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Data Insight: Analyzing Grocery Store Data for Enhanced Retail Strategies

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Final Report for the Business Data Management Capstone Project

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1. Executive Summary

Mamta Kirana & General Stores, established in 1983 in Katni, Madhya Pradesh, has been a trusted local grocery retailer for over 41 years. Owned and managed by Mr. Kamla Prasad Gupta and Mr. Anand Kumar Gupta, the store has built a strong reputation for offering high-quality products at competitive prices. It serves a loyal customer base by providing essential grocery items, including rice, wheat flour, pulses, cooking oil, dairy products, snacks, and packaged food items.

Despite its long-standing success, the store faces three major challenges: inventory management, profit margin optimization, and credit handling. To address these issues, ABC Analysis for Inventory Optimization, Sales Demand Forecasting & Time Series Analysis, and Borrowing Pattern Analysis were conducted using two months of data (Oct–Nov 2024).

The top five products—Rice, Wheat Flour, Milk and Dairy, Sugar, and Cooking Oil—contribute nearly 75% of total revenue, requiring strict stock monitoring to avoid stockouts and potential revenue loss. Conversely, Moong Dal, Chana Dal, Detergents, and General Items are the lowest-selling products, leading to overstocking and increased holding costs. Additionally, low-margin items like Milk (2.50%) and Sugar (4.50%) necessitate supplier negotiations to improve profitability.

Credit handling remains a significant concern, with 26.9% of payments delayed or unpaid. Borrowing patterns indicate that most customers owe between ₹1,000–₹4,000, often repaid in small installments, impacting cash flow. A strong correlation (0.83) between borrowing and repayment suggests that customers eventually repay their dues, but delays create financial instability.

Recommendations include implementing automated reorder systems, dynamic pricing, bundled promotions, supplier negotiations, and stricter credit policies. Adopting digital sales tracking, leveraging data-driven inventory strategies, and transitioning to a Dark Store model in the future will enhance operational efficiency, stabilize cash flow, and ensure sustainable long-term business growth.

2. Detailed Explanation of Analysis Process/Method

To gain meaningful insights from the store's 2-month sales data from October 1st 2024, to November 30th 2024, several analytical techniques and visualization methods were employed to address key business challenges, namely inventory management, profit margin enhancement, and customer credit handling.

1. Data Collection

Data was collected from multiple sources, including:

- Sales Data: Daily transaction records of products sold.
- Inventory Data: Stock levels and product turnover rates.
- Purchase Data: Quantity of items purchased over the period was collected.
- Revenue & Profit Data: Income generated from different product categories.
- Customer List & Borrowing Data: Customer credit transactions and repayment history.

2. Data Cleaning and Preprocessing

Before analysis, the collected data underwent cleaning:

- Handled Missing Values: Ensured key fields like transaction dates and amounts were complete.
- Formatted Numeric Data: Converted currency values (₹) into numerical format.
- Standardized Dates: Reformatted borrowing and repayment dates for accuracy.
- Removed Duplicates: Eliminated redundant entries for precise analysis.

3. Methodologies used for Analysis

3.1. Data Visualization Techniques:

Several visualization techniques were used to identify patterns and relationships among different business metrics:

- **Scatter Plot**: Showed the correlation between expense and revenue generation, helping to identify high-performing products. Also used to show the relation between customer borrowing and amount paid.
- **Box Plot**: Analyzed sales variability and detected outliers in Inventory data.
- **Line Chart**: Depicted trends in sales, revenue, expenditure, and profit over time, highlighting seasonal fluctuations.

- **Pareto Chart** (80/20 Rule): Identified the top-selling products that contribute the most to overall revenue, allowing the business to prioritize key SKUs.
- **Bar Chart**: Compared different product categories' performance in terms of sales profitability and revenue.
- **Heat Map for Profit Margins**: Visualized the profit contribution of different SKUs, highlighting the most and least profitable products.
- **Histograms and Pie Chart**: Used histogram to show borrowing patterns of customers and Pie chart shows different categories or status of credit.

3.1.1 Key Insights:

- Seasonal trends in sales identified peak demand periods.
- The 80/20 rule confirmed that a small subset of products drives most of the revenue.
- Pricing strategies were refined based on high-profit margin products.

3.2. Sales Demand Forecasting & Time Series Analysis:

- A time series forecasting model was used to predict future sales trends based on historical sales data.
- This helped in optimizing stock levels and minimizing stockouts or excess inventory.
- Forecasted data guided purchasing decisions, ensuring the availability of high-demand products while avoiding overstocking of slow-moving items.
- Models Used: ARIMA (Autoregressive Integrated Moving Average), Moving Averages.

Root Mean Square Error: $$\mathrm{RMSE} = \sqrt{\frac{1}{n}\sum_{t=1}^{n}\left(yt - \hat{y}t\right)^2}$$

Where:

n = total number of predictions

yt = actual value at time t

y^t = predicted value at time t

Mean Absolute Error: $$\mathrm{MAE} = \frac{1}{n}\sum_{t=1}^{n}\left|yt - \hat{y}t\right|$$

Mean Absolute Percentage Error: $$\mathrm{MAPE} = \frac{100\%}{n}\sum_{t=1}^{n}\left|\frac{yt - \hat{y}t}{yt}\right|$$

3.2.1. Applications:

- Planning procurement cycles to avoid stockouts.

- Optimizing workforce management based on expected demand.
- Ensuring stock availability during peak demand periods.
- Adjusting pricing and promotions based on seasonal variations.

3.2.2. Key Insights:

- Identified seasonal sales patterns.
- Improved procurement cycles to align with demand fluctuations.
- Helped reduce excess inventory costs and storage issues.
- Demand forecasting enabled better decision-making in inventory purchases, leading to improved profitability**.**

3.3. ABC Analysis for Inventory Optimization:

The inventory was categorized using ABC Analysis to optimize stock management:

- **Category A**: High-value, low-volume items that generate the most revenue (requiring close monitoring).
- **Category B**: Moderate-value items with balanced sales and profitability (requiring moderate monitoring).
- **Category C**: Low-value, high-volume items that contribute the least to revenue but are essential for customer retention.

3.3.1. Key Insights:

- Allowed prioritization of stock replenishment for high-impact products.
- Helped reduce holding costs by avoiding excessive stock of slow-moving items.
- Improved inventory turnover rates, reducing wastage and stockout risks.

$$\text{Inventory Turnover} = \frac{COGS}{Average\ Inventory} = 361.8954$$

3.4. Relationship Between Sales, Revenue, Expenditure, and Profit:

A comparative study of sales, revenue, expenditure, and profit was conducted to identify cost-efficiency and profitability drivers.

$$\text{Total Sales} = \sum (Sales\ of\ all\ products\ over\ all\ days) = 20,625.5$$

$$\text{Average Sales per Day} = \frac{Total\ Sales}{Number\ of\ Days} = \frac{20,625.5}{61} = 338.12$$

$$\text{Average Sales per Product} = \frac{Total\ Sales\ Revenue\ for\ the\ Products}{Number\ of\ Units\ of\ the\ Product\ Sold} = \frac{11,12,456.5}{20,625.5} = 53.93$$

$$\text{Contribution}\,(\%) = \frac{Revenue\ of\ SKU}{Total\ Revenue} \times 100$$

$$\text{Gross Profit} = Revenue - Cost\ of\ Goods\ Sold\ (COGS)$$

$$\text{Gross Margin}\,(\%) = \left(\frac{Gross\ Profit}{Revenue}\right) \times 100$$

3.4.1. Techniques Used:

- Multivariate Analysis: Determined how each factor influences overall profit.
- Trend Analysis: Studied seasonal variations in sales and revenue.
- Profit Margin Analysis: Tracked how expenses impact net earnings.

3.4.2. Key Insights:

- Identified cost-cutting opportunities to improve net profit margins.
- Highlighted high-spending periods and their impact on revenue generation.
- Provided data-driven recommendations for optimizing operational costs.

3.5 Borrowing Pattern Analysis & Revenue Loss Estimation:

3.5.1. Objective: Track prolonged borrowing and prevent inventory mismanagement.

$$\text{Borrowed Amount} = Quantity\ Borrowed \times Selling\ Price\ per\ Unit$$

$$\text{Revenue Loss} = \sum (\text{Pending payments amount} + \text{Delayed payments amount})$$

3.5.2. Methods Used:

- Customer Borrowing Trend Analysis: Identified frequent borrowers and overdue repayments.
- Creditworthiness Scoring: Assigned risk levels based on past borrowing and repayment trends.
- Revenue Loss Estimation: Calculated the impact of unpaid borrowed products on overall profitability.

- Aging Analysis: Analyzed how long products remain borrowed and introduced borrowing limits or repayment timeframes.

3.5.3. Key Insights:

- Frequent borrowers were identified, leading to better tracking and follow-ups.
- Unpaid borrowed products contributed to revenue loss, prompting new credit policies.
- Recommendations included stricter borrowing limits and digital tracking of borrowed items.

3.6 Break-Even Analysis (Based on COGS):

$$\text{Break} - \text{Even Revenue} = \frac{COGS}{1 - Profit\ Margin} = \frac{₹16,540}{1 - 0.107} = \frac{₹16,540}{0.893} \approx ₹18,521$$

- To maintain a 10.7% profit margin, Mamta Kirana Stores needs to generate ₹18,521 in revenue per day.
- The actual daily revenue is around ₹18,540, just slightly above that.

***Tools and Technologies Used*:** The analysis was conducted using a combination of tools including Microsoft Excel for initial data cleaning and exploratory analysis, and Python (with libraries such as Pandas, NumPy, Matplotlib, Seaborn, and Statsmodels) for advanced analysis, visualizations, and time series forecasting using the ARIMA model.

3. Results and Findings

A. Sales, Purchase and Revenue Patterns:

- **Sales Statistics**: The mean of daily sales is 338.12, with a median of 336 and a standard deviation of 56.70, indicating moderate variability in daily sales.

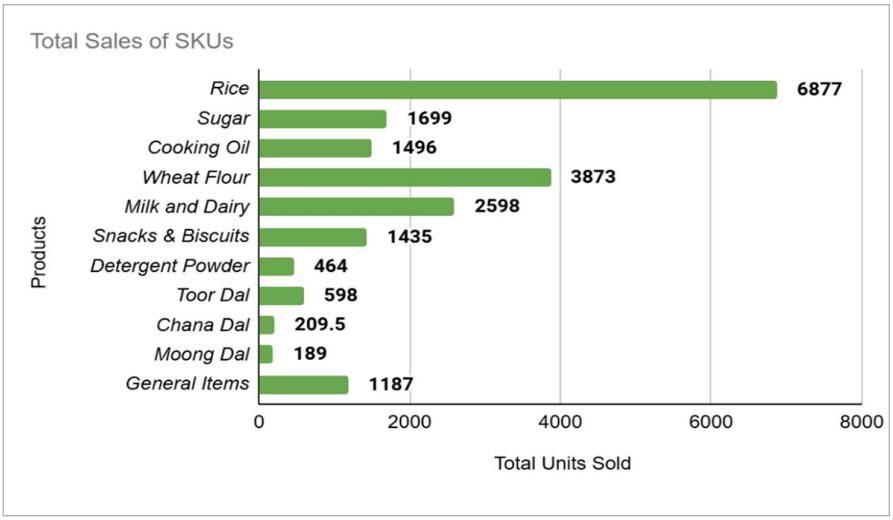


Figure 1. Top best-selling product

Insights from [Figure 1.]

a. Rice, having 6,877 sales.

b. Wheat Flour, with a sale of 3,873.

c. Milk and Dairy, contributing 2,598.

d. Sugar and Cooking Oil with 1,699 and 1,496 sales respectively.

- **Top-Selling Products**: Rice is the top-selling product with 6,877-unit sales, followed by Wheat Flour, Milk and Dairy, Sugar and Cooking Oil.
- **Least-Selling Products**: Moong Dal, Chana Dal, Detergent Powder, Toor Dal, and General Items are the least-selling products.

Time Series Sales Analysis:

Figure 2. Time Series Analysis of Sales

Above plot [***Figure 2.***] shows the decomposition of a time series into its three key components: **Trend**, **Seasonal**, and **Residual**. The decomposition is displayed across four subplots:

1. **Observed**: This is the original time series data showing the overall pattern from October 1, 2024, to November 30, 2024. The values fluctuate significantly over this period, showing some periodic behaviour and general volatility.
2. **Trend**: This subplot captures the long-term movement in the data. It shows a clear downward trend from early October to mid-October, followed by a slight stabilization in November, before another gradual decline toward the end of November.
3. **Seasonal**: This component captures the repeating short-term patterns (seasonality) in the data. It is relatively consistent throughout the period, showing periodic oscillations with roughly similar amplitudes across all months.

4. **Residual**: This subplot shows the remaining variation in the data after removing the trend and seasonal components. It represents the noise or unexplained variability. The residuals seem to fluctuate without a clear pattern, indicating randomness or potential anomalies.

Sales Demand Forecasting:

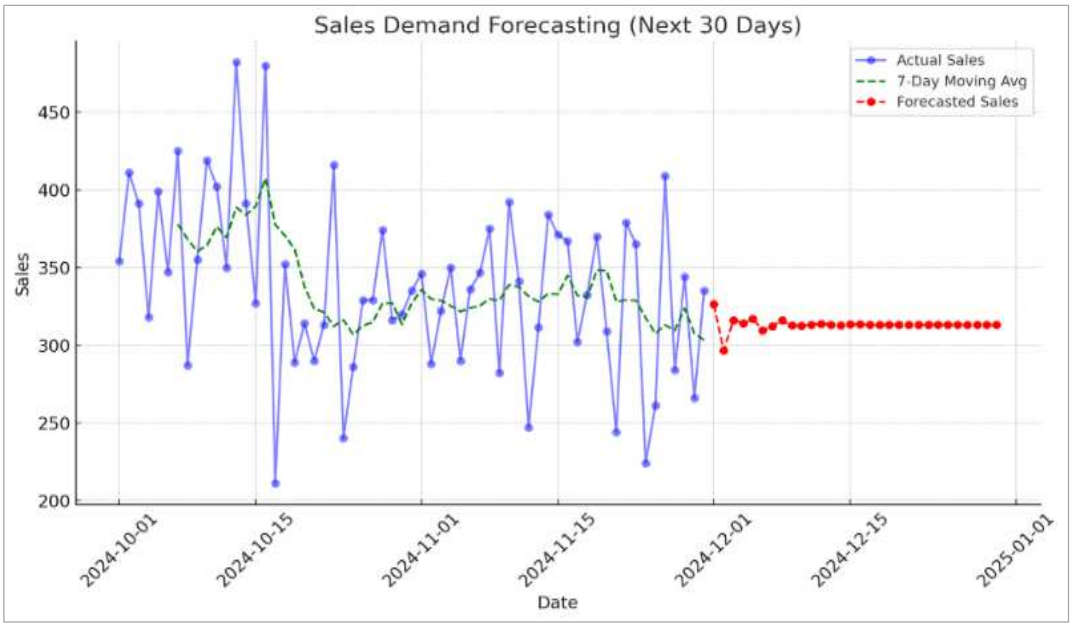


Figure 3. Sales Demand Forecasting with ARIMA Model

This plot [***Figure 3.***] illustrates **Sales Demand Forecasting for the Next 30 Days** based on 2 months sales data.

The 95% confidence interval for the forecasted sales ranges between **288 and 337 units per day**, helping to ensure safer stock levels even during uncertain demand.

- Actual Sales (Blue Line): Shows recorded sales, fluctuating between 200-450 units, indicating seasonality and variability.
- 7-Day Moving Average (Green Dashed Line): Smooths fluctuations, with a peak of ~450 units in mid-October, followed by stabilization at 300-350 units in November.
- Forecasted Sales (Red Dots): Predicts stable sales of 310-320 units for December, suggesting the model (ARIMA) anticipates a steady trend without significant fluctuations.
- The ARIMA (5,1,0) model achieved an RMSE of 63.7978, MAE of 51.7925, and a MAPE of 18.7894%.

Revenue Analysis and Outcomes:

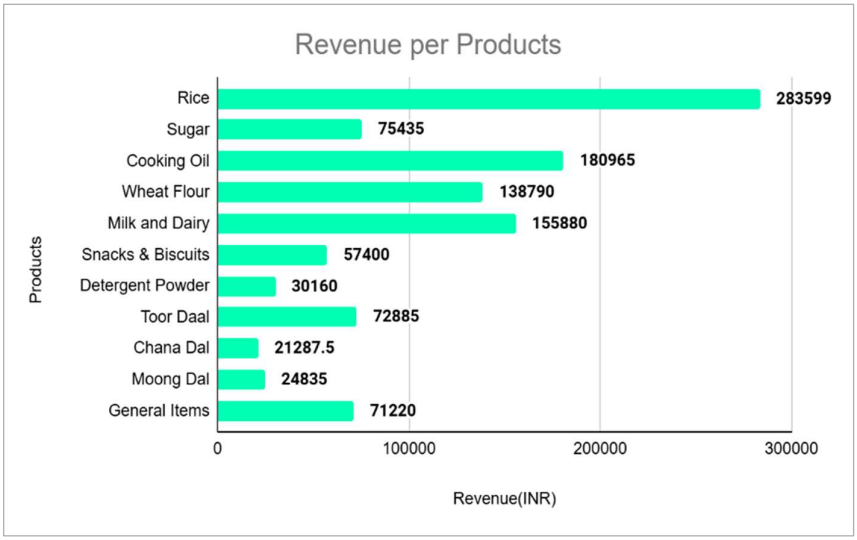


Figure 4. Bar chart showing Revenue

Insights from [Figure 4.]
Top Revenue-Generating Products

a. Rice, generating ₹2,83,599.

b. Cooking Oil, with a revenue of ₹1,80,965.

c. Milk and Dairy, contributing ₹1,55,880.

d. Wheat Flour, bringing in ₹1,38,790.

e. Sugar, adding ₹75,435 to total revenue.

- Among all the listed products, Chana Dal recorded the lowest revenue, ₹21,287.5.
- The combined revenue from all product categories amounts to ₹1,112,456.5.
- Rice, the highest-selling product, contributes approximately 25.5% of the total revenue, making it the most significant individual contributor.
- The top five products collectively account for ₹8,34,669, which represents 75% of the total revenue.
- The remaining six products together contribute ₹2,77,787.5, forming 25% of the total revenue.

Expenditure Results and Patterns:

- The average daily expenditure calculated is ₹16,540.3, with the highest daily spending reaching ₹22,235.5 and the lowest at ₹10,811.5. The standard deviation of ₹2,278.3 suggests moderate fluctuations in daily expenses.
- Among the major spending categories, Rice leads with an average daily expense of ₹4,215, followed by Cooking Oil (₹2,800), Milk and Dairy (₹2,492), Wheat Flour (₹2,099), and Sugar (₹1,181). On the other hand, the least expensive categories include Moong Dal (₹381), Chana Dal (₹323), Detergent Powder (₹449), Snacks & Biscuits (₹706), and General Items (₹778).
- Rice exhibits the highest variability in daily expenditure, with a standard deviation of ₹1,586, indicating significant fluctuations in spending. Toor Dal recorded the highest single-day expense at ₹2,088. Additionally, some products like Chana Dal and Moong Dal had days with no recorded expenditure, suggesting irregular purchasing patterns.

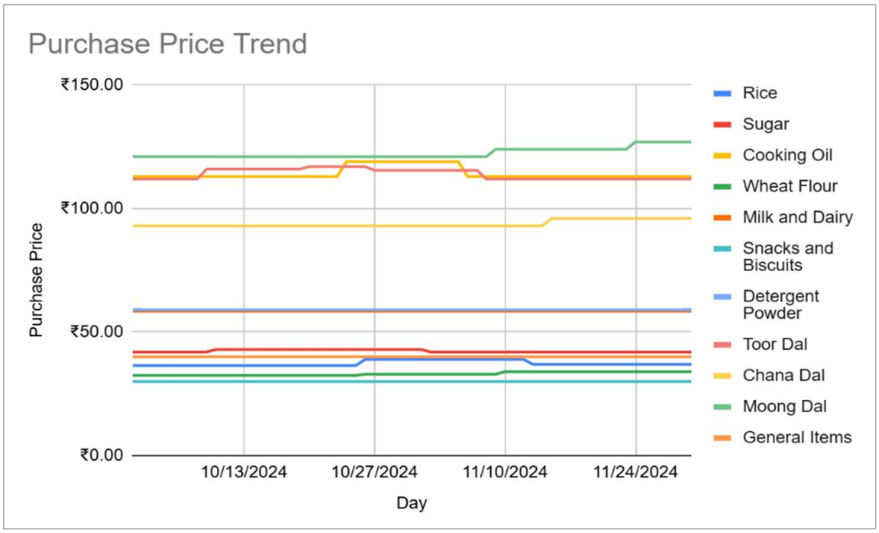


Figure 5. Line Chart depicting purchase price

Insights from [Figure 5.]

a. Stable Pricing: Detergent Powder, Snacks & Biscuits, and General Items show minimal fluctuations.

b. Price Increases: Cooking Oil, Wheat Flour, and Milk & Dairy gradually increase, stabilizing at higher prices.

- **Rice Price Rise:** Observed due to seasonal demand.
- **Sudden Spikes:** Cooking Oil and Wheat Flour experience short-term price jumps, indicating market volatility.
- **Comparative Pricing:**
  - ***Most expensive*:** Cooking Oil, Toor Dal, Chana Dal and Moong Dal (above ₹100).
  - ***Least expensive*:** Snacks & Biscuits, Sugar, Rice and Wheat Flour (below ₹50).
  - ***Moderate expensive***: Detergent powder, Milk and Dairy products (between 50-100)

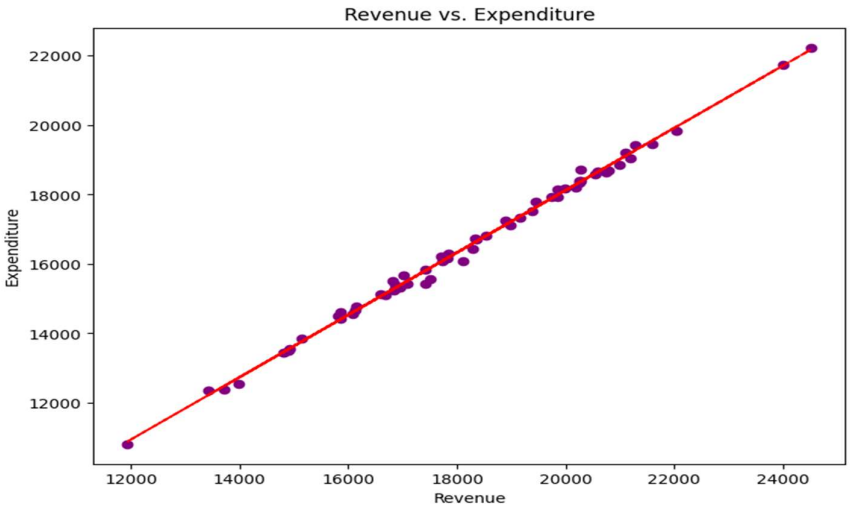


Figure 6. Scatter Plot between Revenue and Expenditure

Key Insights from [Figure 6.]

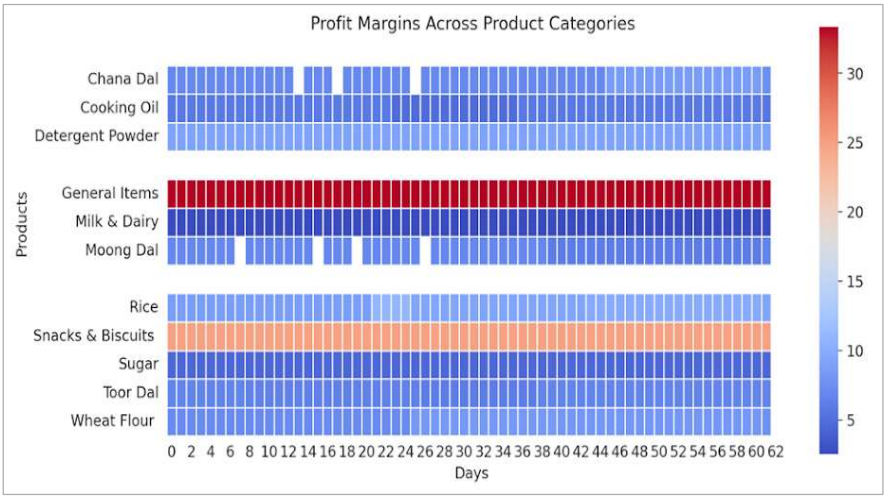
a. Strong Positive Correlation: Revenue and expenditure increase proportionally, (0.998) indicating a strong linear relationship.

b. Consistent Profit Margins: A stable trend suggests well-controlled expenditure relative to revenue.

c. Minimal Outliers: Most data points align with the trend, indicating predictable financial factor.

- **Business Stability:** Efficient cost management ensures that higher revenue does not lead to excessive expenses.

B. Profit and Profit Margin Analysis:



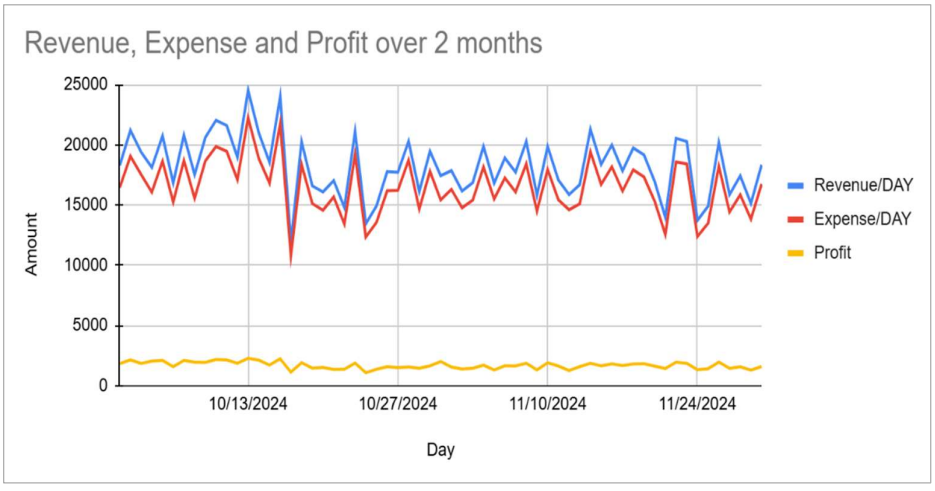
Description:

This heatmap visualizes profit margins across product categories over time, where blue indicates low margins, red indicates high margins, and orange represents moderate margins.

Figure 7. Heat Map presenting profit margins of products

Key Insights from [*Figure 7.*]:

- **Highest Profit Margins:** General Items (33.33%) Snacks & Biscuits (25.00%) are the most profitable.
- **Moderate Margins:** Rice (9.34%), Detergent Powder (9.23%), and Wheat Flour (7.73%) offer decent profitability.
- **Lowest Margins:** Milk and Dairy (2.50%) and Sugar (4.50%) have the lowest profits.
- **Fluctuating Margins:** Moong Dal and Milk and Dairy show irregular profit trends, possibly due to price changes or stock variations.



Description:

The line chart tracks **daily revenue (blue), daily expenses (red), and profit (yellow)** over two months. The y-axis represents the amount in INR, while the x-axis represents days

Figure 8. Line chart between profit, revenue and expense

Key Insights from [*Figure 8.*]:

- **Stable Cost-to-Revenue Ratio:** Revenue and expenses move closely, showing controlled spending.
- **Fluctuations in Sales:** Periodic peaks and drops indicate varying sales and purchase cycles.
- **Low but Steady Profit:** Profit remains small but consistent despite revenue and expense changes.

Products	Profit	Revenue	% of Profit	% of Revenue	Profit Margin
Rice	26482.5	283599	25.59	25.49	9.34%
Sugar	3398	75435	3.28	6.78	4.50%
Cooking Oil	10183	180965	9.84	16.27	5.63%
Wheat Flour	10725.5	138790	10.36	12.48	7.73%
Milk and Dairy	3897	155880	3.77	14.01	2.50%
Snacks & Biscuits	14350	57400	13.87	5.16	25.00%
Detergent Powder	2784	30160	2.69	2.71	9.23%
Toor Dal	4726	72885	4.57	6.55	6.48%
Chana Dal	1601.5	21287.5	1.55	1.91	7.52%
Moong Dal	1601.5	24835	1.55	2.23	6.45%
General Items	23740	71220	22.94	6.40	33.33%
SUM	**103489**	**1112456.5**		**AVERAGE**	10.70%

Table 1: Table shows profit margin and profit percentage with revenue of each SKUs

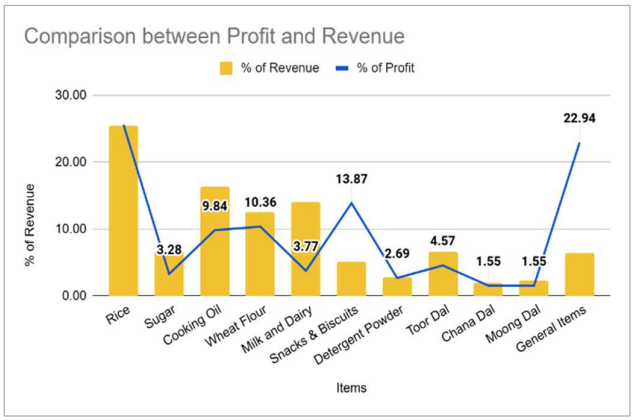


Figure 9. Profit % v/s Revenue %

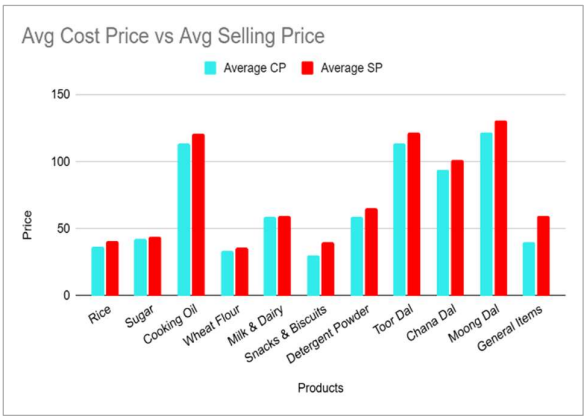


Figure 10. Average CP v/s Average SP

- **From [*Figure 9.*]** Rice drives revenue but low profit of 25.59%; General Items and Snacks & Biscuits give high profits with lower revenue.
- **From [*Figure 10.*]** Selling prices are higher than cost prices for all products, with the largest margins seen in General Items and Snacks & Biscuits.

C. ABC Analysis for Inventory Optimization:

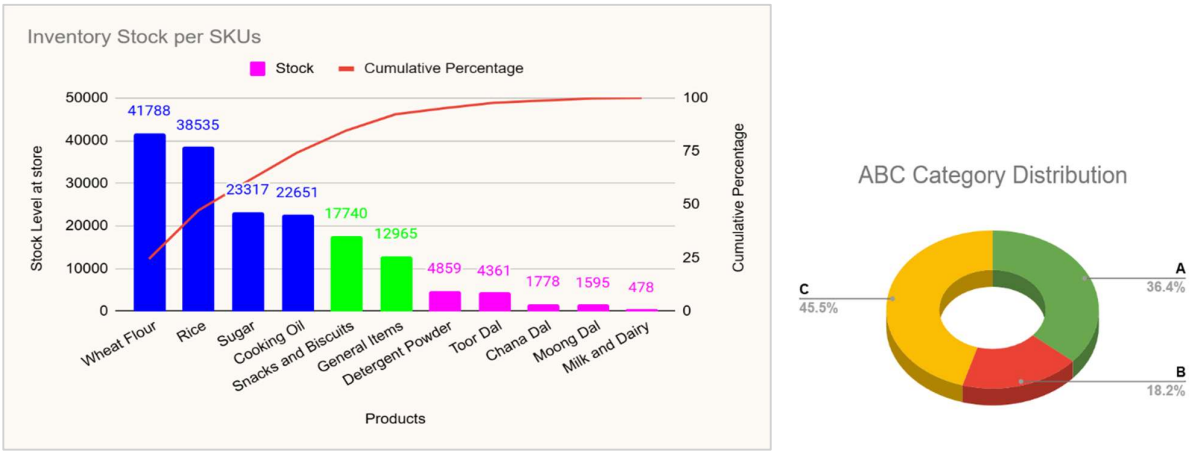


Figure 11. Pareto chart – ABC Analysis

Key Insights from [*Figure 11.*]:

The chart categorizes products based on Inventory Stock Percentage (blue bars) and Cumulative Contribution (red line).ABC Categories:

Category A (Top ~75%) – High-Stock Items

- Products: Wheat Flour, Rice, Sugar, Cooking Oil
    - These 4 items contribute to ~74.26% of total inventory.
    - Require strict inventory monitoring, consistent demand forecasting, and robust supplier coordination.
    - Overstocking or understocking can heavily impact operational efficiency.

Category B (Next ~18%) – Moderate-Stock Items

- Products: Snacks and Biscuits, General Items
    - These account for ~18.05% of total inventory.
    - Need moderate control to maintain availability without excess holding costs.
    - Reordering strategies can be more flexible than A-category items.

Category C (Last ~7%) – Low-Stock Items

- Products: Detergent Powder, Toor Dal, Chana Dal, Moong Dal, Milk and Dairy
    - These items contribute only ~7.69% of inventory.
    - Have minimal financial impact on overall inventory.
    - Can be managed with relaxed inventory policies, occasional restocking, and lower safety stock.

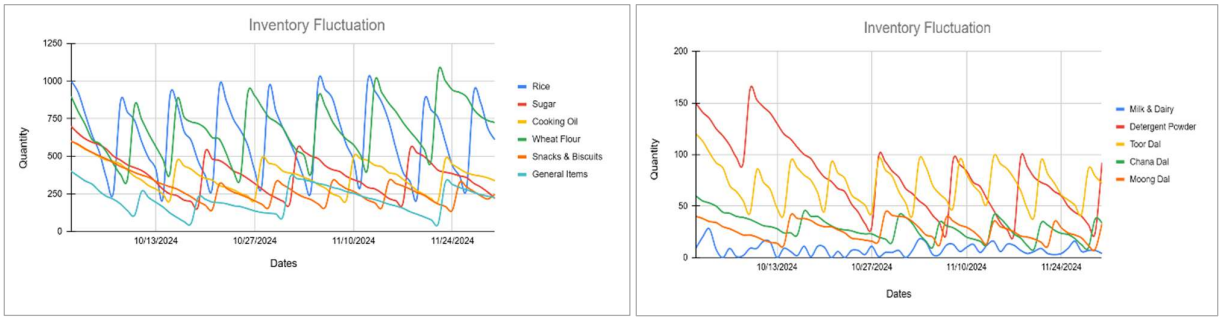
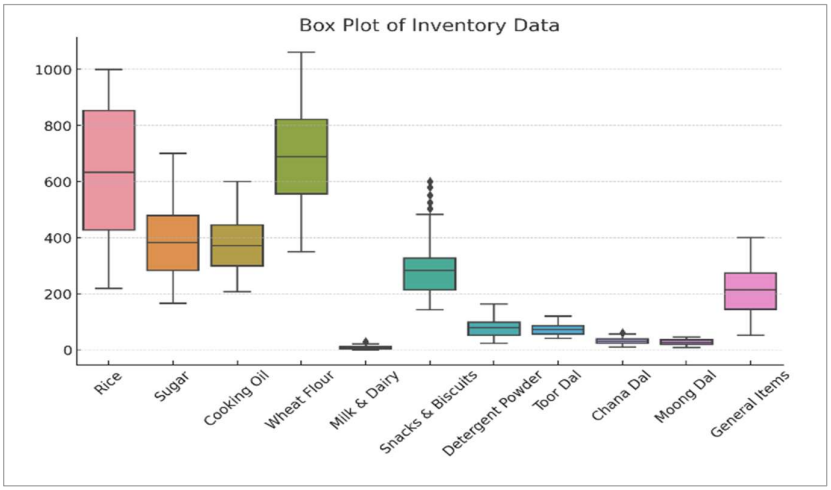


Figure 12. Inventory Fluctuation of store over 2 months

Key Insights from [*Figure 12.*]:

- Regular Stock Replenishment – Items like Rice, Cooking Oil, and Wheat Flour show a cyclical pattern, indicating frequent restocking and consumption.
- Gradual Depletion – Items like Sugar, Snacks & Biscuits, and Detergent Powder show a steady decline, suggesting slower turnover.
- Low & Stable Inventory – Products like Moong Dal, Chana Dal, and General Items maintain consistently low stock levels, implying lower demand or controlled stocking.
- Demand Variability – Peaks and dips in high-demand items (Rice, Wheat and Sugar) indicate sales spikes and replenishment cycles, which can help in forecasting restocking needs.

This analysis helps **optimize procurement strategies**, reducing **stockouts and overstocking risks**.



Description:

The box plot visualizes the distribution of inventory levels across various products. The y-axis represents stock quantity, while the x-axis lists product categories. The spread, median, and outliers indicate stock variability.

Figure 13. Box Plot of Inventory Data

- **High Variability:** Rice and Wheat Flour – frequent stock fluctuations.
- **Moderate Stability:** Sugar, Cooking Oil, Snacks & Biscuits controlled but variable demand.
- **Low & Stable Stock:** Milk and Dairy, Detergent Powder, Pulses – steady but low demand.
- **Outliers:** Snacks & Biscuits, Milk and Dairy – occasional sharp stock changes.

D. Borrowing Pattern Analysis & Revenue Loss Estimation:

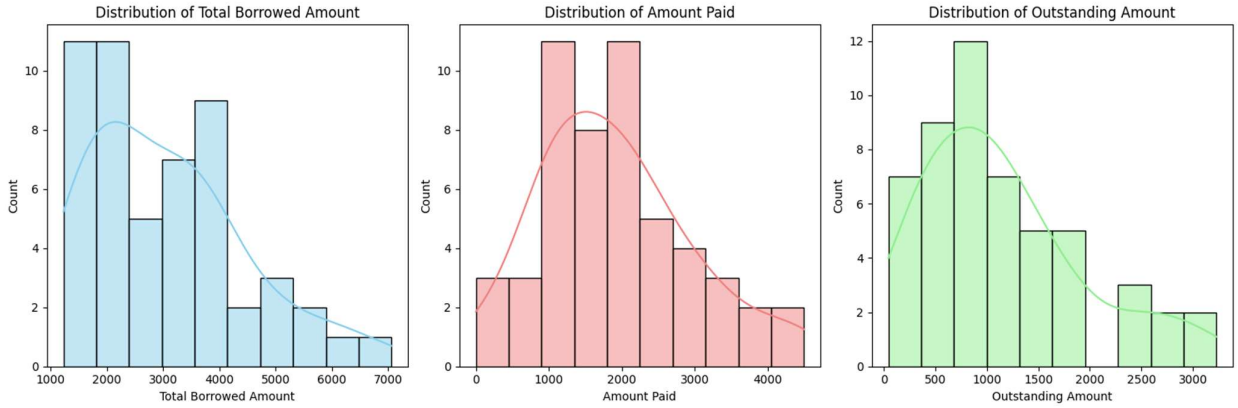


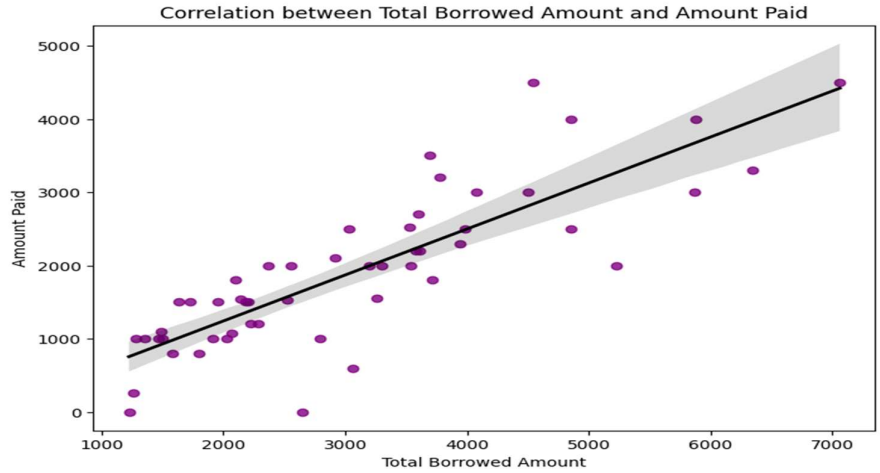
Figure 14. Histograms showing the distributions of Customer Borrowing

The above plot displays three histograms showing the distributions of:

1. **Total Borrowed Amount** (Left, Blue) – The distribution is right-skewed, indicating most customers credit lower amounts (₹1,000-4,000), while fewer borrow higher amounts (₹4,000+).
2. **Amount Paid** (Middle, Red) – The payment distribution follows a similar right-skewed trend, suggesting that many customers repay smaller amounts, with fewer paying larger sums.
3. **Outstanding Amount** (Right, Green) – The majority of outstanding amounts are below ₹1,500, but a few customers still owe higher amounts (₹2,000-3,000+).

Key Insights from [*Figure 14.*]:

- Most Customers take small credit amounts – Many customers are between ₹1000-4000.
- Repayments are Mostly Low – Customers tend to pay back in smaller amounts, leading to accumulated outstanding balances.
- Outstanding Debt Exists – Some customers still have significant unpaid balances, requiring better collection strategies.



Insights from [Figure 15.]:

Strong Positive Correlation: A strong positive correlation (0.83) exists between 'Total Borrowed Amount' and 'Amount Paid', suggesting customers who borrow larger amounts tend to pay back larger amounts.

Figure 15. Scatter plot b/w Borrowed amount and Amount paid

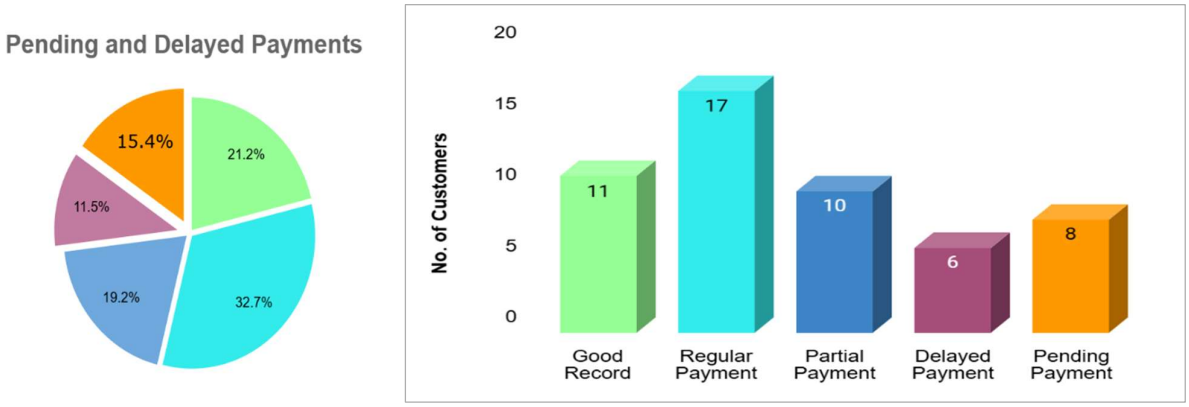


Figure 16. Categorization of 52 Customers based on Outstanding Amount

Insights on Payment Behaviour from [*Figure 16.*]:

Pending and Delayed Payments (Pie Chart)

- The chart segments payments into different categories based on pending or delayed status.
- 32.7% of payments are regular, followed by 21.2% categorized as good records.
- 19.2% of payments are partial, while 15.4% are still pending, and 11.5% are delayed.
- A significant portion (26.9%) of payments have issues, indicating a need for improved credit management. This section accounts for ₹30,880 in terms of revenue loss.

Customer Payment Behaviour (Bar Chart)

- Regular payers (17 customers) form the largest segment, followed by 11 customers with a good record.
- 10 customers make partial payments, indicating irregular payment behaviour.
- 6 customers have delayed payments, and 8 customers have pending payments, highlighting credit risk concerns.
- Strengthening payment follow-ups and offering incentives for timely payments may improve cash flow.

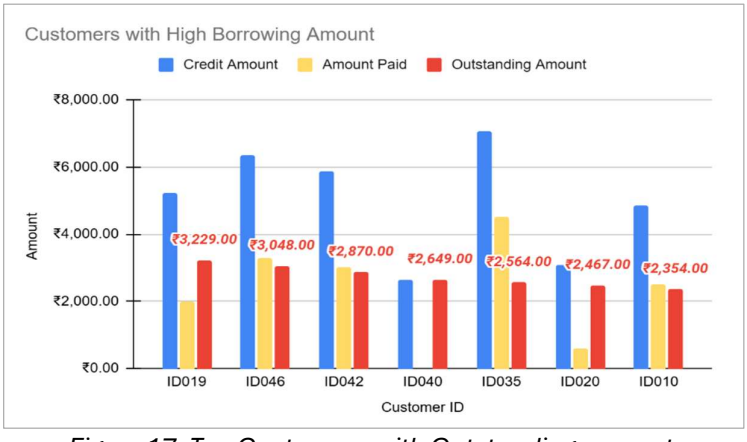


Figure 17. Top Customers with Outstanding amount

Figure 18. Customer Repayment Risk

4. Interpretation of Results:

1. **Top-Selling Products:**

   - **Rice**, **Wheat Flour**, **Milk and Dairy**, **Sugar**, and **Cooking Oil** contribute the highest **sales** volume and **revenue**.
   - These essential household staples have a **strong and consistent demand**, indicating their critical role in the store's revenue generation.

2. **Least-Selling Products:**

   - **Moong Dal**, **Chana Dal**, **Detergent Powder**, and **General Items** have the **lowest sales**, highlighting potential **overstocking issues**.
   - These products may require **promotional strategies** or **bundling offers** to boost sales and reduce **dead stock**.
   - **Inventory adjustments**, including **reduced stock levels** or **supplier negotiations** for better pricing, can improve **profitability** for these **slow-moving items**.

3. **Sales Trends:**

   - A noticeable **downward trend** in **overall sales** was observed over the analyzed period, with **fluctuations** influenced by **seasonal demand**.
   - Factors such as **festival season (Diwali)**, **supply chain disruptions**, and **customer purchasing behaviour** impact **sales performance**.
   - Understanding **seasonal demand variations** will allow better **procurement planning** and **targeted promotions** to stabilize **revenue** across different periods.

4. **Revenue & Expenditure:**

   - The **top five products** contribute nearly **75% of total revenue**, making them the primary focus for sales and inventory strategies.
   - Daily **expenditure** remains **relatively stable**, ensuring that **costs are controlled** and aligned with **revenue generation**.
   - The consistency in **expenditure trends** indicates **efficient cost management**, but opportunities exist to **optimize procurement costs** further to improve **profit margins**.

5. **Profit Margins:**

- **General Items (33.33%) and Snacks & Biscuits (25.00%)** yield the highest profit margins, suggesting a focus on marketing and sales for these categories could drive overall profitability.
- **Rice (9.34%), Detergent Powder (9.23%), and Wheat Flour (7.73%)** provide moderate profitability, but due to their high sales volume, they still contribute significantly to overall profit.
- **Milk and Dairy (2.50%) and Sugar (4.50%)** have the lowest profit margins, meaning pricing and supplier negotiations must be optimized to improve profitability in these categories.

6. **Borrowing & Revenue Loss:**

- A **significant portion (26.9%) of payments** face delays or remain unpaid, leading to potential revenue loss and cash flow constraints.
- The **majority of customers credit small amounts (₹1,000–4,000)**, but repayment is often delayed or made in small installments, accumulating outstanding balances.
- Stronger credit management policies, timely follow-ups, and customer incentives for early repayment can help mitigate these financial risks.
- The borrowing pattern analysis shows a **strong correlation (0.83) between borrowing and repayment**, indicating that higher borrowers do tend to repay, but delays in repayment affect cash flow.

Key Finding: The store is operating just above the break-even point, leaving an extremely narrow margin of safety. A small drop in daily sales, slight increase in supplier prices, or customer defaults could wipe out profits or cause losses. While the store isn't losing money currently, it's not in a stable position either.

5. Recommendations:

1. **Inventory Optimization:**

- Implement **strict monitoring** for high-value and high-selling products (Category A) such as Cooking Oil, Rice, Wheat Flour, and Sugar to prevent stockouts and ensure continuous availability.

- Maintain a **balanced oversight** for mid-value products (Category B) like Snacks & Biscuits and General Items to optimize stock levels while avoiding excess inventory.
- Adopt **flexible inventory policies** for low-value, slow-moving products (Category C) such as Milk and Dairy, Toor Dal, Moong Dal, Chana Dal, and Detergent Powder, ensuring minimal overstocking and reducing waste.
- Introduce minimum stock level alerts to avoid emergency purchases at higher rates, which inflate COGS.

2. Demand Forecasting:

- Utilize **historical sales data and time-series forecasting models** (ARIMA, Holt-Winters) to predict future demand accurately.
- Adjust stock levels based on forecasted seasonal trends to minimize unsold inventory and avoid shortages during peak demand periods.
- Implement **automated reorder systems** for top-selling products to streamline procurement and maintain optimal stock levels.

3. Sales & Pricing Strategy:

- Monitor **price fluctuations** for high-demand products such as Sugar, Cooking Oil, and Wheat Flour to ensure competitive pricing and profitability.
- Offer **seasonal discounts and bundled promotions** to boost sales of least-selling items like Moong Dal, Chana Dal, and General Items.
- Introduce **dynamic pricing strategies** based on demand-supply trends to maximize revenue without affecting customer retention.
- Regularly **review margin contribution** per product to shift marketing focus towards items that bring higher margins, thus reducing break-even dependency.
- **Avoid deep discounting** on essential products unless offset by bundle margins.

4. Credit Management:

- Strengthen follow-ups on outstanding payments by implementing **automated reminders** for due payments via SMS or WhatsApp.

- Introduce **incentives for timely payments**, such as discounts on future purchases or loyalty points, to encourage early repayments.
- Implement **stricter credit policies**, such as setting a maximum borrowing limit based on customer payment history, to reduce credit risk.
- Offer **flexible repayment plans** for trusted customers while tightening credit terms for those with repeated payment delays.

5. Business Growth Strategies:

- Focus on **expanding the sales of high-margin products** (General Items and Snacks & Biscuits) through **promotional offers** and in-store displays.
- To address **credit issues**, the business can improve cash flow by **purchasing stock on credit from dealers** and repaying them using the payments received from customers. This approach allows **more time to accumulate funds for the next purchase**.
- **Optimize pricing** and stock levels for low-margin but **high-demand** products (Milk and Dairy, Sugar) to **maintain profitability** while ensuring customer satisfaction.
- Develop **supplier partnerships** for bulk discounts on fast-selling products like Rice, Cooking Oil, and Wheat Flour to increase profit margins.
- Implement **customer retention programs**, such as discounts for repeat purchases, to boost sales consistency and customer loyalty.
- **Transitioning** into a **Dark Store** will enable Store to optimize supply chain operations, expand into digital sales, and **increase revenue** through **online orders** and **local delivery**, ensuring competitiveness in the evolving retail market.

Limitations and Scope: The analysis is based on a limited two-month dataset (Oct–Nov 2024), which may not capture full-year sales trends or account for seasonal fluctuations. Customer demographic data was unavailable, limiting the ability to perform segmentation or personalized behavioral analysis.

Reference Dataset: LINK

By implementing these strategies, Mamta Kirana Stores can improve profitability, streamline inventory management, and enhance financial stability. A focus on data-driven decision-making, optimized stock levels, strategic pricing, and better credit management will help increase revenue, reduce financial risks, and ensure sustainable business growth.