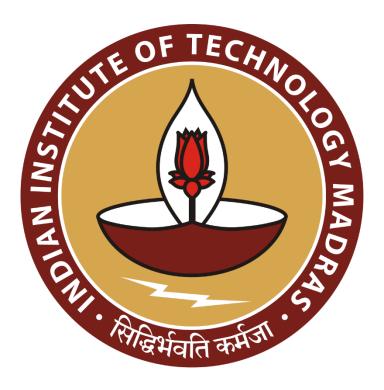
# **Enhancing Operational Efficiency and Cost Savings through Process Optimization at Prajwal Steel and Thibak Agency.**

# Final Submission for the BDM capstone Project

Submitted by

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# **Enhancing Operational Efficiency and Cost Savings through Process Optimization at Prajwal Steel and Thibak Agency.**

# 1 Executive Summary

Operating as an authorized B2B distributor for <u>SHREE TNB POLYMERS LIMITED</u>, this organization expertly manages inventory while maintaining a consistent supply chain for its affiliate dealers. It thrives on the mutual benefits derived from distribution rights, which in turn elevates the mother company by reducing factory storage and inventory costs. We are talking about <u>Prajwal Steel Hardware and Thibak Agency</u>, a specialty distributor of TNB Polymers' products. The brainchild of Prakash More and managed adeptly by Prajwal More, it has evolved from a retail business in 2020 to a market-leading distributor in less than a year.

In 2021, they forged a strategic partnership with TNB, marking a significant milestone in their corporate journey. Expertise lies in the distribution of Drip Irrigation products, Sprinkler products, and PVC pipes, ensuring consistent profitability and holding the third spot in market share.

Ambitious financial projections show a planned turnover increase from 55 lakhs to 1 crore in the 2022-24 fiscal years. These ambitions are mirrored in storage expansion plans from 3,000 to 7,000 square feet, underscoring their commitment to growth.

However, concerns range from credit system complexities, price instability, logistics hiccups, sales seasonality, supply shortages, demand unpredictability, inventory optimization issues, and customer-product mismatches. These challenges pose threats to operational efficiency, customer satisfaction, and overall business growth.

The solution? A well-rounded approach adopting data-driven insights, extensive credit analyses, and demand forecast techniques implementation. This strategy aims to supplement the organization's performance and mitigate the afore-said challenges.

# 2 Analysis Process

The exploratory data analysis was conducted using three primary tools: Excel, PowerBI, and Python. The process was structured in a systematic manner, as detailed below:

#### 1.Data Segregation and Aggregation:

As the data had 64 different types of items in inventory we divided them into four major categories.

- a) LLDPE Pipes
- b) Joiner Accessories
- c) Valve Accessories
- d) Filter Accessories

We had data from Jan 2022- August 2023, but the data was divided into two financial years, we aggregated the data into one single file.

## 2. Volume Analysis:

After segregation we calculated no of items sold per category. After creating a pivot chart we applied a pie chart from it in excel.

#### 3. Sales Analysis:

Similarly we calculated actual sales from each category. After creating a pivot chart we applied a pie chart from it in excel.

#### 4. Volume & Sales Trend Analysis:

We used pivot tables in Excel to group dates by month and obtain the sum of all sold products for each month.

Finally we plotted an appropriate line graph for each year to visualize the trends over time using excel built in functionalities.

### **5. Descriptive Statistics:**

Here we used excel inbuilt function to calculate count(),min(),max() and Average().

#### 6. Credit Analysis:

We calculated total credit extended and paid overtime for a dealer and then by using the pivot table in excel calculated the bar chart .

#### 7. Dealer wise Revenue Analysis:

In this section we created a table with two columns, one for the name of the dealer and other to determine the revenue generated from the sale to the dealer. Thus after creating the pivot table we chose the Treemap.

#### 8. Dealers Map:

Using the above table we added a column named location and then added latitude and longitude with respect to shop or dealer. We used MyGoogleMap to create a customized map to denote the location of dealers, hence the reach.

#### 9. Discrete items:

In revenue generated by dealers we used the function of excel (IF(B2>0,1,0) to check if the item was purchased by the dealer or not . Thus we created the pivot table , from which the chart was generated determining no of unique items the dealer has purchased.

#### 10. Received and Sold Stocks trendlines:

For achieving this task we created two table each with two columns Date and items sold. We then used python notebook to create the comparative line charts .

# 11.SARIMA predictions:

After conducting exploratory analysis, we figured that predicting sales and managing inventory accordingly would be the key to solving all of the business's problems.

To accomplish this, we used a statistical method for time series forecasting known as SARIMA (Seasonal Autoregressive Integrated Moving Average), which extends the popular ARIMA model by incorporating seasonal components.

ARIMA models are useful for modeling time series data that exhibit trend and/or seasonality. However, when the time series data has a seasonal component, such as sales data that fluctuates regularly throughout the year, the standard ARIMA model may not be sufficient. In such cases, the SARIMA model can be used to model the seasonal component of the time series.

Our process for implementing this method was as follows:

- 1. We used pandas group by to group sold values of all products in that category over month-year
- 2. For each of the categories, we fitted a SARIMA model.
- 3. By dividing the data into train and test sets, we found the best model parameters that minimize the error on the test data.
- 4. Finally, we trained this model on the entire three years of data and made predictions for the next 12 months.
- 5. We also plotted graphs using matplotlib to visualize training and predictions.

Overall, we utilized several Python libraries such as pandas, NumPy, matplotlib, and stats models to perform sales predictions using SARIMA. We were able to generate the next 10 months of sales predictions for the shop based on our analysis.

# 3 Results and Findings

After a comprehensive consultation with the agency's owner, we have categorized the entire collection of items into four major groups.

1)LLDPE pipes 2) Joiner Accessories 3)Valve Accessories 4)Filter Accessories

# **Descriptive Statistics:**

During the fiscal year 2022-23, a total of 9 shipments were received between March 23, 2022, and November 20, 2022. The details of the received shipments are as follows:

**LLDPE Pipes**: An average of 90,388.89 meters per shipment was received.

**Joiner Accessories**: An average of 3,622 items per shipment were received.

Valve Accessories: Approximately 208.11 items per shipment were received .

**Filter Accessories**: On average, 26.778 items per shipment were received.

In the same fiscal year, the stock was sold over 53 different days, with the following sales statistics:

**LLDPE Pipes**: A total of 621.33 bundles were sold.

**Joiner Accessories**: Approximately 12,400 pieces were sold.

Valve Accessories: 1,008 items were sold.

**Filter Accessories**: Around 158 items were sold over the period.

Upon analyzing the stock sold over various dates, the following observations were made:

Maximum Purchase: INR 8,21,950.5 was observed on January 31, 2023.

Minimum Purchase: INR 84 was observed on July 3, 2022.

Average Sale: INR 136,508.8 was observed.

**Credit Data:** 

Creditors: Credit extended to 6 dealers..

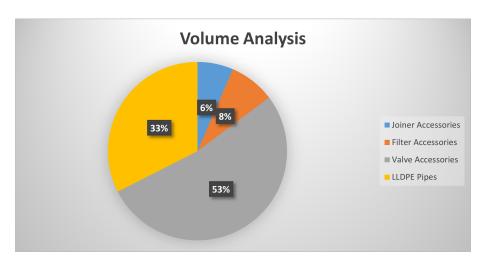
Average Credit Provided: INR 312,980.

**Dealer Statistics:** 

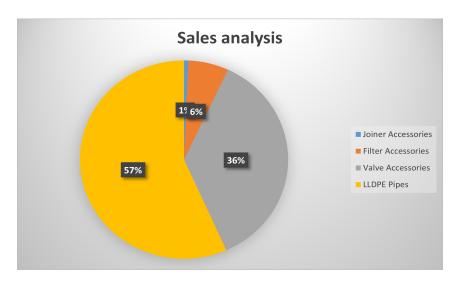
**Dealer Purchases**: Each dealer purchased an average of 13 different items out of 64 available at the distributor.

These descriptive statistics offer a comprehensive overview of the data, shedding light on key patterns and trends that can guide future decision-making and strategy.

# 3.1 Volume Analysis of Sales 22-23:



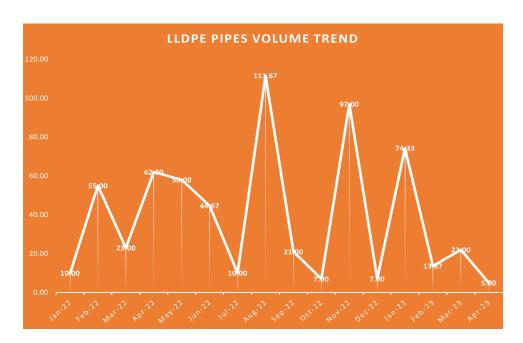
## 3.2 Sales analysis of Sales 22-23:

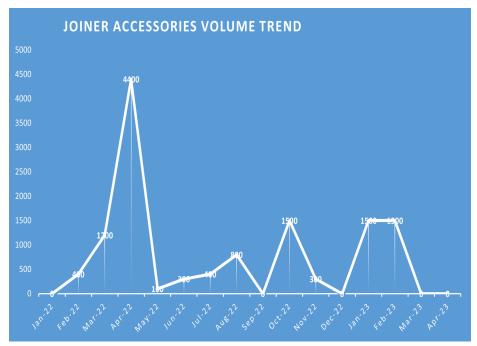


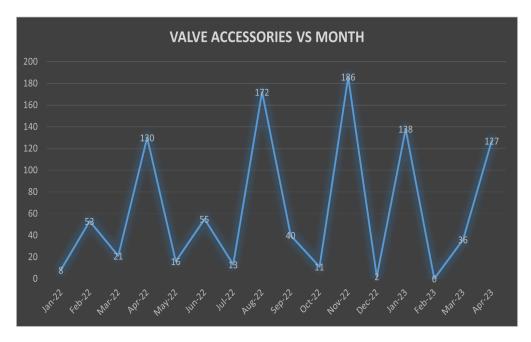
- The pie charts offer significant insights into the categories that lead in both sales and revenue generation. Considering our constrained inventory capacity, it would be prudent to concentrate our efforts on the top-performing category.
- This focus will aid in prioritizing the constant availability of these items, thereby reducing the likelihood of stockout scenarios.

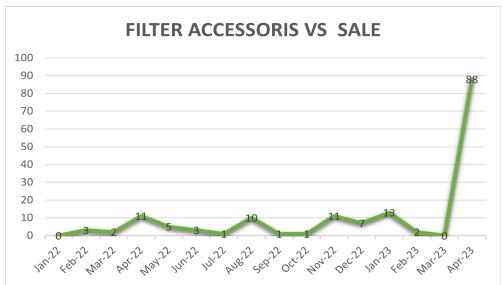
• To realize this objective, we may strategically reduce the inventory of less significant items, allowing for a more efficient allocation of resources to the categories that demonstrate the highest performance.

# 3.3 Volume trend analysis for LLDPE Pipes, Joiner accessories, Valve accessories, Filter accessories categories:





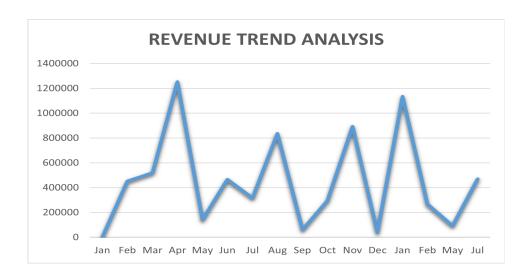




Examining the provided graphs reveals a notable surge in volume during the first quarter, accompanied by considerable fluctuations in the subsequent quarters.

In my analysis of the graphs, I observe a substantial uptick in volume during the initial quarter, followed by significant variability in volume across the remaining quarters.

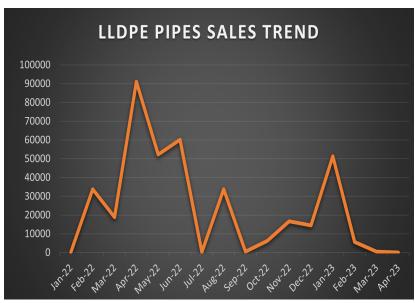
# 3.4 Revenue trend analysis across all categories:

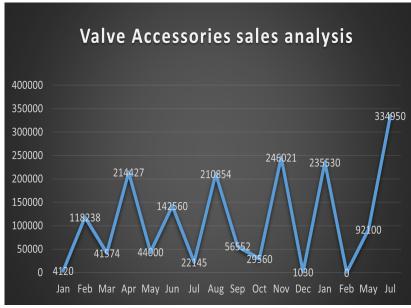


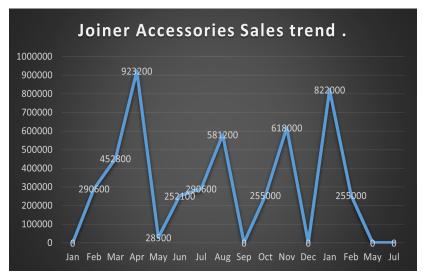
The examination of revenue trends across product categories reveals a prominent pattern—an evident rise in first-quarter revenue compared to subsequent quarters. This recurring trend indicates potential seasonal or cyclical influences, prompting the need to dissect contributing factors.

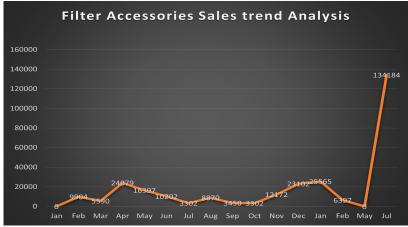
Understanding these dynamics can inform strategic decisions, allowing businesses to capitalize on successful first-quarter strategies throughout the year. It also underscores the significance of maintaining consistent revenue performance across all quarters.

# 3.5 Additional graphs for sales trend analysis across for each categories:







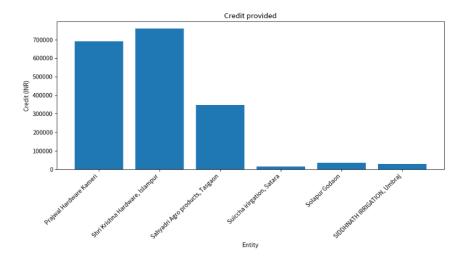


I noticed a consistent pattern where changes in the volume of goods or services sold align with corresponding shifts in the organization's revenue. This suggests a close connection between transaction quantities and overall income.

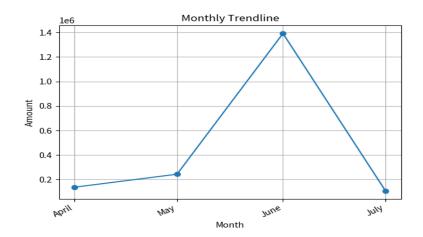
It was observed that the revenue trend closely mirrors the patterns identified in volume analysis. This alignment between transaction quantities and generated income implies a strong correlation between the two metrics.

I discovered that, much like the volume trend, revenue also experiences a surge during the initial quarter of the year. This observation indicates a recurring pattern of increased business activity and higher income during the first months.

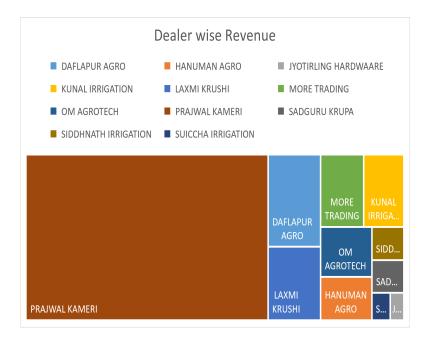
### 3.6 Credit analysis



- **Diverse Range of Credit**: The credit provided to different entities varies widely, ranging from ₹16,650.00 to ₹759,361.00. This indicates a significant disparity in the credit allocation.
- **Entities Involved:** The data includes various types of businesses, such as hardware stores, agro products, and irrigation services. This suggests that the credit is provided to a diverse set of industries.
- **High Credit Recipients:** "Prajwal Hardware Kameri" and "Shri Krishna Hardware, Islampur" are the top two entities in terms of credit received, with amounts exceeding ₹690,000.00.
- Low Credit Recipients: On the other end of the spectrum, "Suiccha irrigation, Satara" received the lowest credit of ₹16,650.00, followed by "Solapur Godaon" and "SIDDHNATH IRRIGATION, Umbraj" with amounts below ₹36,000.00.

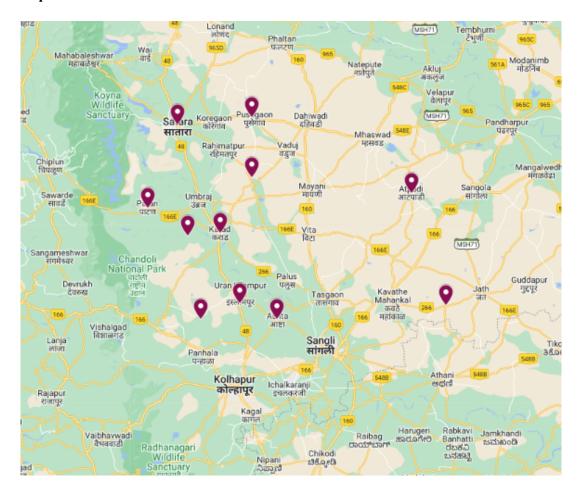


## 3.7 Dealer wise revenue analysis



- The revenue distribution among dealers is highly skewed, with "Prajwal hardware" being an outlier, having the highest revenue of ₹2,938,602.00.
- The average revenue across 11 dealers is ₹416,878.20, with a substantial standard deviation of ₹842,759.40, indicating significant variability.
- The three lowest-revenue dealers are "Jyotirling hardware," "Suichha irrigation," and "Sadguru krupa," with revenues under ₹77,000.00, contrasting sharply with the top performers.

### 3.8 Dealers Map



Take a look at the full map at link.

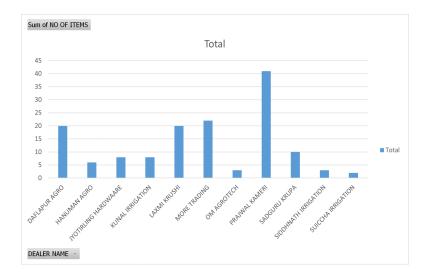
Upon examining the provided map, it's evident that a predominant concentration of dealers is situated to the north of the central distribution center. This center is strategically positioned in Kameri, which is in close proximity to Urun Islampur.

The geographical distribution of dealers indicates a clear trend of their spatial orientation relative to the main distribution center. The majority of dealers seem to be located in the northern direction from this center. This could potentially signify certain logistical considerations or market dynamics that have led to this pattern.

It's plausible to assume that dealers' proximity to the distribution center can influence their accessibility to products, delivery times, and overall operational efficiency. Additionally, this geographic arrangement could also reflect the demographic distribution of potential customers or the strategic placement of dealers to cater to specific regions.

In essence, the map points to a discernible spatial relationship between dealers and the main distribution center, with a notable clustering of dealers to the north of the center in Kameri near Urun Islampur. This spatial insight could hold implications for supply chain logistics, distribution strategies, and potential areas for market expansion.

### 3.9 Discrete items purchased by dealers.

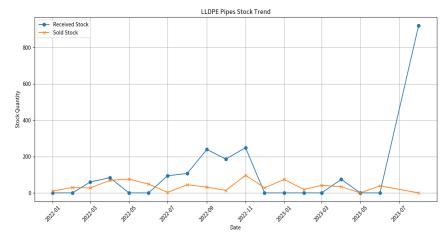


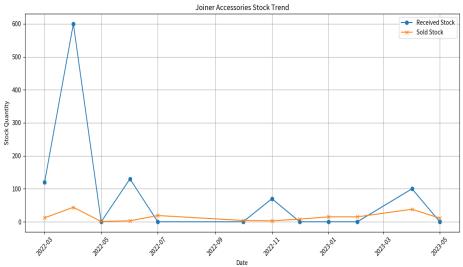
This chart shows the fact that even though 64 items are available in inventory, on average only 13 discrete items are purchased by the dealers.

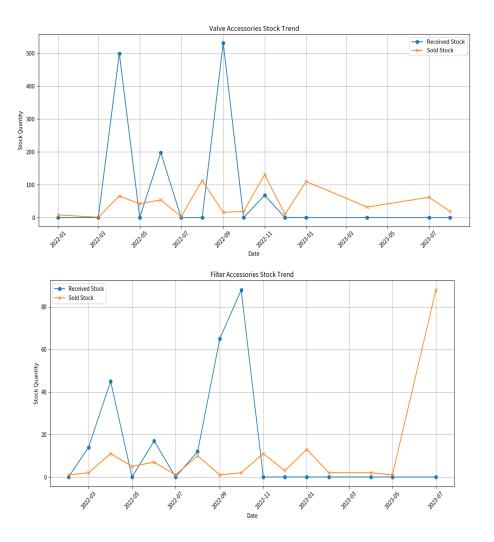
In analyzing the chart and the statement, it becomes apparent that despite the presence of a considerable inventory, it's evident that specific products hold a higher demand compared to others. I can see that certain items tend to resonate more with dealers, possibly due to their alignment with ongoing market trends, customer inclinations, or specific usage scenarios.

Furthermore, the notion of the "long tail" concept could play a role here. It's quite relevant in numerous industries. Essentially, it means that a small cluster of products enjoys frequent and consistent sales, whereas the majority of products experience sporadic or occasional purchases. This phenomenon could be a plausible explanation for the situation where only a limited subset of items is regularly acquired by dealers.

# 3.10 Stock Analysis







Based on the graphs above, we can observe a significant gap between the number of items being received and sold .This gap indicates that there are a significant number of non-selling products that are being stored for extended periods, leading to inefficient inventory management.

To optimize our inventory management strategy and reduce this gap, we aim to implement solutions that help us predict and address any potential stock overload, stockouts in advance. By doing so, we can minimize the amount of non-selling products we store, freeing up space for products that are in high demand.

### 3.11 Revenue growth prediction



Prediction for next 10 months

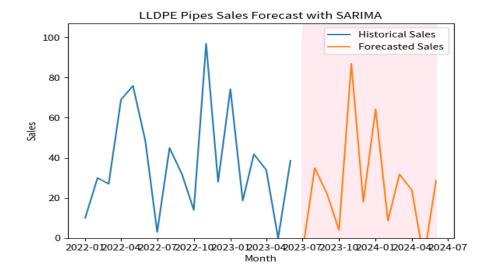
2023-09	2023-10	2023-11	2023-12	2024-01	2024-02	2024-03	2024-04	2024-05	2024-06
320698	237980	273610	258263	307793	382897	392924	706455	703748	644748

- **Strategic Planning:** Revenue forecasts help the organization plan for the future. They guide where to spend money, such as on new products or markets, and help make important investment decisions.
- Cash Flow Management: By predicting future revenue, the organization can manage its money better. This includes planning for enough cash on hand to pay bills and making wise decisions about borrowing and paying back loans.
- Sales and Marketing Optimization: Revenue forecasts help sales teams set realistic goals and guide marketing efforts. By understanding what might sell in the future, the organization can focus on promoting the right products to the right customers.

In essence, these points highlight how revenue forecasting aids in making informed financial, sales, and marketing decisions, ensuring that the organization is well-prepared for future opportunities and challenges.

#### 3.12 Sales prediction Category wise

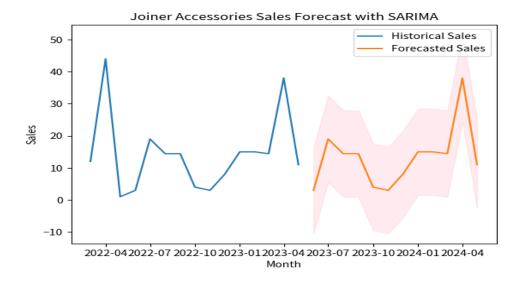
### 3.12.1 LLDPE Pipes



Forecast for LLDPE pipes for 10 months

2023-07	2023-08	2023-09	2023-10	2023-11	2023-12	2024-01	2024-02	2024-03	2024-04
-7	35	22	4	87	18	64	8.67	31.83	24

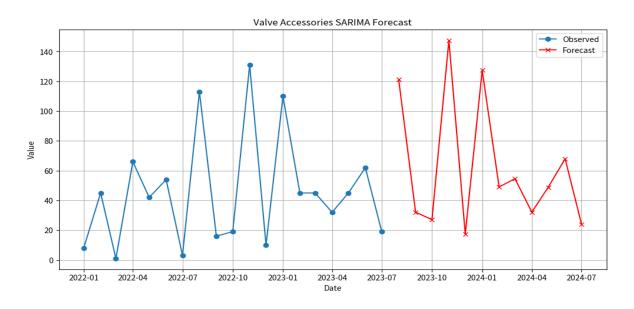
## 3.12.2 Joiner Accessories



**Forecast for Joiner Accessories for 10 months** 

2023-06	2023-07	2023-08	2023-09	2023-10	2023-11	2023-12	2024-01	2024-02	2024-03
3	19	14	14	4	3	7	15	15	15

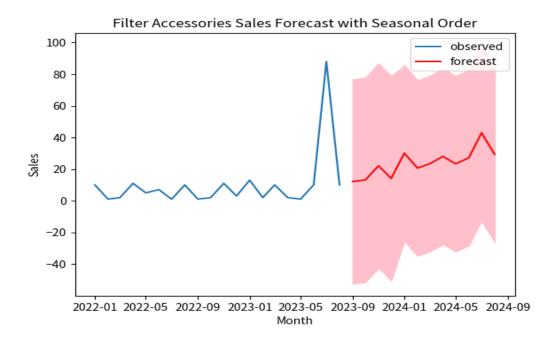
# 3.12.3 Valve Accessories



# Forecast of Valve Accessories for 10 months.

2023-08	2023-09	2023-10	2023-11	2023-12	2024-01	2024-02	2024-03	2024-04	2024-05
121	32	27	147	17	127	49	54	32	48

#### 3.12.4 Filter Accessories



## Forecast of Filter Accessories for 10 months.

2023-09	2023-10	2023-11	2023-12	2024-01	2024-02	2024-03	2024-04	2024-05	2024-06
12	13	22	14	30	20	23	28	23	27

#### 1. Product Management:

Sales forecasts for each category help the organization manage its inventory better. By knowing what's likely to sell, they can have the right products available without overstocking or running out.

# 2. Supply Chain Management:

By understanding sales trends in each category, the organization can work closely with suppliers and distributors. This ensures that products are made and delivered efficiently, and are available where and when customers want them.

# 4. Interpretation of Results and Recommendation

# 4.1. Interpretations

- In terms of volume, the Valve accessories category holds the majority share at 53%, whereas in revenue generated through sales, LLDPE pipes take the lead with 57%.
- There's a notable issue of excessive stock remaining in inventory for certain products, suggesting that numerous products with low demand are being stored for extended durations.
- Although volume trends don't exhibit a distinct pattern across categories, sales trends indicate that the first quarter of the year tends to experience comparatively higher sales.
- A handful of products are experiencing extremely low sales, leading to significant wastage.
- Geographically, the majority of dealer locations are situated to the north of the main distribution center.

#### 4.2. Recommendations

- Moving forward, it is recommended to base stock procurement decisions on the provided sales predictions. These forecasts offer valuable insights into sales trends, highlighting periods of heightened demand and lulls. For instance, an analysis reveals that LLDPE pipes exhibit strong sales from January to April. This predictive data can similarly guide future stock requirements for various product categories.
- Following the anticipated sales patterns, strategically increasing stock orders during months like November,
  January, February, and March can effectively address potential stock-out situations. To optimize inventory
  management, it's advised to refrain from procuring certain products, such as HDPE Sprinkler Pipes, Sprinkler
  Nozzles, TAKEOFF 20MM, LLDPE Flat emitting pipes in 16MM & 20MM 4LPH, and class II items, which
  demonstrate negligible sales and only contribute to inventory buildup.
- To enhance operational efficiency, there is a pressing need to expand the dealer network south of Urun Islampur. This expansion would decrease transportation costs per shipment. Alternatively, if geographical constraints persist, relocating the distribution center to a central location accessible to all dealers should be considered.
- To prevent excessive inventory accumulation and potential losses, it's imperative to introduce incentives that encourage the purchase of diverse product types. This approach would increase the overall count of product categories in stock. Without such measures, inventory could accumulate to problematic levels.
- Currently, credit has been extended to only six out of twelve dealers. Expanding credit offerings to more
  dealers could serve as a powerful incentive for increased purchasing. This extension of credit terms has the
  potential to motivate dealers to engage in higher transaction volumes.