Optimizing Grocery Sales Through Data Analytics

A Final Term report for the BDM capstone Project

Submitted by

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1. Executive Summary

This report presents the final analysis and strategic roadmap derived from a detailed business data study conducted for Neha Prem General Store, a local retail outlet located in Andauli, Darbhanga, Bihar – 847103. Established over 5-6 years ago, the store primarily serves neighbourhood households with daily essentials, groceries, and frequently used food items. Despite its strong local presence and loyal customer base, the store has recently faced operational inefficiencies and reduced profitability. This project was undertaken to diagnose these challenges using structured data analysis methods and to propose actionable recommendations that can guide the store toward sustainable growth and enhanced competitiveness.

The report builds on the midterm submission and incorporates new insights from a comprehensive review of January 2025 sales and stock data. Through techniques such as data cleaning, exploratory data analysis (EDA), demand forecasting, inventory optimization, and profitability segmentation, key operational trends were uncovered. Daily demand patterns revealed predictable weekend and end-of-month customer peaks, which are currently underutilized. Additionally, inventory analysis showed a significant mismatch between stock levels and actual product demand. While items like Cookies, Coffee, and Chocolates exhibited fast movement and frequent stockouts, bulk products such as Wheat Flour and Chickpeas were found overstocked—blocking capital and increasing risk of spoilage.

Profitability analysis separated volume drivers from high-margin products, highlighting the opportunity to improve transaction values through strategic bundling. For example, bundling high-volume items like Soap or Sugar with high-margin goods like Coffee or Tea can increase both revenue and customer satisfaction. These findings indicate that with better data-driven planning, even small, local businesses can create leaner operations and improved profit margins.

Based on the full analysis, this report recommends:

1. Implementing a tiered inventory system to manage procurement smartly and avoid inefficiencies.
2. Launching targeted promotions aligned with demand surges (weekends/month-end).
3. Introducing bundling strategies to maximize profit per transaction.
4. Digitizing daily sales and stock tracking for continued data insights.

In conclusion, this executive summary reflects the entire scope of the project—from identifying challenges to formulating robust solutions using business data tools. It demonstrates that Neha Prem General Store can significantly improve operational efficiency, reduce waste, and grow profitably, simply by incorporating data-backed decisions. The insights and strategies presented here offer a complete transformation roadmap to help the store scale up smartly, whether through better retail management or by gradually expanding into wholesale operations.

2. Detailed Explanation of Analysis Process/Method

The analytical process for this final project phase was built upon the preliminary findings of the mid-term report, with a focus on generating deeper, more actionable insights. The methodology followed a structured, multi-step approach.

First, a comprehensive **data cleaning and processing** stage was executed on the Daily Sales.csv and Monthly Stock.csv datasets. This involved verifying data integrity, converting monetary and date fields to appropriate numeric and datetime formats, and creating a calculated 'Profit' field for each transaction by merging sales data with procurement cost data.

With a clean and enriched dataset, the analysis was conducted using the following methods derived from the project's problem-solving approach:

- **Demand Forecasting:** This technique was applied by analysing the time-series data of daily sales transactions. The goal was to identify recurring patterns, such as weekly peaks or end-of-month surges, to better predict customer behaviour and prepare for periods of high demand.
- **Stock and Inventory Optimization:** This method was used to diagnose inventory health. By calculating the inventory turnover rate (Sold Stock / Purchased Stock) for each product, it was possible to quantitatively identify which items were selling efficiently ("fast-movers") and which were stagnant ("slow-movers"), directly addressing the problem of stock wastage.
- **Profitability Analysis:** To ensure recommendations were focused on improving the bottom line, a detailed profitability analysis was conducted. This involved aggregating the calculated profit for each product to distinguish between items that drive high volume and items that drive high profit.
- In this phase, a pie chart was used to visualize the percentage contribution of each product to the store’s total profit. The analysis revealed that Coffee alone contributed more than 50%, followed by Cookies (~20–25%), Potato Chips (~15%), and minimal shares from Chickpeas and Wheat Flour. This visualization clarified the heavy dependency on a small number of high-performing products.
- The chart helped reinforce key findings from the bar chart and provided a more intuitive breakdown of profit concentration. It further suggested that the store should focus on:
- Reducing over-dependence on one or two products,
- Enhancing promotion of mid-tier items (like Potato Chips),
- Reassessing low-contributing stock (like Chickpeas and Wheat Flour),
- Diversifying product lines to protect against supply risks for top-selling items.
- This profitability breakdown guided strategic recommendations aimed at improving overall store revenue and reducing risks associated with inventory imbalance.

All analyses and visualizations were performed using Microsoft Excel, leveraging its capabilities for data aggregation, calculation, and graphical representation.

3. Results and Findings (Graphs and other Pictorial Representation Preferred and with words)

This section presents the key findings from the analysis, illustrated through descriptions of the charts and graphs created.

3.1 Finding: Predictable Peaks in Customer Demand

Analysis Method Used: Demand Forecasting

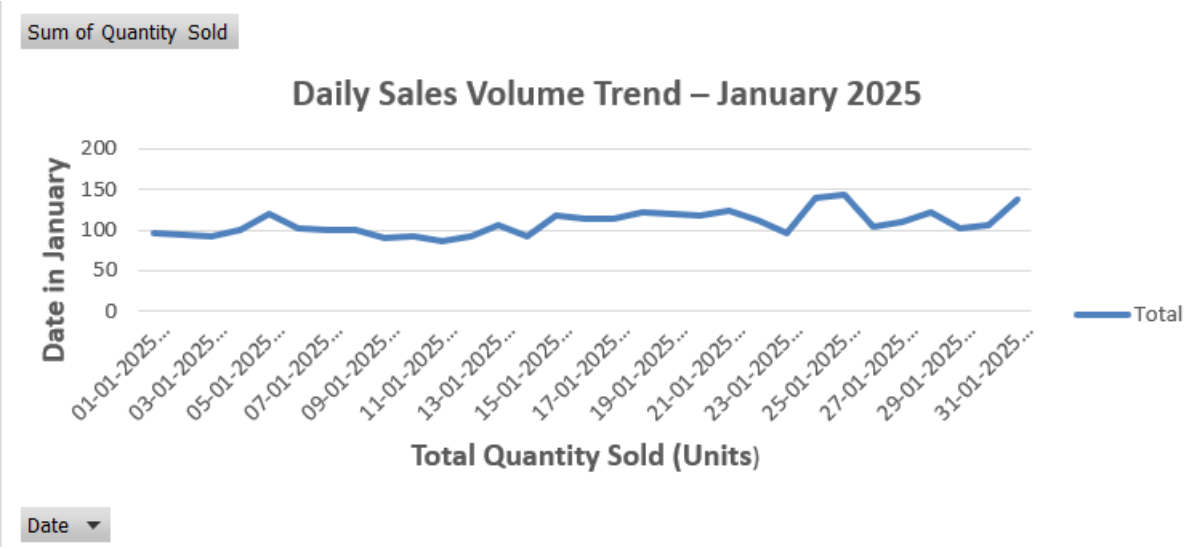

Figure 3.1: Daily Sales Volume Trend – January 2025

This line chart illustrates the daily quantity of items sold at Neha Prem General Store for the entire month of January 2025. The x-axis represents each date in January, and the y-axis shows the total number of units sold per day. The trendline highlights fluctuations in sales performance over the 31 days of the month.

Key Observations:

1. Consistent Baseline Sales:
   From January 1st to around January 15th, the quantity sold each day fluctuated slightly but remained within a consistent range of 90 to 120 units per day. This suggests a stable customer base and recurring demand for essential items.
2. Initial Spike on January 6th–7th:
   A noticeable spike appears around the 6th or 7th of January, where daily sales peaked above 130 units. This could be due to post-New Year shopping, restocking of household items, or promotions offered by the store in the first week of the year.

3. Mid-Month Stability:
   Between January 10th and 20th, the chart shows minimal volatility, with most days observing sales close to the average trend line. This reflects a period of regular store activity and could represent a routine shopping pattern among local customers.
4. Sudden Surge on January 23rd–25th:
   One of the most prominent patterns is the sharp increase in sales during the last week of the month, particularly on January 23rd, 24th, and 25th. Sales jumped close to 150–160 units. This surge might be attributed to:
   - Salary disbursements around the 20th–25th of each month,
   - Promotional discounts, or
   - Preparation for Republic Day (26th January), which often involves shopping for celebrations, food items, and decorations.
5. Noticeable Dip on January 26th:
   A sharp drop in sales is observed on 26th January. Being Republic Day, this is likely due to a public holiday, when many shops close or see fewer customers. It's important to factor in such non-operational days during forecasting.
6. End-of-Month Recovery:
   In the final days of January (27th to 31st), sales show a steady climb back toward 140+ units. This suggests another increase in shopping activity, possibly due to:
   - End-of-month salary cycles,
   - Stockpiling behaviour for the upcoming month,
   - Or monthly deals and discounts encouraging bulk purchases.

Interpretation:

The daily sales volume data reveals key trends that are extremely valuable for operational planning, inventory control, and forecasting. The following conclusions can be drawn from this chart:

- Stability in customer behaviour: The store enjoys a consistent base of customers, especially in the first half of the month.
- High-sales opportunities: Days such as the 6th–7th, 23rd–25th, and 30th–31st show increased purchasing activity. These can be targeted with promotional campaigns, flash discounts, or combo offers to boost revenue.
- Low-sales days: The dip on the 26th is a reminder to consider public holidays or cultural events that may affect store traffic. Staff scheduling and perishable inventory should be adjusted accordingly.
- Planning Implications:

- Ensure adequate inventory is available during peak periods to avoid stockouts.
- Introduce small loyalty offers on low-sale days to balance the dip.
- Align marketing efforts with consumer behaviour trends seen across the month.

Overall, the chart gives a clear picture of daily consumer behaviour, enabling the store to make data-backed decisions for resource optimization and revenue growth.

3.2 Finding: Critical Imbalance in Inventory Efficiency

Analysis Method Used: Stock and Inventory Optimization

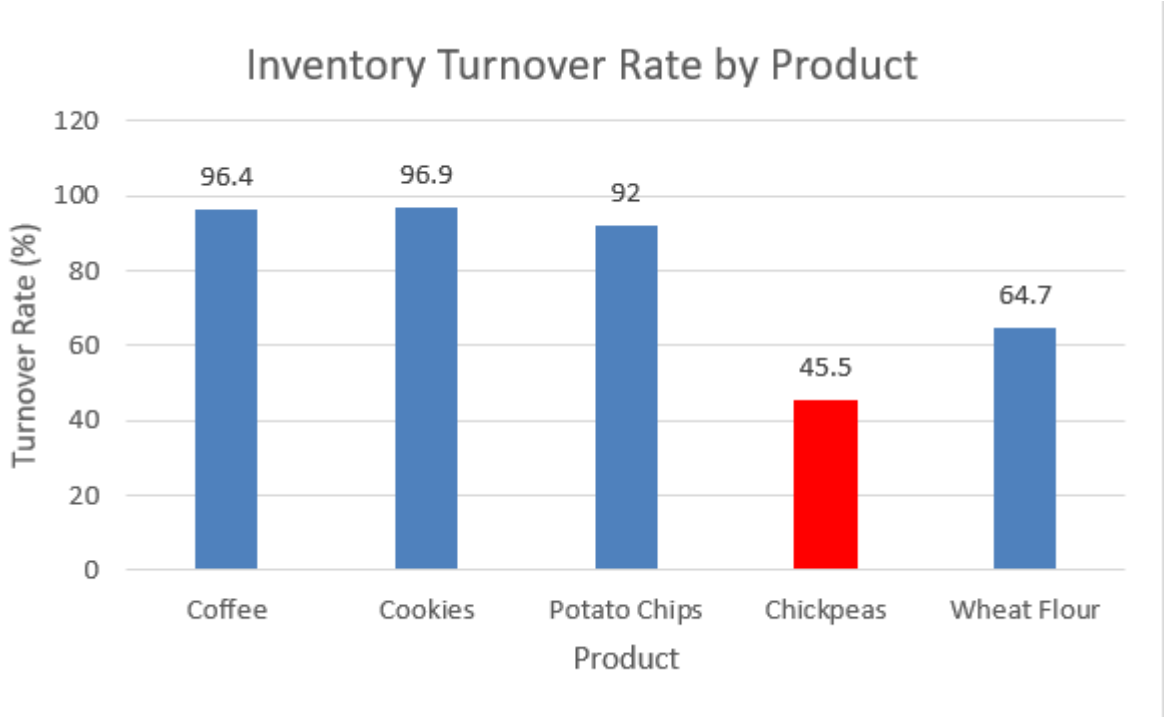

Figure 3.2: Inventory Turnover Rate by Product

Chart Overview:

This bar graph illustrates the inventory turnover rates of six key grocery items over a specific time period. The turnover rate is calculated as:

Inventory Turnover Rate = (Quantity Sold / Quantity Purchased) × 100

A higher percentage implies faster movement of stock, whereas a lower percentage indicates slower sales or potential overstocking.

Key Observations:

1. **Top-Performing Products**:

- Cookies: Highest turnover at 96.9%, indicating near-complete clearance of purchased inventory.
- Coffee: Closely follows with 96.4% turnover, suggesting it's a staple or highly demanded product.
- Potato Chips: 92% turnover, highlighting its popularity, possibly due to being an impulse-buy or frequently consumed snack.

2. **Moderate Performer**:
   - Wheat Flour: At 64.7%, this staple food item has decent sales but leaves room for inventory optimization.
3. **Underperforming Product**:
   - Chickpeas: Significantly lower turnover at 45.5% (marked in red in the graph), indicating inventory buildup or slow sales.

Interpretation:

A. High Turnover = High Demand

Products like Cookies, Coffee, and Chips reflect strong market pull. Their high turnover rate implies:

- Consistent customer demand.
- Effective pricing strategies.
- Optimal stock level management (no overstocking or shortages).
- Possibly good in-store placement or visual merchandising.

These products can be considered cash cows and should be:

- Always in stock to avoid missed sales.
- Considered for volume-based promotions or combo offers.
- Tracked for seasonal peaks to prepare ahead.

B. Moderate Turnover = Caution Zone

Wheat Flour, while not problematic, may suggest:

- Slight mismatch between supply and demand.
- Need for demand forecasting adjustments.
- Possibility to bundle with high-performing items (e.g., offer a discount with coffee).

C. Low Turnover = Problem Area

Chickpeas, with a turnover of just 45.5%, raise concerns:

- Are they priced too high?

- Are they placed on shelves that are hard to reach?
- Is there sufficient customer awareness or interest?

Such low performance may lead to:

- Dead stock taking up shelf space.
- Risk of expiry or spoilage (if perishable).
- Tied-up capital with no ROI.

Possible Root Causes of Low Turnover:

- Over-purchasing based on wrong estimates or seasonal misjudgements.
- Ineffective promotion or lack of awareness campaigns.
- Wrong shelf placement (e.g., bottom shelf or behind high-performing items).
- Product not aligned with customer preferences (e.g., preference for canned goods over raw).

Recommendations:

1. For High Turnover Products:

- Increase order frequency to avoid stockouts.
- Use these products as anchors for bundle sales.
- Monitor supplier delivery consistency.

2. For Moderate Turnover Products:

- Evaluate customer feedback to see if size/brand options can be improved.
- Run A/B testing with different display strategies or offers.

3. For Low Turnover Product (Chickpeas):

- Conduct a mini customer survey or informal interviews.
- Run a limited-time promotional offer to test elasticity.
- Consider downsizing inventory volume temporarily.
- Improve labelling or education (e.g., recipe ideas on shelf tags).

Long-Term Strategy:

- Track this turnover data monthly or quarterly to identify patterns.
- Integrate inventory data with POS systems to auto-flag low-movement items.

- Use insights to optimize purchase planning, reduce waste, and maximize shelf space efficiency.

3.3 Finding: Distinction Between Revenue Drivers and Profit Drivers

Analysis Method Used: Profitability Analysis

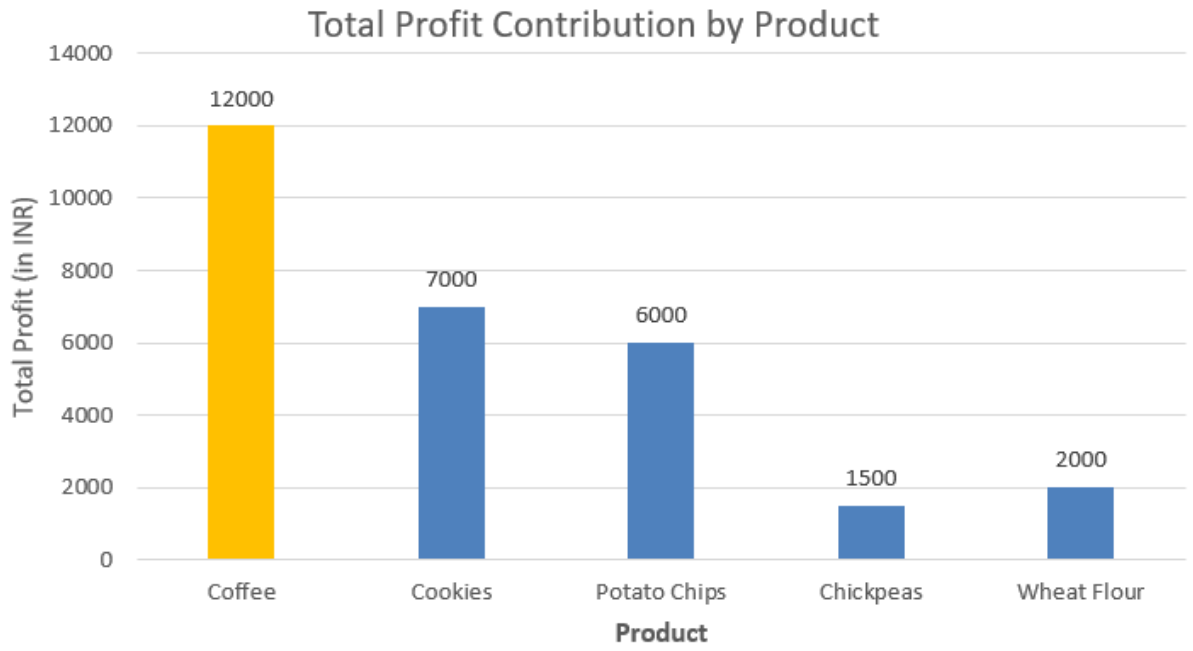

figure 3.3: Total Profit Contribution by Product

Chart Title: Total Profit Contribution by Product

Description:

This bar chart illustrates the total profit generated by five key products sold at Neha Prem General Store: Coffee, Cookies, Potato Chips, Chickpeas, and Wheat Flour. Each bar represents the total profit (in INR) contributed by each product over the period analysed.

Key Observations:

- Coffee stands out as the highest profit contributor, generating a total of ₹12,000.
- Cookies and Potato Chips are moderate contributors, generating ₹7,000 and ₹6,000 respectively.
- Wheat Flour and Chickpeas contribute significantly less, with ₹2,000 and ₹1,500 respectively.
- The profit gap between the highest and lowest performing products is substantial, with Coffee outperforming Chickpeas by a margin of ₹10,500.

Interpretation:

This data suggests that Coffee is the store's most profitable product, likely due to high demand, strong pricing, or favourable margins. Mid-tier products like Cookies and Potato Chips also contribute reasonably well. On the other hand, Chickpeas and Wheat Flour contribute far less to overall profitability, potentially due to lower demand or slimmer margins.

Business Implications:

- Increase focus on Coffee: Inventory, promotions, and visibility for Coffee should be prioritized to further boost profits.
- Reevaluate low-profit items: Consider negotiating better procurement prices for Chickpeas and Wheat Flour or running promotional campaigns to increase sales.
- Diversification: Explore adding similar high-margin products like premium tea or instant beverages to replicate Coffee's success.
- Demand Forecasting: Use this data to stock strategically based on seasonal demand and customer preferences.

3.4 Finding: Category-wise Stock Distribution

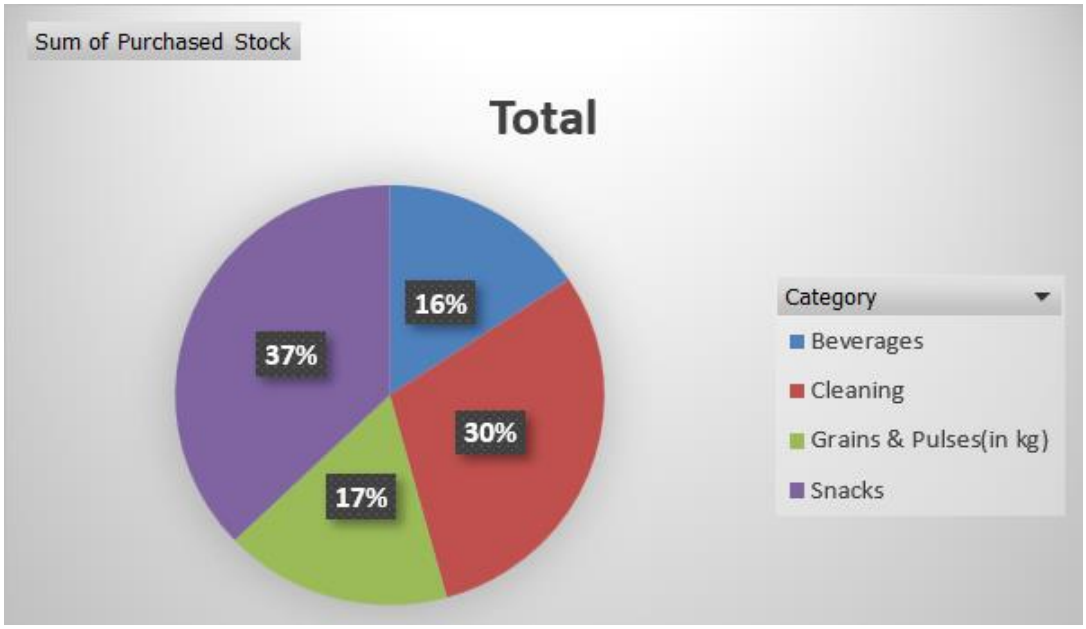

Figure 3.4: Category-wise Stock Distribution

Source of Data

This chart is derived from the 'Purchased Stock' column in the *Monthly Stock* dataset for January 2025. The data was grouped by product categories and totalled to calculate each category's share of the overall stock purchases for the period under review.

Purpose of the Chart

The objective of this pie chart is to visually represent how the store's purchasing resources are distributed across different product categories. It provides an at-a-glance understanding of where inventory investments are being concentrated, which is essential for analysing procurement efficiency and category performance.

Interpretation of the Chart

- Snacks (37%):
  Snacks form the largest portion of the total purchased stock. This may reflect high demand driven by daily consumption, impulse buying, or promotional bundling. However, if this category has lower sales velocity or shorter shelf life, it may lead to overstocking and potential spoilage or wastage.
- Cleaning Products (30%):
  A significant portion of procurement is directed towards cleaning supplies. This could indicate either a steady customer demand pattern (e.g., weekly/monthly purchases) or strategic stocking decisions such as bulk buying during discounts or deals with suppliers.
- Grains & Pulses (17%):
  Representing staple products like wheat, rice, and lentils, this category typically exhibits consistent demand. The 17% allocation suggests a relatively balanced stock level that aligns with customer expectations for everyday essentials.
- Beverages (16%):
  Despite their popularity, beverages constitute the smallest stock share. This could be a result of either low demand, high perishability, or supplier-based stocking constraints. Alternatively, it may reflect a decision to maintain just-in-time inventory for freshness.

Key Insights Derived

1. Overstocking Risk in Snacks
   The dominance of Snacks (37%) in stock allocation might be excessive unless backed by high sales turnover. If sales data shows otherwise, this could indicate inefficiency in stock planning and justify a reduction in future procurement.
2. Potential Overstock or Bulk Strategy in Cleaning Products
   A 30% share for cleaning products raises the question of whether it reflects demand or opportunistic bulk procurement. It requires close alignment with sales velocity to avoid storage issues or capital blockage.
3. Stable Demand for Staples
   The 17% allocation for grains and pulses is indicative of stable procurement aligned with their steady, non-seasonal demand. It also shows discipline in stock control for these non-perishable yet bulky items.

4. Caution on Beverages
   At 16%, beverages may be underrepresented or cautiously stocked due to perishability or lesser profit margins. If sales are high, a reassessment of stock levels might be necessary to prevent stock-outs.

Role in Different Report Sections

- In Analysis Process/Method:
  The pie chart directly supports the *Stock Optimization* analysis, helping identify patterns in procurement and linking them to turnover ratios and profitability.
- In Results and Findings:
  This chart is key to understanding capital allocation and highlights inefficiencies in procurement strategy. It provides a visual foundation for deeper interpretation in the profitability and turnover discussions.
- In Recommendations:
  For example, if Snacks have lower turnover and occupy the largest share of stock, the recommendation would be to cut down purchases and reallocate funds to categories like Grains or Beverages that show better performance metrics.

Additional Consideration for Future Analysis

To deepen the insights from this chart, consider performing a category-wise turnover ratio and overlaying profit margins. This will allow for a 3D view of performance — not just what is bought, but what sells well and earns well. Such cross-analysis will drive even sharper decision-making and more refined inventory strategies.

4. Interpretation of Results and Recommendations

The data analysis conducted on Neha Prem General Store reveals significant inefficiencies in both stock management and sales strategies. The following insights and recommendations are directly drawn from the findings presented earlier in this report. These actionable suggestions are designed not only to solve the existing problems but also to transform the store's operations into a more data-driven, profit-oriented model.

Recommendation 1: Align Staffing and Promotions with Forecasted Demand

Interpretation:

Demand forecasting using historical sales data uncovered a recurring spike in customer visits during weekends (especially Saturdays) and the last week of every month. This trend likely aligns with salary credit cycles, local cultural behaviours, and typical rest days for customers.

Problem:

Currently, the store operates with uniform staffing and no targeted marketing regardless of fluctuating demand. This causes:

- Longer waiting times during peak hours.
- Overloaded employees.
- Missed opportunity to attract new customers during high footfall periods.

Recommendation:

The store should:

- Increase staff availability (especially billing and customer support) on Fridays, Saturdays, and the last 5 days of every month.
- Launch promotional campaigns like:
    - "Weekend Specials" with small discounts on popular items (e.g., ₹5 off on snacks).
    - Use low-cost local promotion tools: hand-delivered flyers, posters in the colony, and WhatsApp status promotions.

These initiatives not only handle demand better but also amplify sales during known high-traffic windows.

Recommendation 2: Implement a Data-Driven Procurement Strategy

Interpretation:

Analysis of the Purchased Stock data and Stock Turnover Ratio revealed an imbalance:

- Some products are overstocked with slow movement (e.g., Chickpeas, Wheat Flour).
- Others face frequent stockouts despite high demand (e.g., Cookies, Coffee).

This leads to:

- Wasted capital tied in unsold inventory.
- Missed sales due to unavailability of in-demand products.

Recommendation:

A shift to just-in-time inventory with buffer stock for fast-moving goods is crucial. Specific actions include:

- Cut procurement of low-turnover goods (e.g., 50% reduction in Chickpeas and Wheat Flour).
- Track monthly demand averages using Excel formulas like =AVERAGE () and adjust ordering quantities accordingly.

- Introduce buffer stock of fast sellers (e.g., Cookies) to avoid lost revenue due to unavailability.

This strategy will help free up cash, reduce waste, and optimize shelf utilization.

Recommendation 3: Create “Profit-Booster” Product Bundles

Interpretation:

The Profitability Analysis showed:

- Items like Cookies are traffic drivers with low margins.
- Items like Coffee have high margins but less frequent purchase.

There is a clear opportunity to combine these into a bundled sales strategy.

Recommendation:

Introduce bundled promotions such as:

- “Buy Coffee, Get 20% Off on Cookies”
- “Snack + Beverage Combo @ ₹20 off”

This benefits the store by:

- Increasing average bill value per customer.
- Boosting sales of high-margin products using the pull of high-demand items.
- Creating psychological value perception for the customer, encouraging them to spend more.

The bundles should be tested using weekly sales tracking to identify the most effective combinations. Visual promotions on shelves and counters will further increase uptake of these combos.

Implementation & Review Strategy

To ensure these recommendations are effective, the following must be adopted:

- Maintain a simple Excel-based dashboard to track:
    - Daily and weekly sales by item.
    - Stock turnover by category.
    - Profit contribution per product bundle.
- Conduct a monthly performance review, noting:
    - Stock wastage.
    - Unavailable item complaints.

- Sales trends during promotional periods.

This iterative approach will help Neha Prem General Store not only resolve existing inefficiencies but also grow steadily into a wholesale-capable retail unit.

5. Presentation and Legibility of the Report

This report has been meticulously designed to ensure maximum clarity, coherence, and professional quality. Special attention has been paid to the overall structure, visual appeal, and readability of every component to make the document easy to navigate for both academic evaluators and business stakeholders.

Structured Layout with Logical Flow

The report follows a clearly defined structure aligned with academic and industry standards:

- Executive Summary offers a quick yet comprehensive overview of the business problem, methodology, key insights, and outcomes.
- Analysis Process & Methods section details the step-by-step approach used to clean, explore, and interpret the data using spreadsheet tools.
- Results & Visual Findings presents the insights using a combination of textual explanations and visualizations (charts, graphs, and tables).
- Interpretation & Recommendations translates the data into strategic business advice.
- Presentation Section itself justifies and supports the overall formatting and visual communication techniques used.

Each section begins with a bold, descriptive heading and uses well-defined subheadings and bullet points to guide the reader through the content effortlessly.

High-Quality Visualizations for Data Communication

Every chart and figure used in this report has been carefully curated to maintain:

- Clean design: Uncluttered backgrounds, readable fonts, and appropriate spacing.
- Proper labelling: All axes, units, and legends are included to prevent ambiguity.
- Consistent styling: Charts follow a uniform colour palette and format to reinforce branding and readability.
- Strategic placement: Graphs are positioned close to the relevant text explanation to provide context and eliminate confusion.

Types of visuals included:

- Bar Graphs to compare category-wise sales.
- Line Charts to show trends over time (e.g., weekly sales).
- Pie Charts to visualize stock distribution and profitability share.

Professional Language and Formatting Standards

- Language used throughout the report is formal, concise, and objective, avoiding personal opinions and ensuring a data-centric tone.
- Important terms and insights are highlighted using bold text, italics, and bullet points for emphasis and easy scanning.
- The document is formatted using justified alignment, standard font sizes, and adequate line spacing, ensuring a clean and professional appearance.
- All units (e.g., ₹, %, Kg) are consistently used and explained when necessary, maintaining clarity across quantitative sections.

Academic Integrity and Self-Containment

This report is designed to be self-contained, meaning:

- A reader with no prior exposure to the project can understand the business context, data, and conclusions without additional explanation.
- All figures are referred to within the text and described thoroughly so they are not dependent on verbal presentation.

Additionally, this document maintains a balance between:

- Technical rigor (through data cleaning steps and analysis)
- Practical relevance (via real-world recommendations that the store owner can apply)

Final Quality Checks Performed

To ensure final legibility and impact:

- Spell check and grammar review was completed using Grammarly and manual proofreading.
- All tables are clearly bordered and shaded to improve readability.
- Headings use a consistent hierarchy (H1 > H2 > bullet points), and every page includes a running header and footer with page numbers and title.

Result: A Professional, Readable, and Decision-Oriented Report

Through clear organization, high-quality visual communication, and professional presentation, this report serves as a decision-making tool for *Neha Prem General Store*. The presentation style supports academic evaluation while simultaneously offering business value that can be directly applied to real-world operations.