

*"Improving Operational Efficiency and Customer Experience in  
an RO Machine Store"*

**A Final report for the BDM capstone Project**

**Submitted by**

**Name: Rashi Sharma**

**Roll number: 22f3000442**



**IITM Online BS Degree Program,**

**Indian Institute of Technology, Madras, Chennai**

**Tamil Nadu, India, 600036**

## Contents

1. Executive Summary .....	2
2. Detailed Explanation of Analysis Process/Method .....	4
2.1 Data Collection .....	4
2.2 Data Description .....	4
2.3 Data Cleaning and Preprocessing .....	6
2.4 Data Analysis Techniques .....	6
3. Results and Findings .....	9-15
4. Interpretation of Results and Recommendations .....	16
4.1 Interpretation of Results .....	16-17
4.2 Recommendations for Business Improvement.....	18-19

# 1. Executive Summary

Rudra Enterprises, a local **RO water purifier store in Shalimar Garden Extension 2, Sahibabad**, was founded by **Mr. Manoj Sharma in 2005**. Over the years, the store has built a **loyal customer base**, primarily through **RO machine sales, water refills, and maintenance services**. However, in recent years, **sales have declined** due to rising competition, operational inefficiencies, and poor stock management.

To understand these challenges, a data-driven approach was taken, analyzing three months of handwritten sales records, combined with interviews with the owner and market research. The report aims to uncover sales patterns, customer behavior, and financial trends, using tools like Excel and Python for data cleaning, visualization, and statistical analysis.

The analysis begins with a detailed methodology, explaining how data was processed to ensure accuracy. Key sales trends were identified, revealing seasonal demand fluctuations, with higher sales in summer months and frequent service requests from repeat customers. By visualizing data through histograms, line graphs, and bar charts, patterns in monthly sales, service requests, and inventory levels were highlighted. Advanced statistical measures like skewness and kurtosis were also used to understand distribution trends.

The findings indicate that poor stock management has led to inventory shortages and over-purchases, directly affecting revenue. Additionally, customer complaints about water flow and float valve failures point to a need for better service tracking.

Based on these insights, the report provides practical recommendations to improve sales and profitability. Suggestions include implementing digital record-keeping for better inventory tracking, optimizing stock levels based on seasonal demand, and enhancing customer engagement strategies. By adopting these solutions, Rudra Enterprises can streamline operations, increase customer satisfaction, and regain a competitive edge in the local market.

By leveraging these insights, Rudra Enterprises can make informed business decisions, improve financial tracking, and develop long-term strategies for growth and sustainability.

## 2. Detailed Explanation of Analysis Process/Method

### 2.1 Data Collection

The data for this study was obtained from **Rudra Enterprises**, a business specializing in the sales and service of RO water purifiers. The primary source of data was **handwritten sales and service logs** maintained over one year (Jan 2024 – Dec 2024). These records were manually transcribed into a structured **Excel format** for analysis.

To enhance the depth of insights, **qualitative data** was gathered through a structured interview with **Mr. Manoj Sharma**, the business owner. This interview helped understand **sales trends, seasonal demand fluctuations, common service issues, and customer expectations**.

The dataset focused on key operational and financial parameters, including:

- **Sales Data:** Number of RO units sold per month, categorized by brand.
- **Service Data:** Types of maintenance or repair requests received.
- **Customer Interaction Data:** Feedback, complaints, and recurring service requests.
- **Profitability Metrics:** Revenue and profit per sale/service, helping identify peak and low-profit periods.

This combination of **quantitative records** and **qualitative insights** ensured a **holistic** understanding of the business performance. The **transcription process** also revealed inconsistencies in data recording, such as missing dates or misclassified service types, which were carefully addressed to maintain data integrity.

By compiling these records, the study provides **actionable insights** into inventory optimization, sales strategies, and customer service improvements, enabling better decision-making for Rudra Enterprises.

### 2.2 Data Description

The dataset analyzed in this study consists of **structured business records** from **Rudra Enterprises**, covering sales, services, and profitability trends over **one year (Jan 2024 – Dec 2024)**. This data was **transcribed and categorized** into key business attributes for an in-depth evaluation of operational efficiency and financial performance.

**RO Sales Data:** [Click here](#)

- **Dataset Overview:** The dataset contains monthly sales data of RO units, service requests, inventory stock levels, and profitability figures to assess business trends and operational efficiency.
- **Time Period Covered:** The records span from **Jan 2024 to Dec 2024**, capturing seasonal variations and long-term trends.
- **Data Source:** The data has been collected from handwritten logbooks maintained by Rudra Enterprises, which were transcribed into a structured Excel format for analysis.
- **Primary Objective:** The dataset is utilized to analyze sales trends, assess service performance, evaluate inventory management efficiency, and identify profitability patterns. These insights are crucial for improving decision-making and business operations.

### **Contents of the Data:**

The dataset consists of the following key attributes:

- **Date:** Specific day of sale or service.
- **Month:** Month of sale/service for trend analysis.
- **Customer Name:** Name of the customer (if available).
- **Service Type:** Whether the request was for installation, maintenance, or spare part replacement.
- **RO Brand:** The brand of the RO unit (e.g., Aqua, Swift).
- **Quantity:** Number of units sold or services performed.
- **Total Amount:** Revenue earned per transaction.
- **Profit:** Profit generated from each sale/service.

By systematically organizing and analyzing these records, the dataset provides valuable insights into **inventory planning, demand forecasting, and profitability optimization**, helping Rudra Enterprises improve its operations and service efficiency.

## 2.3 Data Cleaning and Preprocessing

The process of data acquisition was a significant time-intensive effort that involved gathering handwritten financial records from the shop. Given the manual nature of record-keeping, the data was scattered and required thorough validation before analysis. The primary challenge in this phase was ensuring that all transactions were accurately recorded and free from inconsistencies.

- **Data Digitization:** The handwritten records were systematically transcribed into Excel to create a structured digital dataset.
- **Error Handling:** Missing values were identified and addressed through logical imputation or exclusion where necessary.
- **Duplicate Removal:** Redundant records were filtered out to prevent skewed analysis results.
- **Standardization:** Dates, product brand, and service descriptions were formatted uniformly for seamless interpretation.
- **Categorization:** The dataset was organized into meaningful groups (e.g., sales, services, and profit) to facilitate efficient analysis and visualization.

## 2.4 Data Analysis Techniques

A comprehensive set of analytical techniques was applied to derive meaningful insights from the dataset.

### 1. Statistical Data Analysis

To establish a strong foundation for further analysis, **descriptive statistics** were applied to understand the distribution and variability of sales, profit, and quantity sold.

### Statistical Summary of the Dataset

Measure	Total Amount (₹)	Profit (₹)	Quantity Sold
<b>Mean</b>	₹3,738.15	₹1,213.72	1.11
<b>Median</b>	₹1,948.00	₹940.50	1.00
<b>Mode</b>	₹7,500	₹1,799	1
<b>Standard Deviation</b>	₹3,832.07	₹891.46	0.51
<b>Minimum</b>	₹541.00	₹440.00	1.00
<b>Maximum</b>	₹30,000.00	₹8,500.00	5.00
<b>Skewness</b>	3.43 (Positive)	5.57 (Positive)	5.82 (Positive)
<b>Kurtosis</b>	20.56 (High)	44.10 (High)	38.25 (High)

**Fig 2.1**

- **Central Tendency Measures:** The **mean sales amount is ₹3,738.15**, with an **average profit of ₹1,213.72** per sale. The **median and mode values indicate** that most transactions involve lower-priced products with relatively stable profit margins.
- **Variability & Dispersion:** The **high standard deviation** in sales and profit suggests significant fluctuations in transaction values.
- **Skewness & Kurtosis:**
  - **Positive skewness** indicates that most sales are on the lower side, but occasional high-value transactions impact the overall trend.
  - **High kurtosis** suggests the presence of outliers, meaning a few high-profit transactions dominate the dataset.

These insights help in identifying revenue-driving transactions, managing inventory effectively, and strategizing promotional efforts.

## 2. Monthly Profit Trend Analysis

The **Monthly Profit Trend Analysis** focuses on evaluating fluctuations in profitability over the observed period to identify peak and low-profit months.

- **Timeline Analysis:** Profit figures for each month were plotted using line graphs to visualize profit trends.

- **Identifying Peaks and Troughs:** The analysis highlighted the highest and lowest profit-generating months.
- **Strategic Implications:**
  - Focus marketing efforts on months with lower profits to boost sales.
  - Investigate reasons behind peak profits in May and attempt to replicate successful strategies.

### 3. Revenue and Quantity-Based Analysis

The **AB Analysis** was conducted using both revenue-based and quantity-based categorizations to optimize inventory management and sales strategies.

- **Categorization Approach:**
  - **Category A:** High-revenue and high-quantity products that drive business profitability.
  - **Category B:** Low-revenue and low-quantity products that may need reassessment or targeted marketing efforts.
- **Strategic Insights:**
  - Prioritize Category A products for stock availability, marketing, and profitability maximization.
  - Evaluate Category B items to decide on potential promotions, bundling, or discontinuation.
- **Operational Recommendations:**
  - Ensure uninterrupted availability of high-demand products.
  - Adjust stock levels based on sales and demand fluctuations.
  - Minimize inventory holding costs for underperforming products.

### 4. Monthly Sales Trend Analysis

The **Monthly Sales Trend Analysis** examines fluctuations in product sales over time to identify patterns and seasonality.



- **Timeline Analysis:** Sales data was plotted on a month-by-month basis to visualize trends.
- **Identifying Peaks and Troughs:** Seasonal demand variations were analyzed to optimize stocking and marketing efforts.
- **Strategic Takeaways:**
  - Leverage peak sales insights to plan future promotions and inventory stocking.
  - Address low sales periods through targeted advertising and discounts.

## 5. Service and Maintenance Analysis

The **Service and Maintenance Analysis** focuses on identifying common service requests and their operational impact.

- Consider introducing a preventive maintenance plan or service subscriptions.
- Improve tracking of service requests to enhance response efficiency.

## 6. Inventory Analysis

To optimize inventory management, a combination of **Descriptive Analytics** and **Forecasting Techniques** is used to analyze stock levels, predict demand, and enhance procurement planning.

### Descriptive Analytics (Stock vs. Demand Analysis)

This technique is used to analyze the **current stock levels** of spare parts and compare them with the **estimated annual demand**. By classifying inventory into categories such as **shortage risk, balanced stock, and overstocked**, this method helps in identifying inefficiencies in stock management.

## 3. Results and Findings

### 3.1 Descriptive Analysis for Overall Sales Data (2024)

The dataset used in this analysis consists of sales and service records of **Rudra Enterprises** for a period of one year. It includes details such as total sales amount, profit per sale, and quantity sold

for each transaction. To ensure a structured and insightful understanding of the dataset, statistical measures were applied to analyze the data distribution:

### (XY Scatter) of Profit Distribution:

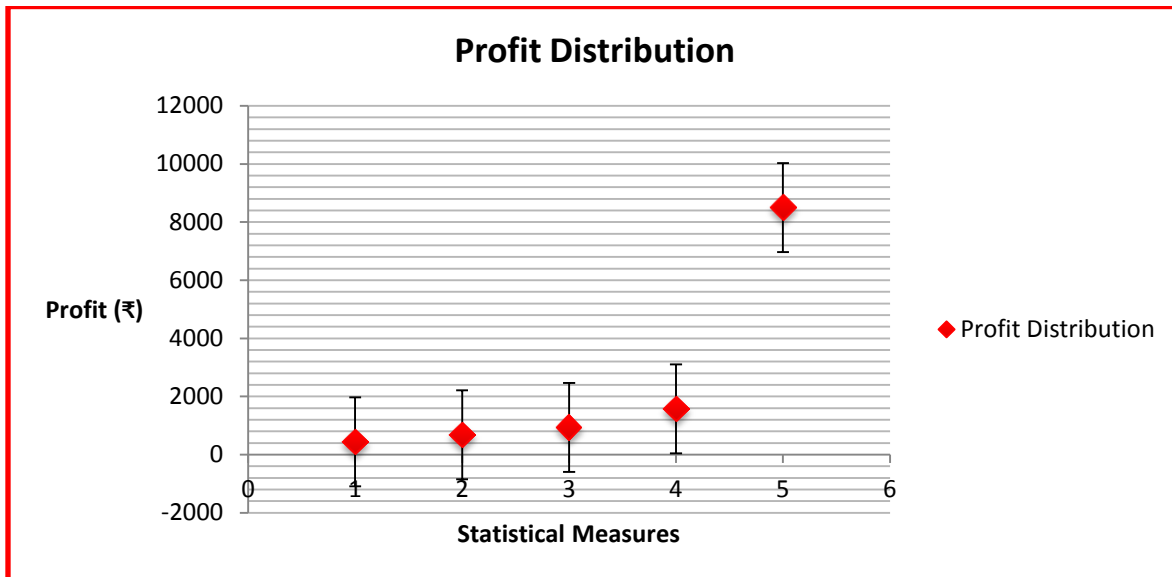


Fig 3.1

### Key Observations from the Data Distribution

- **Average Sales & Profit:** The mean sales amount is **₹3,738.15**, with an average profit of **₹1,213.72** per sale.
- **High Variability:** The standard deviation values indicate significant fluctuations in sales and profit across transactions.
- **Skewness & Kurtosis:**
  - **Positive skewness** in all three categories indicates that most transactions are clustered towards the lower values, with occasional high-value sales.
  - **High kurtosis** suggests the presence of extreme values, meaning a few very large sales significantly impact the overall data trends.
- **Transaction Distribution:** The mode of quantity sold is 1, meaning most transactions involved a single unit purchase. The maximum quantity sold in a single transaction was 5 units.

### 3.2 Sales Trends

The analysis of monthly sales trends has revealed key patterns in product demand and seasonal fluctuations. These insights are crucial for improving marketing strategies, inventory management, and demand forecasting.

- Sales varied significantly, fluctuating between **2 and 17 units per month**, indicating inconsistent customer demand.
- **June** recorded the highest sales (**17 units sold**), which could be attributed to increased summer demand or targeted promotions during this period.
- **March** had the lowest sales (**2 units sold**), which raises concerns about market engagement and customer interest during this month.
- **April** showed signs of recovery with **8 units sold**, suggesting a potential upward trend after a low-performance period.
- **Recent months have shown a declining sales trend**, which could be due to rising competition, lack of marketing initiatives, or seasonal changes in demand.

#### Line Graph of Monthly Sales:

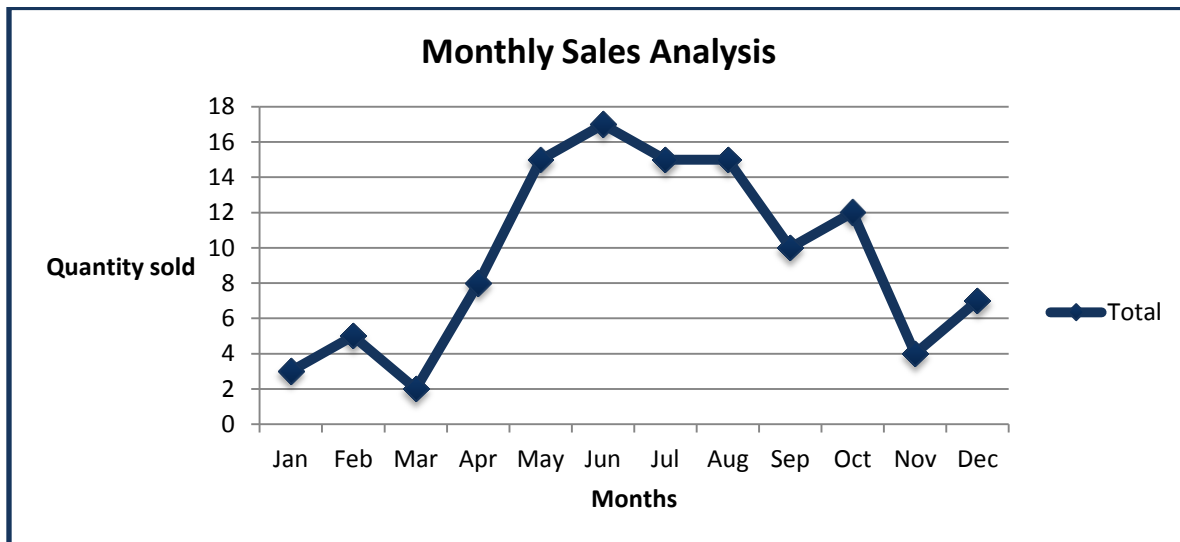


Fig 3.2

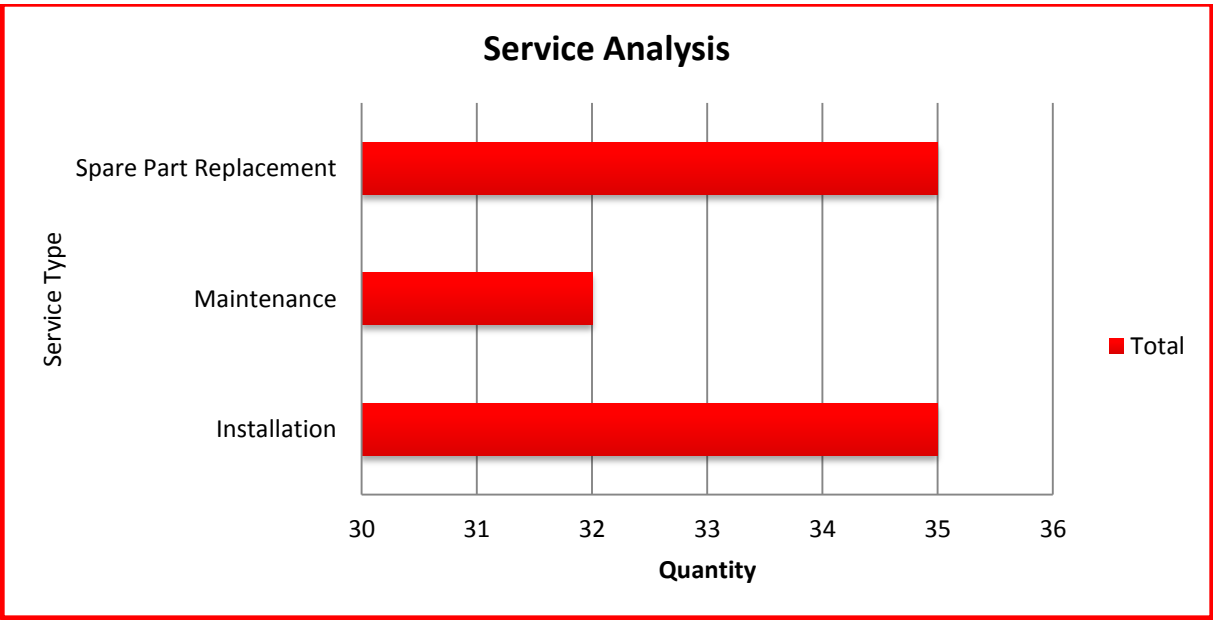
This variation in sales highlights the importance of analyzing external influences such as weather conditions, marketing efforts, and consumer purchasing power during different times of the year.

### 3.3 Service and Maintenance Analysis

Service requests were analyzed to identify common issues, customer support needs, and potential areas for improvement in service efficiency.

- **Water flow issues and float valve malfunctions** were the most frequently reported problems, indicating persistent technical challenges.
- A majority of customers required **maintenance within 6-8 months of purchase**, pointing to wear-and-tear issues or potential design flaws in the products.
- Despite a high retention rate, **delays in service tracking** led to extended wait times, which may have impacted customer satisfaction.
- The frequency of service requests suggests that certain spare parts and components experience more wear than others, affecting product reliability and customer trust.

**Bar Chart of Service Requests:**



**Fig 3.3**

Helps pinpoint which service issues require urgent attention and where inventory for spare parts should be optimized.

### 3.4 Inventory Analysis

To ensure optimal inventory levels, we apply **Descriptive Analytics** to compare stock levels with demand. We compare **Current Stock** with **Estimated Annual Demand** to determine whether an item is in **shortage, balanced, or overstocked**.

Spare Part Name	Current Stock	Estimated Demand of a Year	Stock Status
RO Membrane	50	40 (Installation + SP Replacement)	Balanced Stock
Carbon Filter	20	33 (Maintenance)	Shortage Risk
Sediment Filter	60	33 (Maintenance)	Overstocked
Float Valve	10	40 (SP Replacement)	Shortage Risk
Pump	25	8 (Approx)	Balanced Stock
UV Lamp	12	10 (Approx)	Balanced Stock
Solenoid Valve	30	12 (Approx)	Overstocked

**Fig 3.4**

**Shortage Risk:** Carbon Filters, Float Valves (Require urgent restocking).

**Balanced Stock:** RO Membranes, Pumps, UV Lamps (Sufficient levels, but need monitoring).

**Overstocked:** Sediment Filters, Solenoid Valves (Reduce future orders to minimize storage costs).

**Results:**

- **Carbon Filters & Float Valves:** Require **monthly restocking** based on predicted trends.
- **Sediment Filters & Solenoid Valves:** Orders should be **reduced** to prevent excess stock.
- **RO Membrane & Pump:** Maintain **buffer stock** to handle unexpected surges.

### 3.5 Revenue-Based and Quantity-Based Analysis

Combining revenue-based and quantity-based ABC analysis provided a comprehensive view of product performance:

- **Category A (Top Sellers - 90% of Revenue):** Swift RO, Aqua Fresh
  - These products are the primary revenue drivers and should always be readily available.
- **Category B (Low Contribution - 10% of Revenue):** Kent
  - Moderate revenue contribution, requiring better marketing or repositioning.
- **Inventory Strategy:** Prioritize stocking and promoting high-performing products.
- **Strategic Focus:** Focus on aggressive marketing for Swift RO & Aqua Fresh, while reassessing the viability of Kent.

#### Pie Chart Analysis (Revenue-Based):

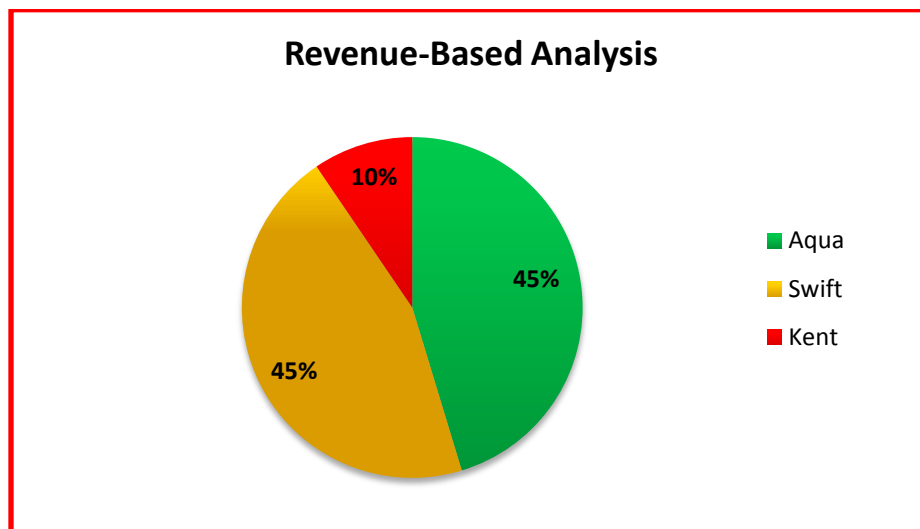
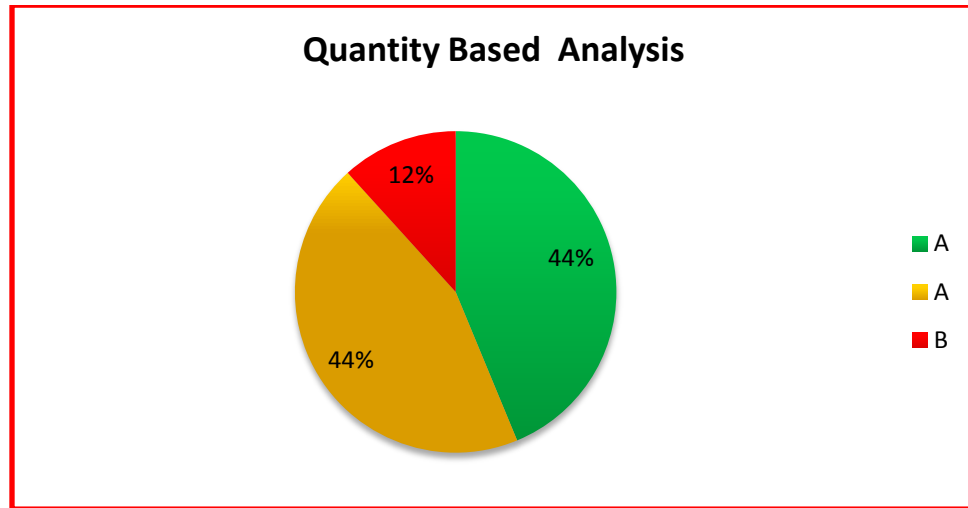


Fig 3.5

### Pie Chart Analysis (Quantity-Based):



**Fig 3.6**

- Visual representation of product contributions helps optimize marketing and inventory strategies.

### 3.6 Monthly Profit Trend

Profit analysis highlighted revenue patterns and operational efficiency:

- **May had the highest profit (~₹4455)**, likely due to increased sales and higher-margin products.
- **March had the lowest profit (~₹1250)**, possibly due to fewer sales or higher service costs.
- **June and July showed moderate fluctuations**, requiring further evaluation to understand shifting customer demand.

### Monthly Profit Comparison:

- Enables comparison of monthly profitability and assists in refining pricing and sales strategies.

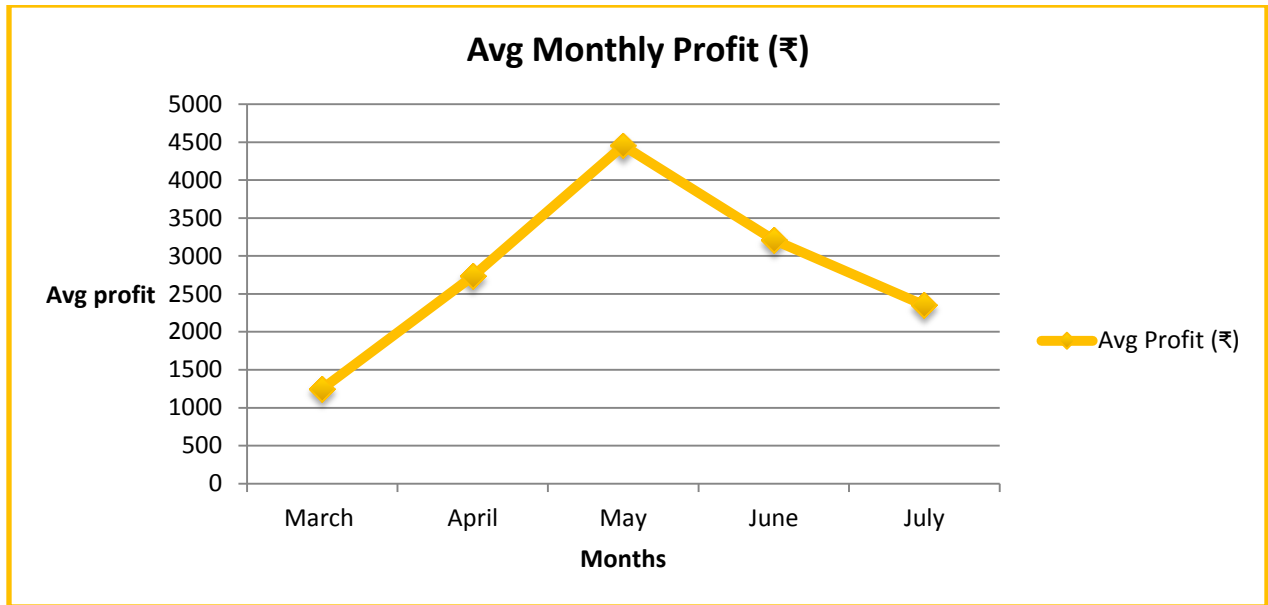


Fig 3.7

## 4. Interpretation of Results and Recommendations

### 4.1 Interpretation of Results

#### 1. Understanding Customer Preferences and Demand Trends

**Implication:** A limited understanding of customer preferences can result in inefficient inventory management, suboptimal marketing strategies, and missed revenue opportunities.

**Result:** From the **Pie Chart Analysis**, it is evident that mid-range RO models such as Swift RO and Aqua Fresh are the most preferred by customers. High-end and budget models witness lower demand, indicating that customers are looking for cost-effective and reliable options. This trend also extends to service requests, where filter replacements and pump repairs are the most frequent needs.

#### 2. Inventory Management Challenges: Overstocking & Understocking Issues

**Implication:** Overstocking leads to unnecessary capital blockage and increased storage costs, while understocking can cause missed sales opportunities and dissatisfied customers.



**Result:** The **Inventory Analysis** revealed that products like Carbon Filters and Float Valves are frequently understocked, leading to potential revenue losses. On the other hand, Sediment Filters and Solenoid Valves are overstocked, increasing holding costs and reducing inventory turnover. Maintaining an optimal stock level for each category is essential for maximizing efficiency and profitability.

### **3. Fluctuations in Sales & Seasonal Demand Trends**

**Implication:** Failure to anticipate seasonal demand variations can lead to stockouts during peak periods or excess inventory during off-seasons.

**Result:** The **Monthly Sales Trends Graph** indicates that June had the highest sales, likely due to seasonal demand, while March recorded the lowest. The declining trend in recent months suggests external factors such as competition, lack of marketing initiatives, or economic conditions affecting sales.

### **4. Service and Maintenance Issues**

**Implication:** Delays in servicing impact customer satisfaction, leading to negative word-of-mouth and reduced repeat business.

**Result:** From the **Bar Chart of Service Requests**, it is clear that water flow issues and float valve malfunctions are the most reported problems. Many customers require maintenance within 6-8 months of purchase, suggesting that either product quality needs improvement or customers require better guidance on usage and maintenance.

### **5. Profitability and Revenue Patterns**

**Implication:** Unoptimized cost structures and inconsistent revenue streams can impact business sustainability and growth.

**Result:** The **Monthly Profit Trends Analysis** highlights May as the most profitable month, whereas March had the lowest profit. Since installation and servicing contribute significantly to revenue, improving operational efficiency in these areas can help stabilize overall profitability.

## 4.2 Recommendations for Business Improvement

### 1. Optimize Inventory Management

- Implement an **automated inventory tracking system** to prevent stock imbalances.
- Ensure **just-in-time inventory management** for high-demand products like Carbon Filters and Float Valves.
- Reduce procurement of overstocked items like Sediment Filters and Solenoid Valves to free up capital.

### 2. Improve Demand Forecasting

- Use **historical sales data and predictive analytics** to anticipate seasonal sales trends.
- Adjust procurement strategies to align with peak demand months (e.g., increase stock in May-July).

### 3. Enhance Marketing and Customer Engagement

- Launch targeted promotions during **low-sales months (March-April)** to boost demand.
- Use **social media advertising and WhatsApp Business** to engage with local customers.
- Offer **seasonal discounts and bundle deals** on RO products and maintenance services.

### 4. Strengthen After-Sales Service & Maintenance

- Maintain a **well-stocked inventory of essential spare parts** to ensure timely servicing.
- Introduce **scheduled maintenance packages** for better customer retention.
- Improve **customer support response times** by streamlining service request tracking.

### 5. Improve Cost-Effectiveness and Profit Maximization

- Optimize pricing strategies by offering **discounted installation services** for customers who buy RO systems.

- Negotiate **bulk purchase discounts** with suppliers to reduce procurement costs. Track **operational inefficiencies** and implement cost-cutting measures where necessary.

## 6. Gather and Act on Customer Feedback

- Conduct **regular customer surveys** to identify service pain points and product preferences.
- Offer personalized recommendations and solutions based on feedback.
- Engage directly with customers via WhatsApp and calls to enhance satisfaction and trust.

## Conclusion

Rudra Enterprises has demonstrated strong potential in the water purification and service industry, but its growth is currently hindered by fluctuations in sales, inefficiencies in inventory management, and inconsistencies in service operations. By utilizing a data-driven approach, the business can significantly enhance its decision-making processes and operational efficiency, ensuring long-term success.

One of the key takeaways from this analysis is the necessity of optimizing inventory management. Overstocking and understocking issues can directly impact profitability and customer satisfaction. Additionally, prioritizing high-performing products and adjusting purchase orders accordingly will improve revenue generation.

Sales trends indicate a need for strategic marketing initiatives to counter seasonal demand fluctuations. Leveraging digital marketing, targeted promotions, and customer loyalty programs will help maintain consistent engagement and drive higher sales throughout the year.

By implementing these insights and recommendations, Rudra Enterprises can enhance operational efficiency, increase profitability, and strengthen its competitive position in the market.