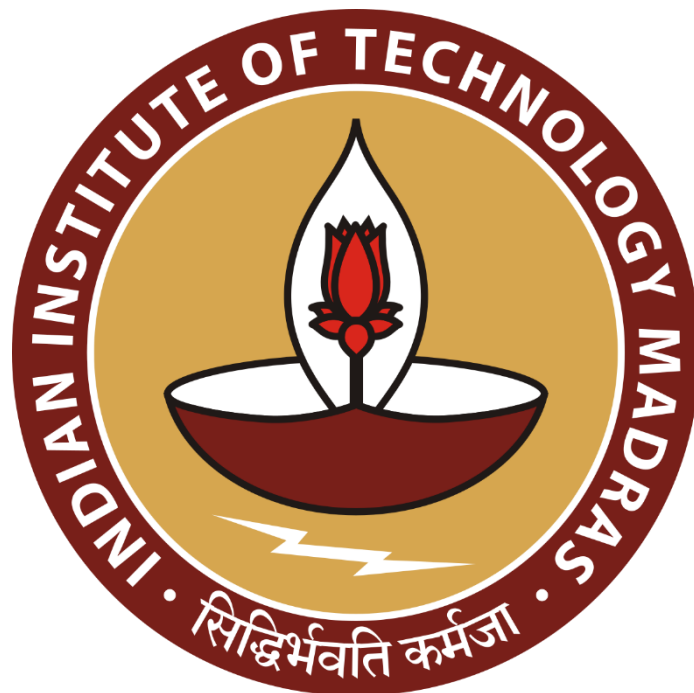
A Quantitative Analysis to Evaluate and Enhance Operational Efficiency and Profitability in a Pharmaceutical Retail Store

A Final Report for Business Data Management Capstone Project

Submitted by

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1. Executive Summary

This capstone project focuses on "Singh Medico," a pharmaceutical retail store located in Lalgutwa, Ranchi, Jharkhand. The business primarily deals with medicinal drugs and related FMCG products, serving a substantial geographical area due to a lack of nearby medical stores. The store benefits from the area's growth, with many housing projects underway. To expand the business and improve profitability, various analytical techniques were used to analyse the sales, purchase, and stock data. The dataset was collected through multiple visits to the store, enhancing the understanding of the business operations. Data cleaning involved addressing missing categorical data and structuring the dataset for analysis. Exploratory Data Analysis was performed to gain insights into the data and its attributes. Detecting correlations and patterns among attributes helped understand demand and address any shortcomings. Analysing top-selling products provided insights into improving profitability and inventory management.

The analysis of sales data from October 2023 to December 2023 highlights potential seasonal trends and changes in customer preferences. To capitalize on this, implementing dynamic pricing strategies and adjusting product mix to focus on high-value items like NICIP PLUS, MEGACHOLIN PLUS TAB, and SAFAXIN-200 TAB is crucial. Despite strong sales, profitability does not always correlate with sales volume, indicating a need for strategic pricing and promotion. Outliers in sales and profit suggest inefficiencies that can be addressed through improved inventory forecasting and management practices. The presence of top manufacturing companies underscores customer preference, suggesting opportunities for strategic partnerships or exclusive promotions. To address unsold items and maximize profit, regular inventory turnover analysis, supplier negotiations, and targeted promotions are recommended. Moreover, staff training, competitor analysis, and investment in technology can enhance overall efficiency and profitability. Regular performance reviews and customer feedback analysis should guide continuous improvement efforts.

2. Detailed Explanation of Analysis Process/ Method

- a) The dataset was collected over a duration of a few weeks through several visits to the store. It consists of the sales and purchase data for a duration of 3 months from 1st October, 2023 to 31st December 2023. This was accompanied by stock data of the store as on 31st January 2024.

- b) The dataset consists of Product Name, Bill Number, Manufacturing Company, Pack, Expiration Date, MRP, Quantity, Discount Amount, Grand Total, Payment Mode etc.
- c) Python notebook was primarily used as the analysis tool involved throughout the project. Firstly, all the data files were loaded on the notebook as a .csv file after importing all necessary python libraries such as Pandas, NumPy etc.
- d) Since sales and purchase data were gone through manually during the process of data collection, they lacked the presence of any missing data. On the other hand, stock data was obtained as a .csv file generated by the store software. It involved various missing data points for 4 categorical columns, which were, Item Code, Product Name, HSN Name and Salt. The missing datapoints were handled using simple imputation with the mode value of that particular column.
- e) Further on, it was ensured that all datatypes are correct for each column (for example, MRP, Balance, Grand Total etc were stored as floats or integers.) This was followed by taking care of inconsistencies involved in the dataset such as duplicates.
- f) EDA was performed on the sales, purchases and stock data. It involved the calculation of basic statistics like mean, median, mode, min, max, 25%, 50%, 75%, standard deviation in order to understand the central tendency and dispersion involved among the data points for a particular numerical feature of the dataset.
- g) By utilizing python packages like Matplotlib and Pandas, a spread of total sales across October, November and December was plotted using histogram.
- h) For the given months, the top 10 products were deduced and plotted using python notebook.
- i) Next, utilizing the matplotlib package the variation of profit with respect to sales price was found for the overall data set as well as across individual months. This process has also helped to find out the outliers.
- j) The ten most profitable products were filtered out of the whole dataset as well for individual months.
- k) We also found the list of manufacturing companies that are in highest demand among the customers and plotted the same pictorially using python.

3. Results and Findings

Dataset: [Click Here](#)

A. In order to check the spread of sales in the month of October (Figure 1), we used a histogram plot. From the plot we can see that:

- i) In the month of October, the maximum frequency of sales amount occurs between the values of ₹0 to ₹1000. It is also observed that the second and third most frequent values occur between this range.
- ii) It has been also observed that the total sale in October ranges between ₹89.00 to ₹6931.00 with the average value being ₹3682.72. It was also observed that 75% of the values lie within ₹4487.00.

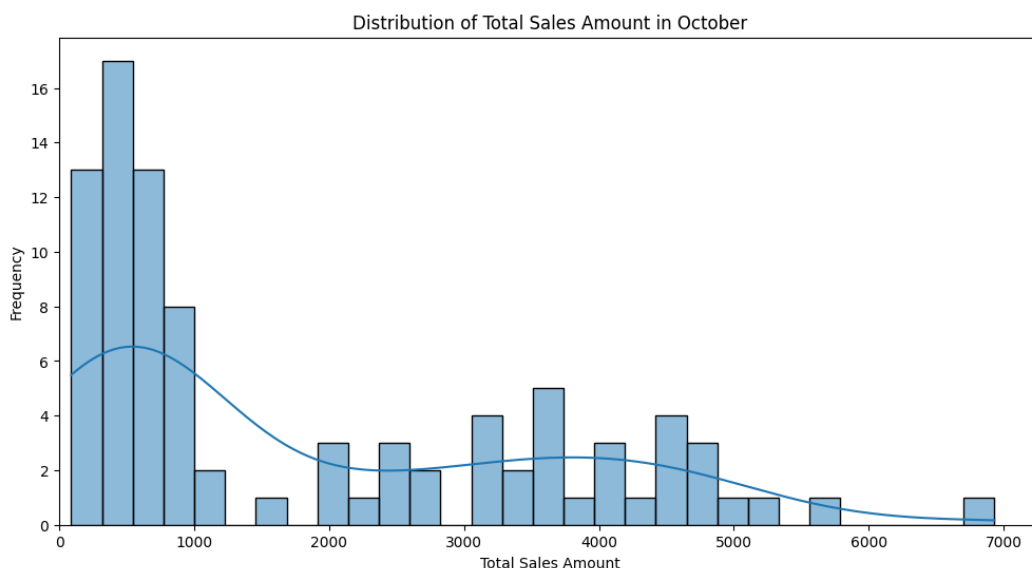


Figure 1: Spread of total sales in October

B. In order to check the spread of sales in the month of November (Figure 2), we used a histogram plot. From the plot we can see that:

- i) In the month of November, the top four most frequently occurring values lie between the values of ₹0 to ₹1000.
- ii) It has been also observed that the total sale in November ranges between ₹30.00 to ₹6623.00 with the average value being ₹3687.43. It was also observed that 75% of the values lie within ₹5349.00.

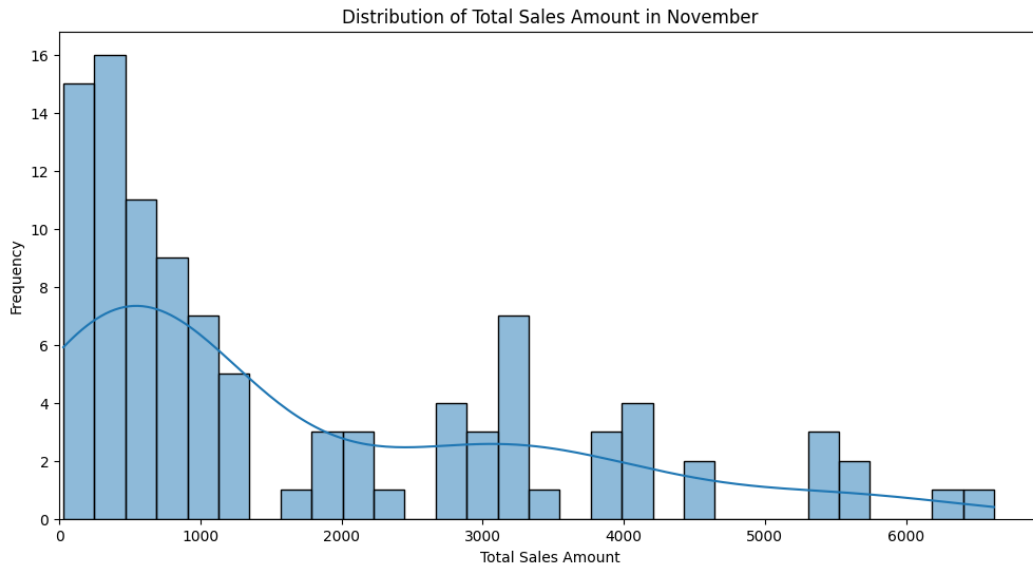


Figure 2: Spread of total sales in November

C. In order to check the spread of sales in the month of December (Figure 3), we used a histogram plot. From the plot we can see that:

- i) In the month of December, the top four most frequently occurring values lie between the values of ₹0 to ₹1000.
- ii) It has been also observed that the total sale in December ranges between ₹43.00 to ₹5824.00 with the average value being ₹3176.54. It was also observed that 75% of the values lie within ₹4178.00.

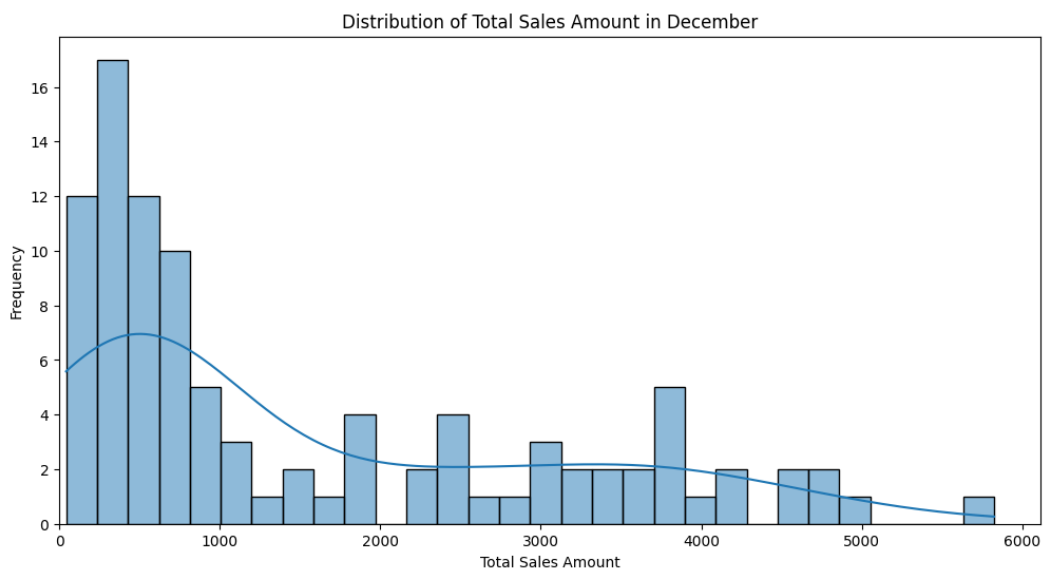


Figure 3: Spread of total sales in December

D. It has been found that the top 10 products in terms of sales over the 3 months are: NICIP PLUS (₹10093.20), MEGACHOLIN PLUS TAB (₹9984.55), SAFAXIN-200 TAB (₹9795.36), MANFORCE 100 Mg (₹9380.00), ALDIGESTIC-SP (₹8986.20), ALDIGESTIC-MR (₹8482.00), NFLOX TZ NDS (₹8340.85), CEKODA CV TAB (₹7578.00), REBOZEN DSR CAP (₹6240.60), FROXIME 500MG (₹6035.40).

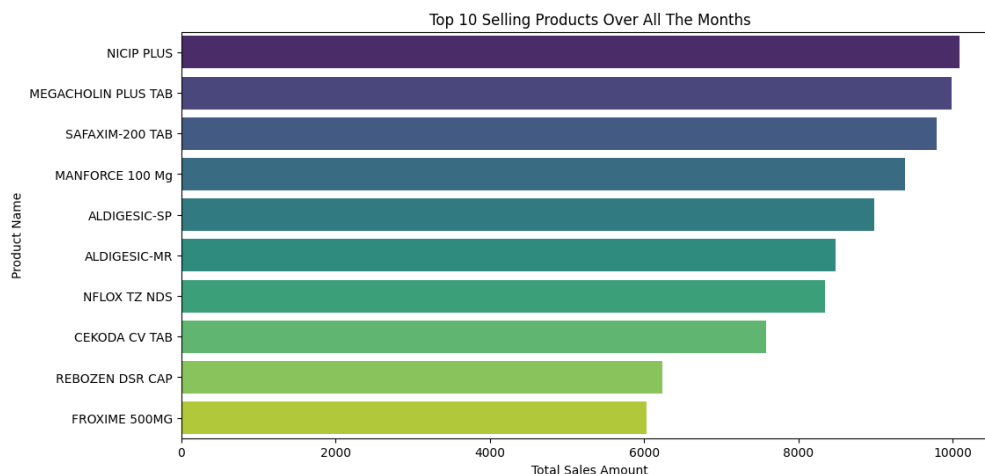


Figure 4: Top 10 Products that adds the most to sales overall

E. It has been found that the top 10 products in terms of sales in the month of October are: MEGACHOLIN PLUS TAB (₹5723.09), LACTOGEN 1 REFILL (₹3951.20), NICIP PLUS (₹3637.40), ALDIGESTIC-MR (₹3286.00), SAFAXIN-200 TAB (₹3075.82), MANFORCE 50 Mg (₹2917.20), MANFORCE 100 Mg (₹2560.00), REBOZEN DSR CAP (₹2538.90), ALDIGESTIC-SP (₹2536.80), FROXIME 500MG (₹2521.80).

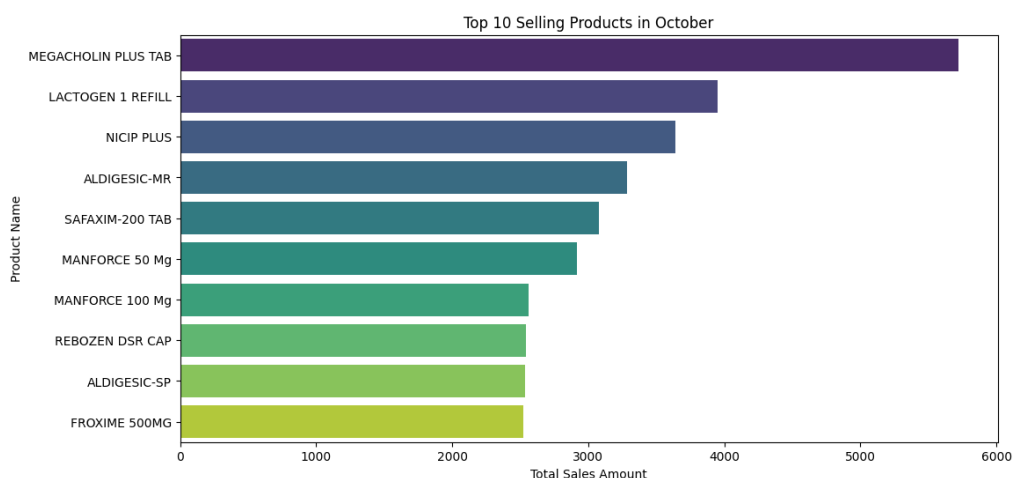


Figure 5: Top 10 Products in October

F. It has been found that the top 10 products in terms of sales in the month of November are: MANFORCE 100 Mg (₹4850.00), SAFAXIN-200 TAB (₹3629.41), NICIP PLUS (₹3500.90), CEKODA CV TAB (₹3492.00), NFLOX TZ NDS (₹3377.98), ALDIGESTIC-MR (₹3198.00), ALDIGESTIC-SP (₹2547.60), ORPENEM ER 300 TAB (₹2435.39), FROXIME 500MG (₹2016.00), PAN D (₹2001.09).

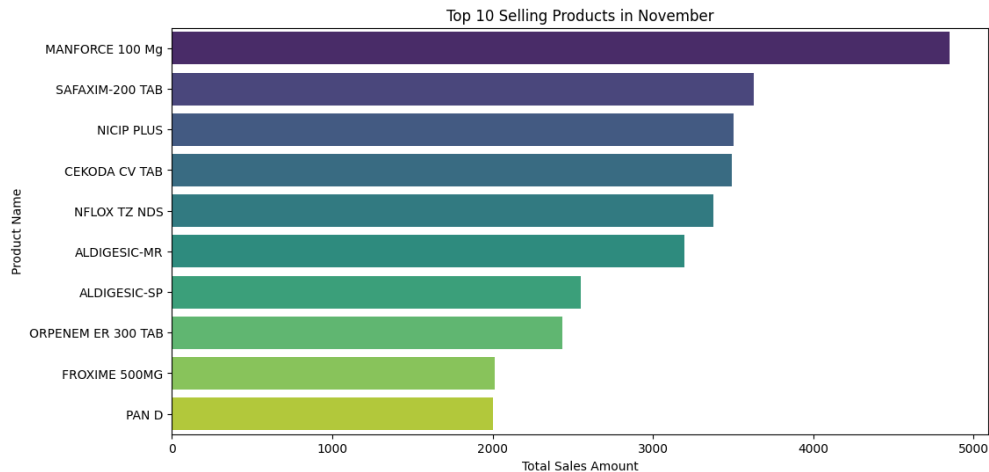


Figure 6: Top 10 Products in November

G. It has been found that the top 10 products in terms of sales in the month of December are: ALDIGESTIC-SP (₹3901.80), SAFAXIN-200 TAB (₹3090.13), NFLOX TZ NDS (₹2980.14), NICIP PLUS (₹2954.90), MEGACHOLIN PLUS TAB (₹2360.27), CEKODA CV TAB (₹2046.00), REBOZEN DSR CAP (₹2016.00), ALDIGESTIC-MR (₹1998.00), MANFORCE 100 Mg (₹1970.00), COREX DX SYRUP (₹1711.00).

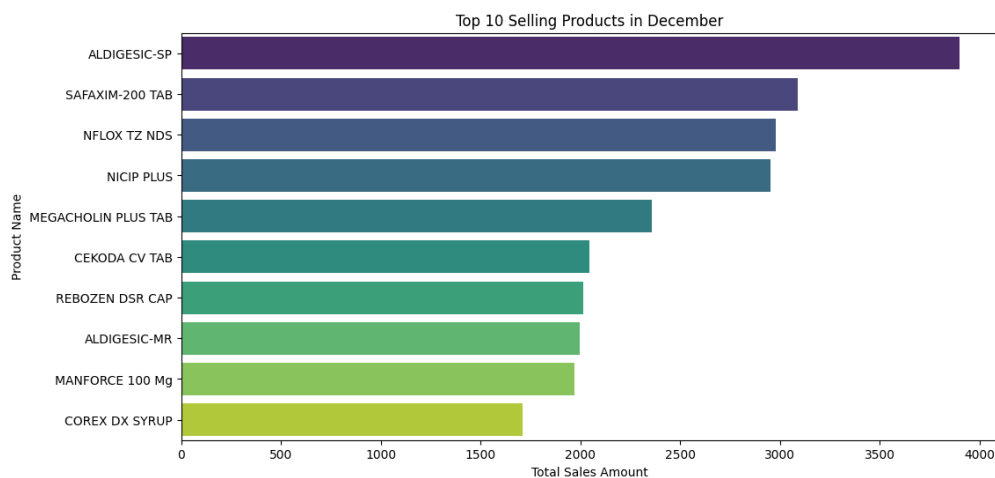


Figure 7: Top 10 Products in December

- H. We can see that a large number of products cluster between the price of ₹0 to ₹2000 for which the profit ranges between -₹2000 to ₹2000. We can also see that there are several outliers in terms of profit and sales price.

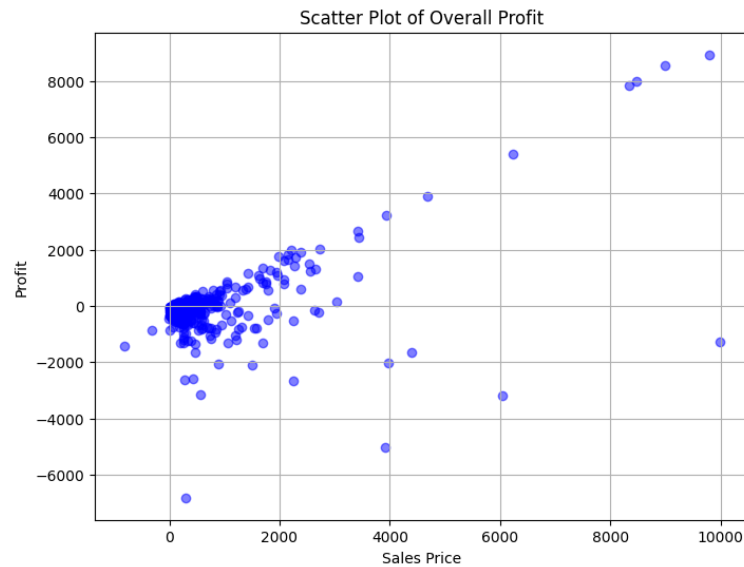


Figure 8: Scatter plot depicting the overall profit of Singh Medico

- I. From Figure 9, we can see that most of the products in October cluster between the price range of ₹0 to ₹1000 with a profit ranging between -₹2000 to ₹2000. We can also see a few outliers in terms of profit and price.

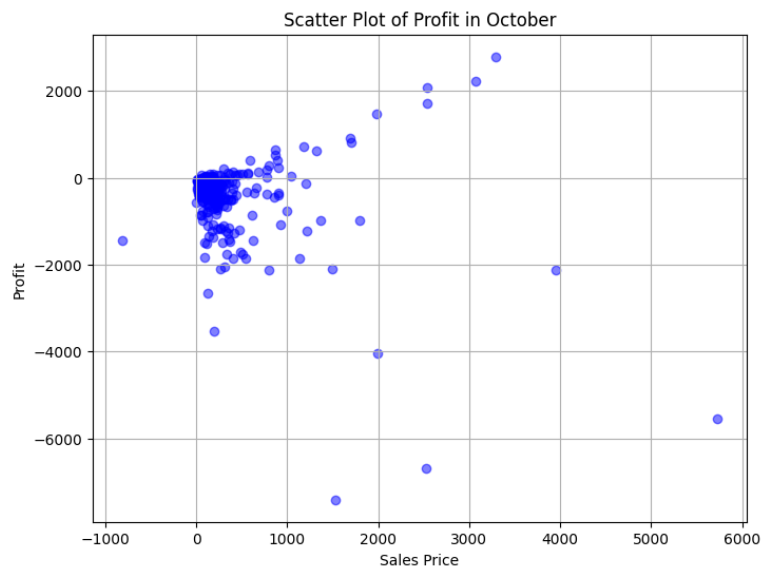


Figure 9: Scatter plot depicting the profit in October

- J. From Figure 10, it has been observed that in the month of November the products form a cluster between the price range of ₹0 to ₹500 with a profit ranging between ₹0 to -₹2000. In this case also outliers in terms of price and profit can be observed.

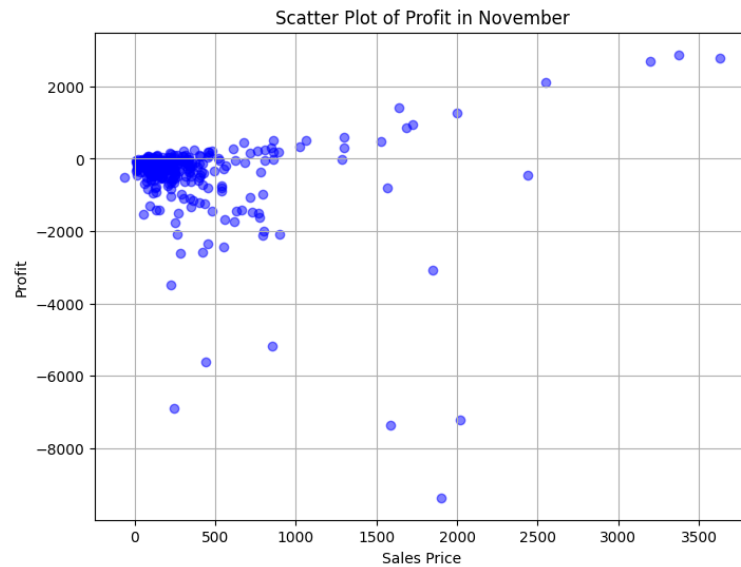


Figure 10: Scatter plot depicting the profit in November

- K. From Figure 11, it has been observed that in the month of December the products form a cluster between the price range of ₹0 to ₹1000 with a profit ranging between ₹0 to -₹2000. In this case also outliers in terms of price and profit can be observed.

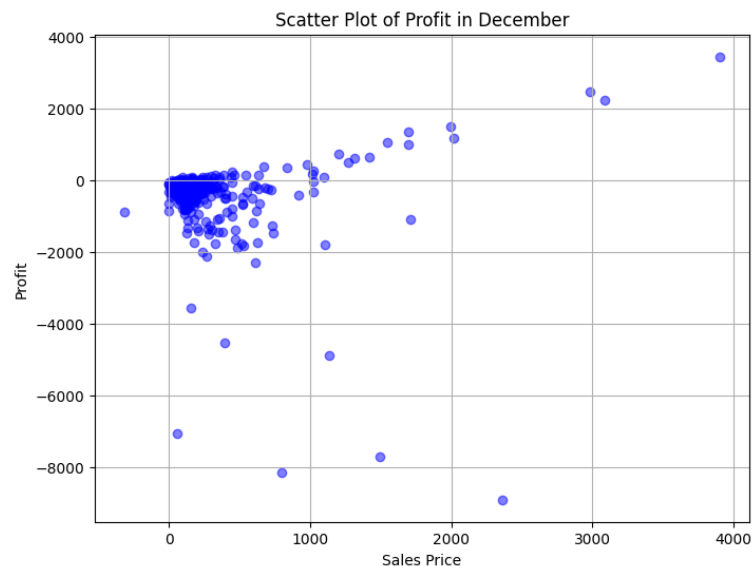


Figure 11: Scatter plot depicting the profit in December

- L. From Figure 12, it has been observed that the top 10 most profitable products over the three months are: SAFAXIM-200 TAB (₹8939.36), ALDIGESIC-SP (₹8536.20), ALDIGESIC-MR (₹7989.20), NFLOX TZ NDS (₹7838.85), REBOZEN DSR CAP (₹5410.60), AMOXYCLAV 625 (₹3906.91), MIFTY KIT (₹3243.12), PAN D (₹2664.62), MEFTAL SPAS TAB (₹2436.12), BROADICLOX-NOVO CAP (₹2031.82).

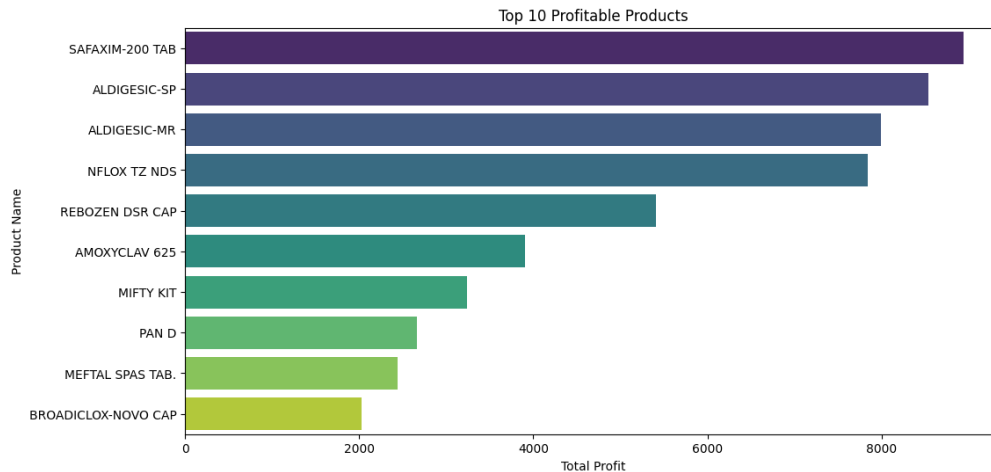


Figure 12: Top 10 Profitable Products

- M. As per Figure 13, it has been observed that the top 10 most profitable products in the month of October are: ALDIGESIC-MR (₹2793.20), SAFAXIM-200 TAB (₹2219.82), ALDIGESIC-SP (₹2086.80), REBOZEN DSR CAP (₹1708.90), NFLOX TZ NDS (₹1480.73), AMOXYCLAV 625 (₹912.90), NEBULIZER ROMSONS ANGEL (₹825.00), TITANIC K2 (₹710.00), LULIFORD CREAM (₹641.25), MIFTY KIT (₹627.93).

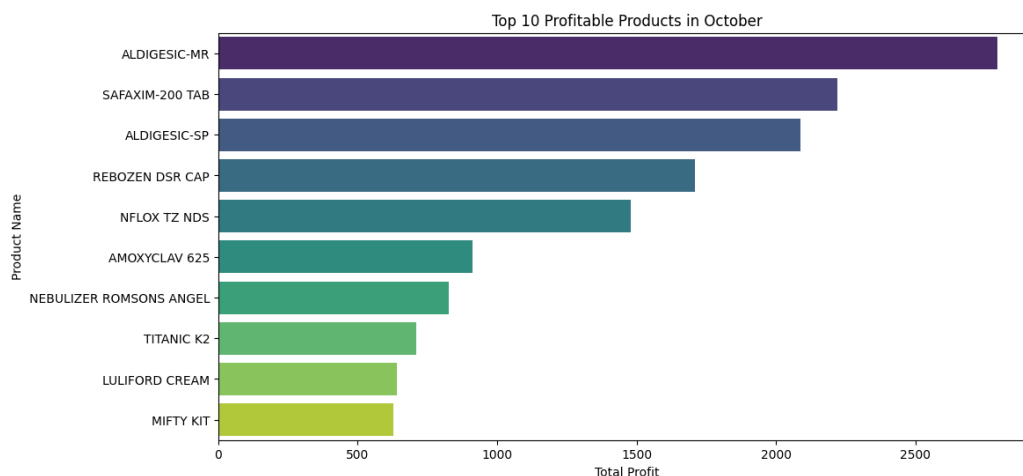


Figure 13: Top 10 Profitable Products in October

N. As per Figure 14, it has been observed that the top 10 most profitable products in the month of November are: NFLOX TZ NDS (₹2875.98), SAFAXIM-200 TAB (₹2773.41), ALDIGESIC-MR (₹2705.20), ALDIGESIC-SP (₹2097.60), CHLOROMYCETIN APLICAP (₹1418.39), PAN D (₹1251.09), AMOXYCLAV 625 (₹950.86), REBOZEN DSR CAP (₹855.70), MIFTY KIT (₹608.62), FUNTIME DS GOLD TAB (₹514.75).

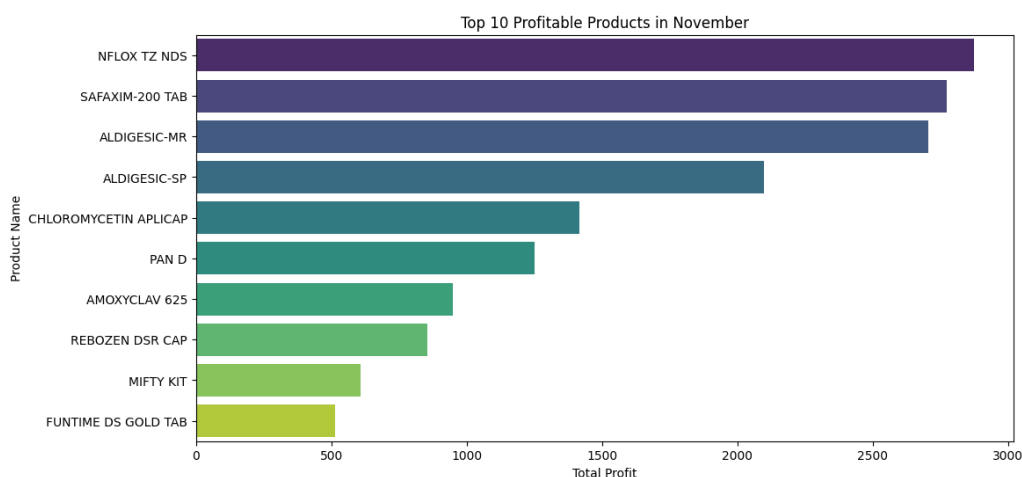


Figure 14: Top 10 Profitable Products in November

O. From Figure 15, it has been observed that the top 10 most profitable products in the month of December are: ALDIGESIC-SP (₹3451.80), NFLOX TZ NDS (₹2478.14), SAFAXIM-200 TAB (₹2234.13), ALDIGESIC-MR (₹1505.20), MOXIMAX D E/DROP (₹1341.05), REBOZEN DSR CAP (₹1186.00), MOXIFORD-D E/DROP (₹1053.00), BROADICLOX-NOVO CAP (₹1007.50), TITANIC K2 (₹730.00), MOXIFORD-L EYE DROP (₹658.85).

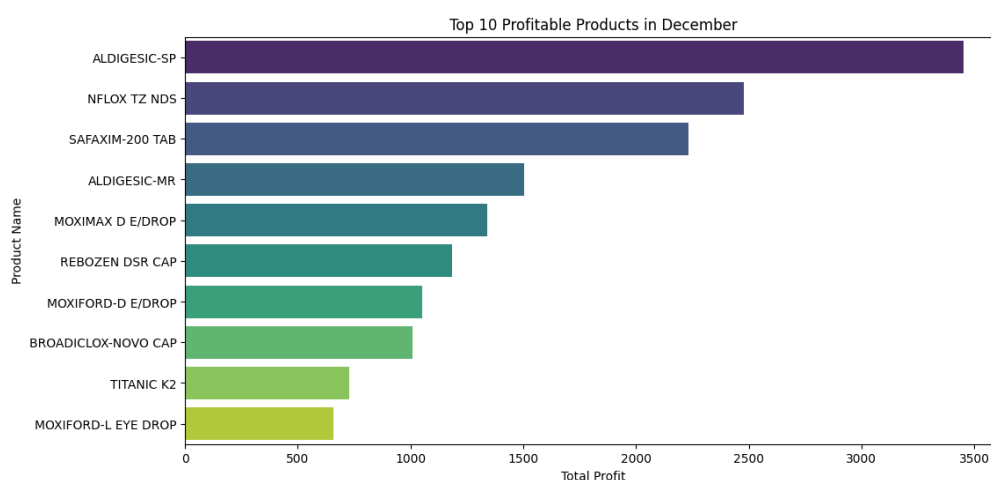


Figure 15: Top 10 Profitable Products in December

P. From Figure 16, it has been observed that there are 12 outliers in terms of price, namely, ALDIGESIC-MR (₹8482.00), ALDIGESIC-SP (₹8986.20), AMOXYCLAV 625 (₹4681.91), APTAMIL-3 GOLD (₹3914.50), FROXIME 500MG (₹6035.40), HORLICKS 500GM (BOTTLE) (₹3976.00), LACTOGEN 1 REFILL (₹4391.20), MEGACHOLIN PLUS TAB (₹9984.55), MIFTY KIT (₹3932.44), NFLOX TZ NDS (₹8340.85), REBOZEN DSR CAP (₹6240.60), SAFAXIM-200 TAB (₹9795.36).

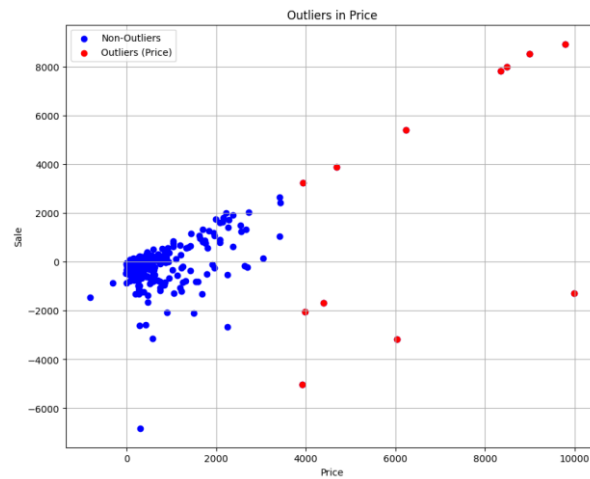


Figure 16: Overall outliers in terms of price

Q. The presence of 7 outliers in terms of price has been detected for the month of October (Figure 17), which are namely: ALDIGESIC-MR (₹3286.00), ALDIGESIC-SP (₹2536.80), FROXIME 500MG (₹2521.80), LACTOGEN 1 REFILL (₹3951.20), MEGACHOLIN PLUS TAB (₹5723.09), REBOZEN DSR CAP (₹2538.90), SAFAXIM-200 TAB (₹3075.82).

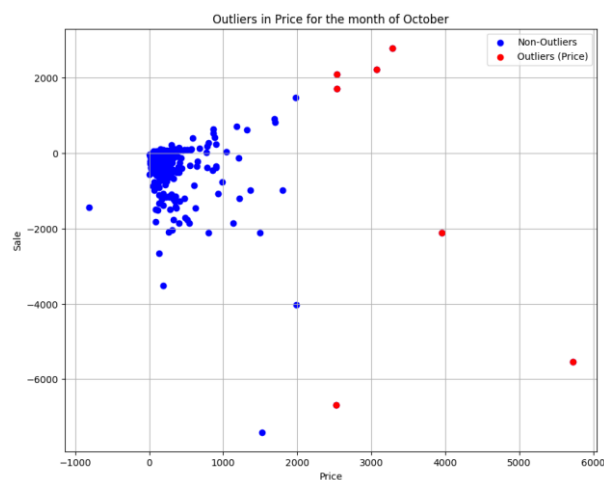


Figure 17: Overall outliers in terms of price for the month of October

- R. From Figure 18, it has been observed that there are 9 outliers in terms of price for the month of November namely, ALDIGESIC-MR (₹3198.00), ALDIGESIC-SP (₹2547.60), FROXIME 500MG (₹2016.00), LUPISOZ D CAP (₹1850.59), MEGACHOLIN PLUS TAB (₹1901.19), NFLOX TZ NDS (₹3377.98), ORPENEM ER 300 TAB (₹2435.39), PAN D (₹2001.09), SAFAXIM-200 TAB (₹3629.41).

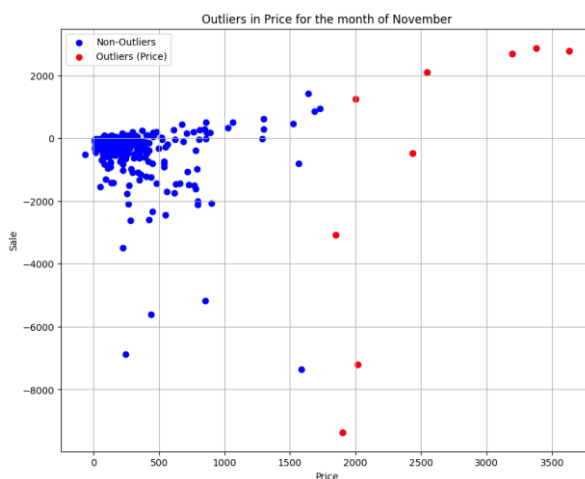


Figure 18: Overall outliers in terms of price for the month of November

- S. From Figure 19, it has been observed that there are 9 outliers in terms of price for the month of December namely, ALDIGESIC-MR (₹1998.00), ALDIGESIC-SP (₹3901.80), BROADICLOX-NOVO CAP (₹1697.50), COREX DX SYRUP (₹1711.00), MEGACHOLIN PLUS TAB (₹2360.27), MOXIMAX D E/DROP (₹1698.55), NFLOX TZ NDS (₹2980.14), REBOZEN DSR CAP (₹2016.00), SAFAXIM-200 TAB (₹3090.13).

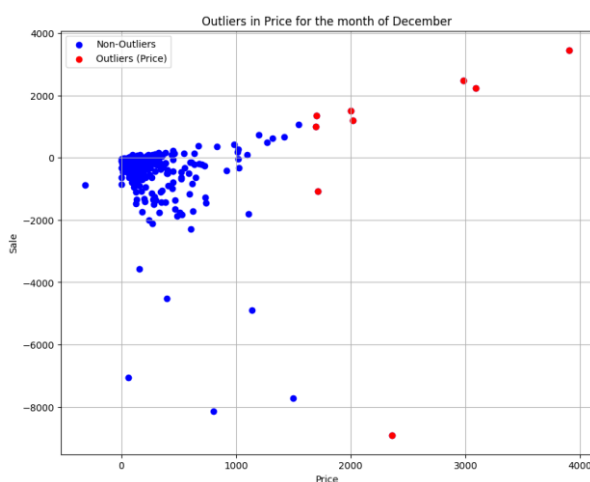


Figure 19: Overall outliers in terms of price for the month of December

T. The presence of a total of 11 outliers has been detected for the course of 3 months in terms of profit (Figure 20), they are as follows: ALDIGESIC-MR (₹7989.20), ALDIGESIC-SP (₹8536.20), AMOXYCLAV 625 (₹3906.91), APTAMIL-3 GOLD (-₹5020.80), FROXIME 500MG (-₹3180.60), MIFTY KIT (₹3243.12), NFLOX TZ NDS (₹7838.85), PRACTIN TAB (-₹3142.71), REBOZEN DSR CAP (₹5410.60), SAFAXIM-200 TAB (₹8939.36), SENSODYNE SOFT BRUSH (-₹6822.80).

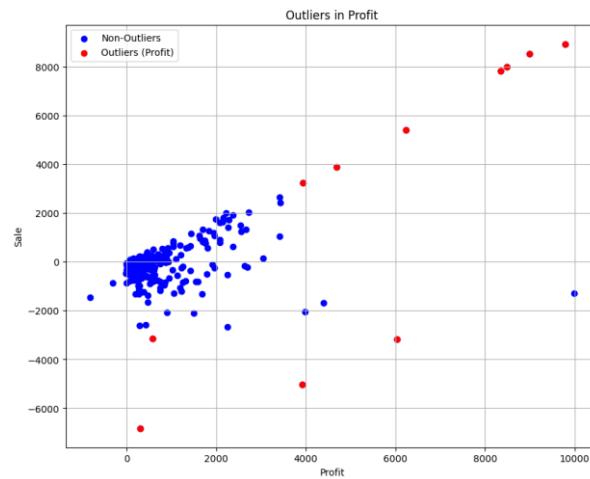


Figure 20: Overall outliers in terms of profit

U. From Figure 21, it has been observed that there are 6 outliers in terms of profit for the month of October namely, ALDIGESIC-MR (₹2793.20), APTAMIL-3 GOLD (-₹7408.90), FROXIME 500MG (-₹6694.20), HORLICKS 500GM (BOTTLE) (-₹4034.35), MEGACHOLIN PLUS TAB (-₹5540.07), PRACTIN TAB (-₹3523.46).

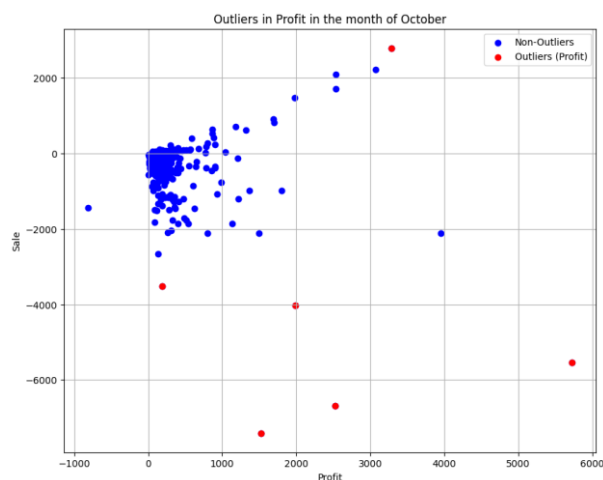


Figure 21: Overall outliers in terms of profit for the month of October

V. From Figure 22, it has been observed that there are 7 outliers in terms of profit for the month of November namely, APTAMIL-3 GOLD (-₹7348.80), FROXIME 500MG (-₹7200.00), HORLICKS 500GM (BOTTLE) (-₹5170.35), LACTOGEN 1 REFILL (-₹5620.00), MEGACHOLIN PLUS TAB (-₹9361.97), NFLOX TZ NDS (₹2875.98), SENSODYNE SOFT BRUSH (-₹6882.80).

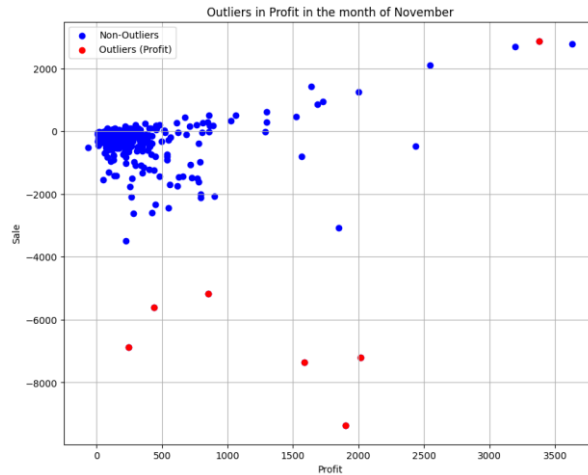


Figure 22: Overall outliers in terms of profit for the month of November

W. From Figure 23, it has been observed that there are 7 outliers in terms of profit for the month of December namely, ALDIGESIC-SP (₹3451.80), APTAMIL-3 GOLD (-₹8133.70), FROXIME 500MG (-₹7718.40), HORLICKS 500GM (BOTTLE) (-₹4886.35), LUPISOZ D CAP (-₹4519.64), MEGACHOLIN PLUS TAB (-₹8902.89), SENSODYNE SOFT BRUSH (-₹7066.80).

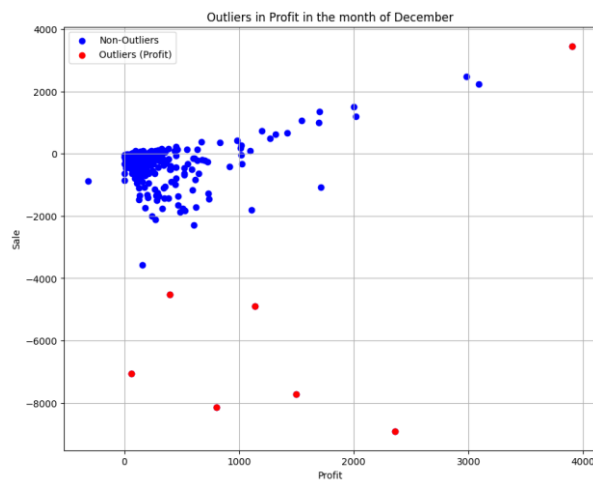


Figure 23: Overall outliers in terms of profit for the month of December

- X. From the purchase and sales dataset, it has been observed that over the months of October, November and December the number of purchases made was 780 whereas the number of items sold from that batch was 568. This gives us a total of 212 unsold products which account for 27.17% of the items bought during October, November and December adding to the dead stocks.
- Y. From Figure 24, it can be deduced that the following are the top 10 manufacturing companies demanded across total sales: ALKEM LABORATORIES LTD. (₹40230.87), LEEFORD HEALTHCARE LTD (₹31678.41), CIPLA LTD. (₹30265.26), MANKIND (₹29550.26), ARISTO PHARMACEUTICALS PVT.LTD. (₹17963.55), NESTLE INDIA LIMITED (₹17877.98), ABBOTT (₹17274.92), EXCEL REMEDIIES (₹14195.50), ALKEM HELTH SCIENCE (₹12684.96), LABORATE PHARMACEUTICALS INDIA LTD. (₹10170.05).

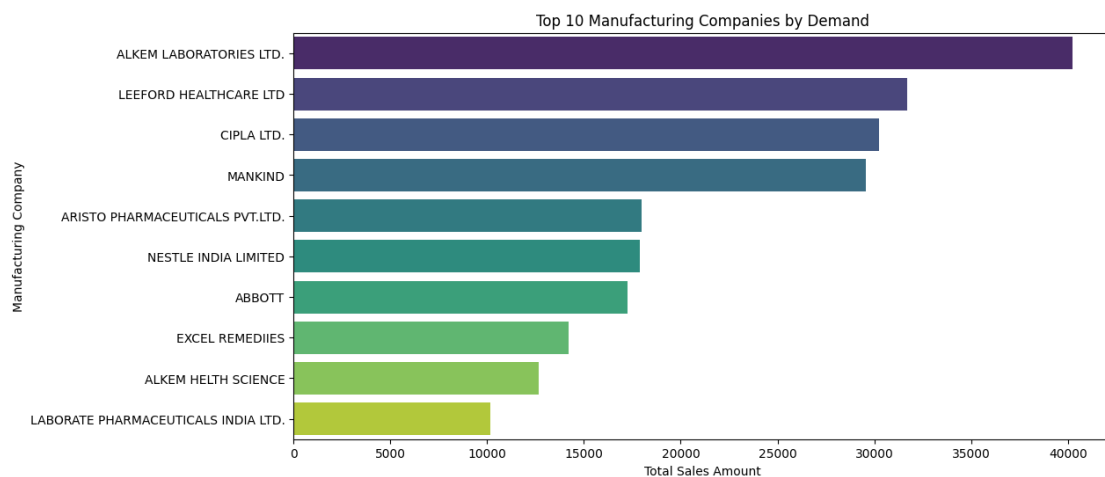


Figure 24: Top 10 Manufacturing Companies adding most to the total sales.

4. Interpretation of Results

- a) There is an indication of possible seasonal trend and/ or a change in customer preferences based on the sales distribution and top-selling products across the months of October, November and December.
- b) A trend of lower sales price and profit is observed in December compared to October and November. This could be due to the pricing strategies not synchronizing with the seasonal demand variations during festive seasons.
- c) Products such as NICIP PLUS, MEGACHOLIN PLUS TAB and SAFAXIN-200 TAB consistently added to high value items over the duration of October, November and December.
- d) The top 10 products in terms of profit and the top 10 products in terms of sales over the three months were different, indicating that the profitability does not necessarily correlate with sales.
- e) Outliers in terms of price and profit were observed which indicate that the business involves unusually high or low sales price and profit as well.
- f) There is a strong presence of the top 10 manufacturing companies in terms of sales given that they are consistently present across the months of October, November and December.
- g) Companies like ALKEM LABORATORIES LTD, LEEFORD HEALTHCARE LTD and CIPLA LTD are popular amongst customers given they were among the top manufacturing companies in terms of sales.
- h) The fact that 27.17% of the items brought across the months of October, November and December remained unsold indicates that the store has an inefficient inventory management.
- i) Products with higher prices did not always result in higher profits.
- j) Outliers indicate that across the months of October, November and December some high-priced products resulted in negative profits.

- k) There is a strong indication that there is lack of proper pricing strategies to maximize the profit.

5. Recommendations

- a) In order to adjust pricing and marketing strategies in accordance to seasonal demand trends and/ or customer preferences, a detailed seasonal analysis is to be done periodically.
- b) In order to maximize profitability in accordance to changes in customer preferences and seasonal demand variations, implementation of dynamic pricing strategy is an immediate requirement.
- c) Continuously review and optimize the product mix based on sales performance to focus on high-value items such as NICIP PLUS, MEGACHOLIN PLUS TAB, and SAFAXIN-200 TAB.
- d) It is important to analyse the profitability of products in order to optimize pricing and come up with novel and effective promotional / marketing strategies for high profit products.
- e) The store should utilize inventory forecasting techniques and tools to minimize stockouts and overstocking situations. This would result in an efficient inventory management.
- f) In order to increase the sales and put a check on dead stocks, promotional campaigns for high-profit products and seasonal items should be carried out.
- g) Negotiating better terms with suppliers can result in an improved supply chain ecosystem with a chance of improved profit margins in accordance to a potential reduction in purchase cost.
- h) Periodic monitoring of inventory turnover rates can help in identification of slow-moving items, to clear which, discounts and seasonal offers can be provided.
- i) In order to better understand the current preferences and improve product offerings, collection and analysis of customer feedback should be carried out.
- j) In order to stay competitive and to capture market share as well as customer base, monitoring of competitors' pricing and promotional strategies should be carried out on a priority basis.

- k) With utmost priority price elasticity analysis is to be conducted in order to understand varying effects of price changes on sales and consequently come up with better pricing strategy.
- l) Providing regular and relevant training to the staff on inventory management and market knowledge as well as business dynamics shall improve efficiency and customer service.
- m) It is important to identify products which are frequently bought together and have more or less same demand in order to implement cross-selling and upselling strategy to add to positively in the overall profitability.
- n) It is recommended to invest in inventory management software and analytics tools to streamline operations and make data-driven decisions.
- o) Conduction of regular performance reviews can help in improve profitability and inventory management by tracking progress against goals and adjusting strategies accordingly.