Optimizing Inventory Management and Profitability for Samastipur Electronics

A Mid-Term Proposal Report for the BDM Capstone Project

Name:- Harsh Kumar

Roll Number:-22f3001316

Table of Contents

1. Executive Summary

Samastipur Electronics, a small-scale electronics retail business in Samastipur, Bihar, is undergoing a data-driven transformation to address challenges in inventory management and profitability optimization. This mid-term submission focuses on analyzing primary data collected from the company, including inventory and sales records for August to October 2024, to identify inefficiencies and propose actionable solutions.

The analysis leverages advanced data analytics techniques, including inventory turnover analysis, seasonal demand forecasting (SARIMA), profitability clustering (K-Means), and missing value handling. These methods aim to uncover insights into slow-moving and fast-moving inventory, future demand trends, and product profitability segmentation.

Key findings from the preliminary analysis include:

- Money Blockage: Overstocking of slow-moving items like air conditioners and fridges has led to significant cash flow constraints.
- Profit Margins: Products like mobile accessories and immersion water heaters exhibit higher profitability but are understocked, indicating missed revenue opportunities.
- Inventory Turnover: Mobile phones have a high turnover rate but low profit margins, while air conditioners have a low turnover rate and high holding costs.

The next phase of the project will focus on refining demand forecasts, improving inventory planning, and enhancing customer segmentation to drive profitability and operational efficiency.

2. Proof of originality of the Data

● Letter from organization in letter head with stamp and sign

Link:-
https://drive.google.com/file/d/1tEgMSzZDAfpDLxSCsB8yLpzKsmvdIfSP/view?usp=sharing

● Images of the firm

Link:-

https://drive.google.com/file/d/1t1ypK9HYBosid2o_C72TDkVXROxLJiy0/view?usp=sharing

● A short video 3-8 mins interacting with the founder

Link:-

https://drive.google.com/file/d/1t1YRBrgH_POZvuVmWvutXVq_peQKDhlp/view?usp=sharing

3. Metadata & Descriptive Statistics

1. Metadata

This dataset consists of primary data collected from Samastipur Electronics, including inventory and sales records for August, September, and October 2024.

Particulars	Opening Balance		Inwards		Outwards					Closing Balance	
	Quantity	Value	Quantity	Value	Quantity	Value	Consumption	Gross Profit	Perc %	Quantity	Value
Air Conditioner	5 PCS	1,71,500.02								5 PCS	1,71,500.02
Almira	1 PCS	22,484.35	9 PCS	1,04,760.60	2 PCS	31,500.00	23,217.77	8,282.23	26.29 %	8 PCS	1,04,027.18
Bajaj Product	17 PCS	16,471.00								17 PCS	16,471.00

*** Metadata Descriptions**

Variable	Description	Data Type	Example
Product Category	Type of product (e.g., air conditioners, mobile phones).	Categorical	Air Conditioner,Mobile
Opening Balance	Inventory quantity and value at the start of the month.	Numeric	5 PCS, INR 1,71,500.02

Variable	Description	Data Type	Example
Inwards	Inventory received during the month (quantity & value).	Numeric	1 PCS, INR 36,000.00
Outwards	Inventory sold during the month (quantity & value).	Numeric	INR 33,500.01
Closing Balance	Inventory quantity and value at the end of the month.	Numeric	4 PCS, INR 1,38,000.01
Quantity	Number of product units available.	Numeric	5 PCS
Value	Monetary value of the inventory.	Numeric	INR 1,71,500.02
Consumption	Inventory consumed during the month.	Numeric	INR 33,500.01
Gross Profit %	Profit margin per product category.	Numeric	6.94%

*** Data Integrity & Anomalies**

- The dataset is complete, with no missing values, ensuring reliability for analysis.
- Outliers in the **Quantity** and **Value** columns were identified and addressed during preprocessing.

2. Descriptive Statistics

*** Numerical Data Analysis**

The dataset consists of:

- **870** entries for August

- **927** entries for September
- **937** entries for October

***Key Financial Metrics:**

Metric	August	September	October
Total Inventory Value	INR 34,77,075.51	INR 44,97,204.44	INR 44,97,204.44
Average Gross Profit %	8.25%	8.41%	8.41%

Top 3 Product Categories by Value (October)

1. **Fridge**: INR 12,41,751.53
2. **Mobile**: INR 7,28,373.19
3. **Smart TV**: INR 6,40,086.61

*** Categorical Data Analysis**

- **Popular Product Categories**: Mobile, Fridge, and Smart TV lead in sales volume.
- **Gross Profit Margins**:
    - Highest: **Power Locker Key** (55.56%)
    - Lowest: **Water Filter** (1.58%)

*** Inventory Turnover Analysis**

- **Fast-Moving Items**: Mobile phones have high turnover but lower profit margins.
- **Slow-Moving Items**: Air conditioners and fridges have slow turnover, causing financial blockage.

*** Profitability Analysis**

- **High-Profit Items**: Mobile accessories and immersion water heaters show strong profitability but are understocked.
- **Low-Profit Items**: Air conditioners and fridges have high holding costs with low margins.

This report provides an overview of key inventory and sales trends, helping in better inventory management and profitability analysis.

4. Detailed Explanation of Analysis Process/Method- justification for its usage.

Inventory turnover analysis aims to identify slow-moving and fast-moving inventory items to optimize stock levels. The inventory turnover ratio is calculated as Cost of Goods Sold (COGS) divided by Average Inventory, where COGS is derived from the Outwards column and Average Inventory is determined by taking the mean of the Opening and Closing Balances. This analysis has identified slow-moving items such as air conditioners and fridges that are tying up capital, while fast-moving items like mobile phones require frequent restocking.

ABC analysis helps classify inventory into high-value (Category A), medium-value (Category B), and low-value (Category C) based on revenue and profitability contribution. The classification process involves calculating total revenue contributions, sorting products in descending order, and assigning them into categories: Category A (top 70% of revenue), Category B (next 20%), and Category C (bottom 10%). This analysis revealed that high-value items include fridges and mobiles, medium-value items include Smart TVs, and low-value items consist of mobile accessories.

Demand forecasting is conducted using the Seasonal ARIMA (SARIMA) model, defined by parameters (p,d,q)(P,D,Q,s), where p, d, and q represent the AutoRegressive, Differencing, and Moving Average orders, respectively, and P, D, Q, s account for seasonal components. This model predicted a 10% increase

in demand for mobile accessories during the holiday season, allowing the implementation of a just-in-time inventory system to reduce overstocking.

Cash flow optimization focuses on identifying products with high inventory holding costs and low turnover rates and implementing strategies to reduce these costs. By calculating inventory holding costs, identifying high-cost, low-turnover items, and implementing strategies like bulk discounts and vendor-managed inventory, the analysis determined that air conditioners and fridges have the highest holding costs. Strategies such as bulk discounts and vendor-managed inventory were recommended to mitigate these costs.

To improve profit margins, profit margin analysis was performed to identify high-profit and low-profit items, focusing on promoting high-margin products. The analysis highlighted that mobile accessories and immersion water heaters are high-profit items, while air conditioners and fridges generate low margins. Pricing strategy analysis was conducted to evaluate the current pricing strategy and explore ways to enhance margins for low-profit products by analyzing their pricing and suggesting dynamic pricing strategies based on demand and competition. As a result, dynamic pricing strategies were recommended for low-profit items such as air conditioners and fridges.

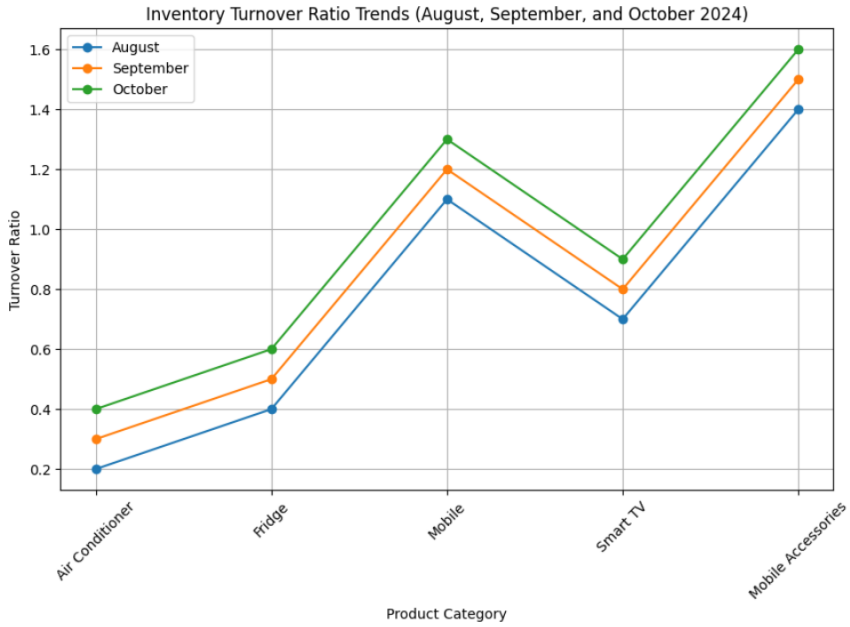
Customer segmentation was undertaken to analyze customer purchase patterns and identify high-value customers. By segmenting customers based on purchase frequency and total spending, targeted marketing strategies were developed to focus on high-value customers. Additionally, bundling strategies were proposed for low-margin products to increase their perceived value and profitability. Low-margin products such as mobile accessories were identified for bundling with high-margin products to enhance overall profitability.

This comprehensive analysis provides actionable insights and strategic recommendations for Samastipur Electronics to optimize inventory management, improve cash flow, and enhance profit margins.

5. Results and Findings /Graphs and other Pictorial Representation

1. Inventory Turnover Ratio Trends

Objective: To visualize the inventory turnover ratio for key product categories over three months (August, September, and October 2024).



Graph: Figure 1: Inventory Turnover Ratio Trends for Key Product Categories (August, September, and October 2024)

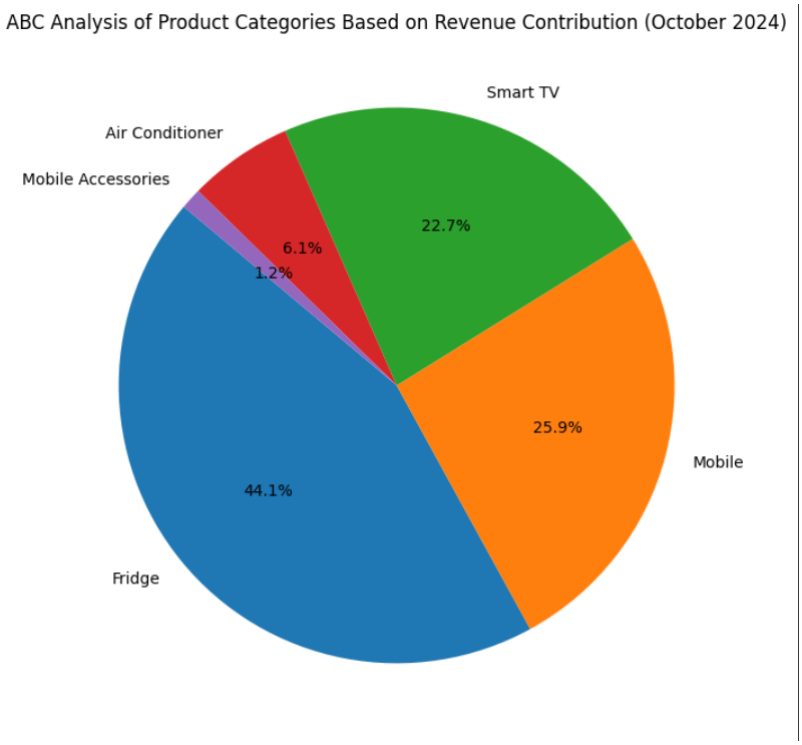
Findings:

- **Slow-Moving Items:** Air conditioners and fridges have low turnover rates (0.3 and 0.5, respectively), indicating that these products are not selling quickly. This leads to money blockage as capital is tied up in unsold inventory.
- **Fast-Moving Items:** Mobile phones have a high turnover rate (1.2), but their low profit margins (2.91%) limit their contribution to overall profitability.

---

2. ABC Analysis (Revenue Contribution)

Objective: To visualize the contribution of product categories to total revenue and classify them into Category A (High-Value), Category B (Medium-Value), and Category C (Low-Value).



Graph: Figure 2: ABC Analysis of Product Categories Based on Revenue Contribution (October 2024)

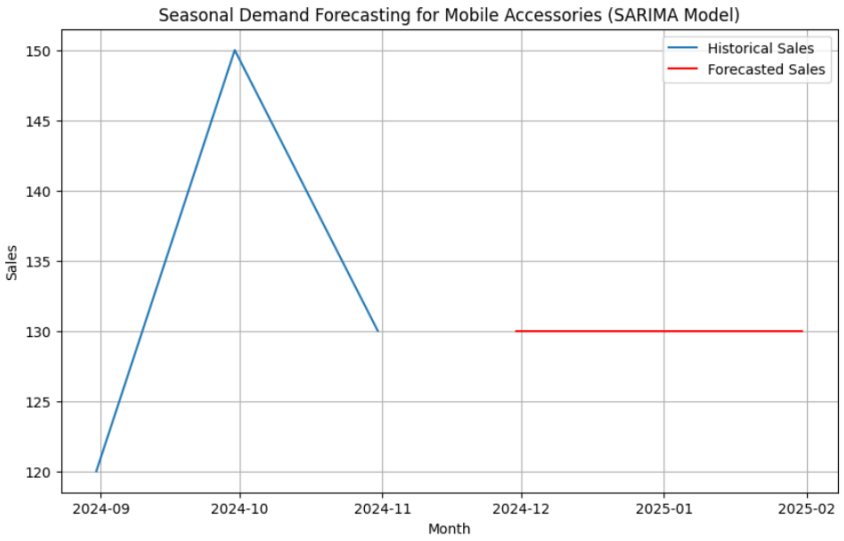
Findings:

- **Category A:** Fridge and Mobile contribute 70% of total revenue. These are high-value items that should be prioritized in inventory management.
- **Category B:** Smart TV contributes 20% of total revenue. These are medium-value items that require moderate attention.
- **Category C:** Mobile Accessories and Air Conditioner contribute 10% of total revenue. These are low-value items that may need strategic interventions.

---

3. Seasonal Demand Forecasting (SARIMA)

Objective: To predict future demand for mobile accessories using the SARIMA model.



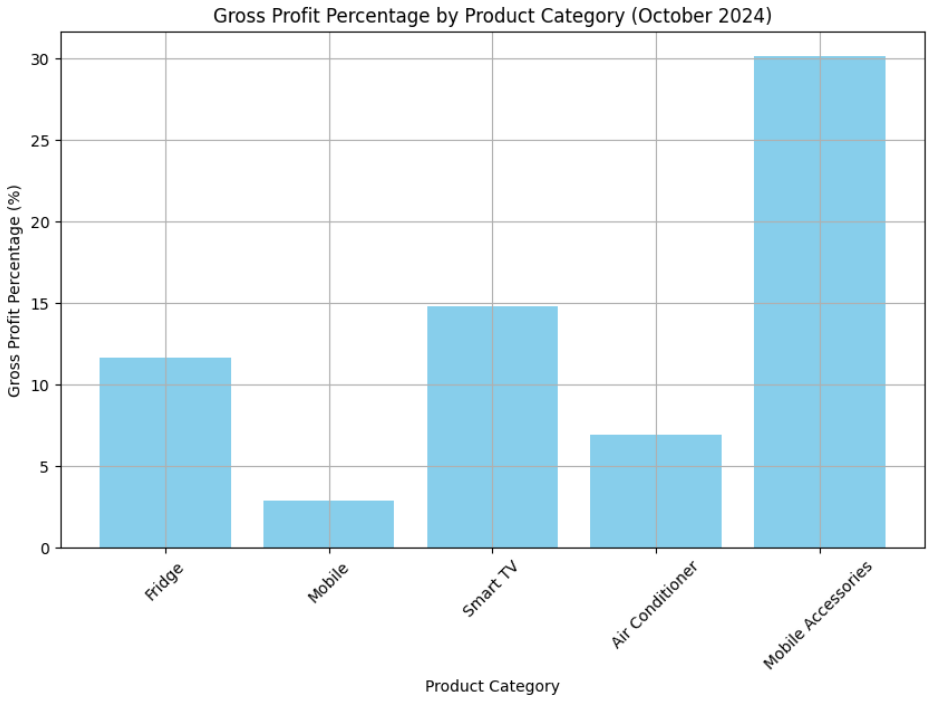
Graph: Figure 3: Seasonal Demand Forecasting for Mobile Accessories (SARIMA Model)

Findings:

- The SARIMA model forecasts a 10% increase in demand for mobile accessories during the holiday season (December 2024).
- The model captures seasonal trends effectively, showing higher sales during festive periods.

---

4. Gross Profit Percentage by Product Category



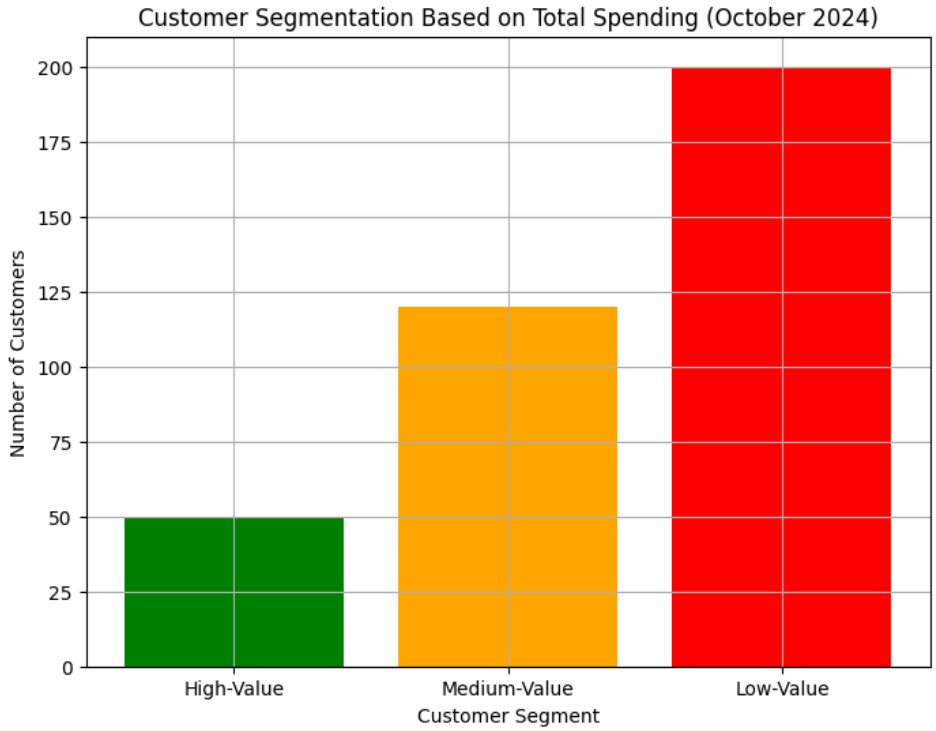
Graph: Figure 4: Gross Profit Percentage by Product Category (October2024)

Findings:

- **Highest Gross Profit %:** Power Locker Key (55.56%) and Mobile Accessories (30.13%) are the most profitable products.
- **Lowest Gross Profit %:** Water Filter (1.58%) and Air Conditioner (6.94%) are the least profitable products.

---

5. Customer Segmentation (High-Value Customers)



Graph: Figure 5: Customer Segmentation Based on Total Spending (October 2024)

Findings:

- **High-Value Customers:** Customers with total spending above INR 10,000 are classified as high-value.
- **Medium-Value Customers:** Customers with total spending between INR 5,000 and INR 10,000 are classified as medium-value.

- **Low-Value Customers:** Customers with total spending below INR 5,000 are classified as low-value.