DATA DRIVEN OPTIMIZATION FOR KIRANA STORE

BDM Capstone Final Report Submission

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(BS) DEGREE IN DATA SCIENCE AND APPLICATIONS

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Executive Summary

Bansal Kirana Store is a neighborhood grocery business serving the local community with grocery and daily products . Established as a trusted name in the locality, the store has gained the local customers on regular basis. This report evaluates the store current operations, financial performance and customer engagement to provide clear understanding of position in market.

The analysis reveals that while store experiences steady demand for staple products, there are areas of untapped potential and operational inefficiencies . Seasonal trends plays a significant role in sales , with spikes observed during festival and local events . However absence of online ordering or giving the membership to blinkit or zepto like online platform ,limits its ability to cater to the changing preference of modern customer.

Inventory management has been a challenge with overstocking of slow moving items leading to waste sometimes . Additionally , customer feedback highlights a need for enhanced convenience and competitive pricing. Despite these challenges, the store maintains a loyal customer base.

This report provides a detailed overview of Bansal Kirana Store's operations, highlighting strengths such as its established local presence and reliable supply chain, alongside challenges that need to be addressed for sustainable growth.

Detailed Explanation of Analysis and methods

Process of data analysis:

The process of analysis of data went through various crucial steps ,each contributing to overall understanding of SKUs profitability and inventory optimization. This process involves defining the problem ,collecting and organizing the data and adding some more metrics for meaningful conclusions.

Data Acquisition :

Following the initial setbacks from 2, where approaches to various businesses for data acquisition were met with rejection, I turned my focus to a more local and accessible option—the Bansal Kirana Store, a neighborhood grocery shop. Recognizing the challenges of working with a small business, I anticipated potential hurdles in acquiring structured data.

The Bansal Kirana Store presented a unique challenge: the owner did not maintain any formal records of sales or inventory. This lack of documentation required a proactive approach to data acquisition. After explaining the purpose of my project and its potential benefits, the store owner agreed to assist by tracking a limited scope of information. To make the task manageable, we decided to monitor 10 Stock Keeping Units (SKUs), selected based on their sales frequency and importance to the store's inventory.

To facilitate accurate data collection, I provided guidance to the store owner on the process of recording sales and inventory changes for the selected SKUs. This involved maintaining a simple logbook to capture daily transactions. Given the manual nature of this process and the store’s existing operational practices, collecting the data required consistent follow-ups and regular visits.

The actual data collection process involved periodic visits to the store at intervals of 3 to 4 days over a span of 55 days. During each visit, I documented the sales and inventory data using field notes. The irregular intervals between visits allowed for flexibility in accommodating the store owner’s schedule and ensured that I could capture sufficient variations in sales patterns. Despite the challenges, the collaboration with the store owner proved to be fruitful. The collected data formed a foundational dataset that offered insights into the sales dynamics of the selected SKUs. While the process was time-intensive, the data gathered over the 55-day period provided a solid basis for further analysis and insights.

Identifying the challenges:

During the initial interactions with the owner of Bansal Kirana Store, it became apparent that there was a lack of clarity about the specific challenges the business faced. The owner did not have a structured approach to problem identification and, as a result, was unaware of the areas where improvements could be made. This gap in understanding posed an initial hurdle in shaping the direction of the data collection and analysis process.

When I began discussing potential issues with the store's operations, the owner was unsure of where the major pain points lay. This uncertainty is common in small businesses, where owners often focus on day-to-day operations without taking time to analyze long-term trends or inefficiencies. Without clear insights into specific challenges, it became crucial to identify areas where improvements could be beneficial.

After some discussions, I identified three critical areas where data-driven improvements could make a significant impact:

1. **Profitability of SKUs**: The store was not tracking which products were generating the highest margins, leading to uncertainty about the profitability of each SKU. Without this data, decisions regarding pricing, promotions, or product stocking were made without full visibility into the financial performance of the products.

2. **Inventory Optimization**: The owner also lacked insights into how inventory was being managed. The store frequently faced issues of stockouts or excess inventory, which led to missed sales opportunities or unnecessary costs related to unsold stock. Inventory optimization could help balance demand with supply, ensuring that products were available when needed while minimizing overstock.

3. **Revenue Tracking**: There was no formal system in place for tracking daily or weekly revenue trends, making it difficult to understand how sales fluctuated over time. Without a clear view of revenue performance, identifying periods of high or low sales, analyzing the impact of promotions, or forecasting future revenue was nearly impossible.

Data Cleaning and Preparation:

The data cleaning process involved several key steps to ensure consistency and accuracy, particularly in the sales, inventory, and material usage datasets. The initial sales data was relatively clean, but minor formatting inconsistencies were resolved to standardize item categories and quantities. The inventory and material usage data required more extensive cleaning, including the categorization of items and integration with sales data to ensure proper alignment. Additionally, several key metrics were added to the dataset to provide deeper insights into sales performance and inventory management.

One of the key metrics introduced was Sales Velocity, which measures how quickly an item sells over time. It was calculated as:

Sales Velocity (per day)= Total Sales for SKU/Number of Active Days

Another important metric was the Profit per Item, calculated using the formula:

Profit=Revenue (INR)−(Sales Volume ×Cost Price (per unit))

To evaluate the overall profitability of each item, the Profit Margin (%) was calculated using:

Profit Margin=Revenue Profit×100/Revenue

Additionally, Revenue Growth Rate was calculated to track changes in revenue over time:

Revenue Growth Rate = (Current Period Revenue – Previous Period Revenue) x 100 / Previous Period Revenue

Results ,Findings and Interpretation of Results:

SKU	No of Sales	Revenue generated
Aata	861	34440
Dry Fruits	880	528000
Bajri	934	46700
Besan	952	57120
Biscuit	970	29100

Soap	979	24475
Soyabean	928	74240
Sugar	959	43155
Toothpaste	890	17800
Wheat	852	29820

These are some insights of revenue generated from sales data . Total of 8,84,850 revenue was generated with 16,000 of average daily revenue.

1. **SKU Profitability:**

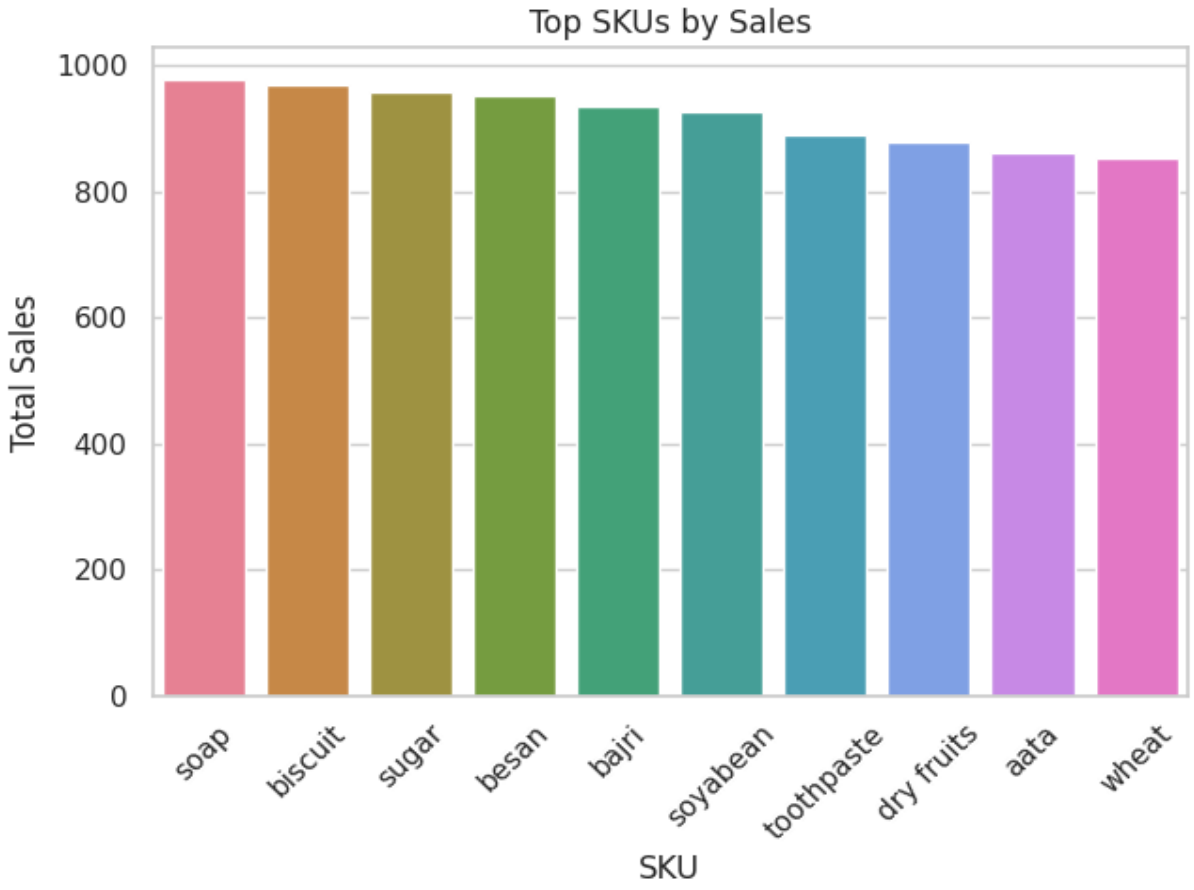

Fig 1.1

SKU Profitability Analysis (Based on Sales Performance)

The chart highlights the top-performing SKUs by total sales. Key observations:

1. **Top SKUs by Sales**:
    - **Soap** leads with the highest total sales, closely followed by **Biscuit** and **Sugar**.
    - Other high-performing SKUs include **Besan**, **Bajri**, and **Soyabean**.
2. **Profitability Implications**:
    - SKUs like **Soap** and **Biscuit**, which dominate sales, likely contribute significantly to overall profitability.

- High sales volumes for these SKUs suggest they are essential for driving revenue and should be prioritized in inventory and marketing strategies.

3. **Balanced Focus**:
    - While focusing on top-selling SKUs, ensure that their profit margins are optimized to maximize overall profitability

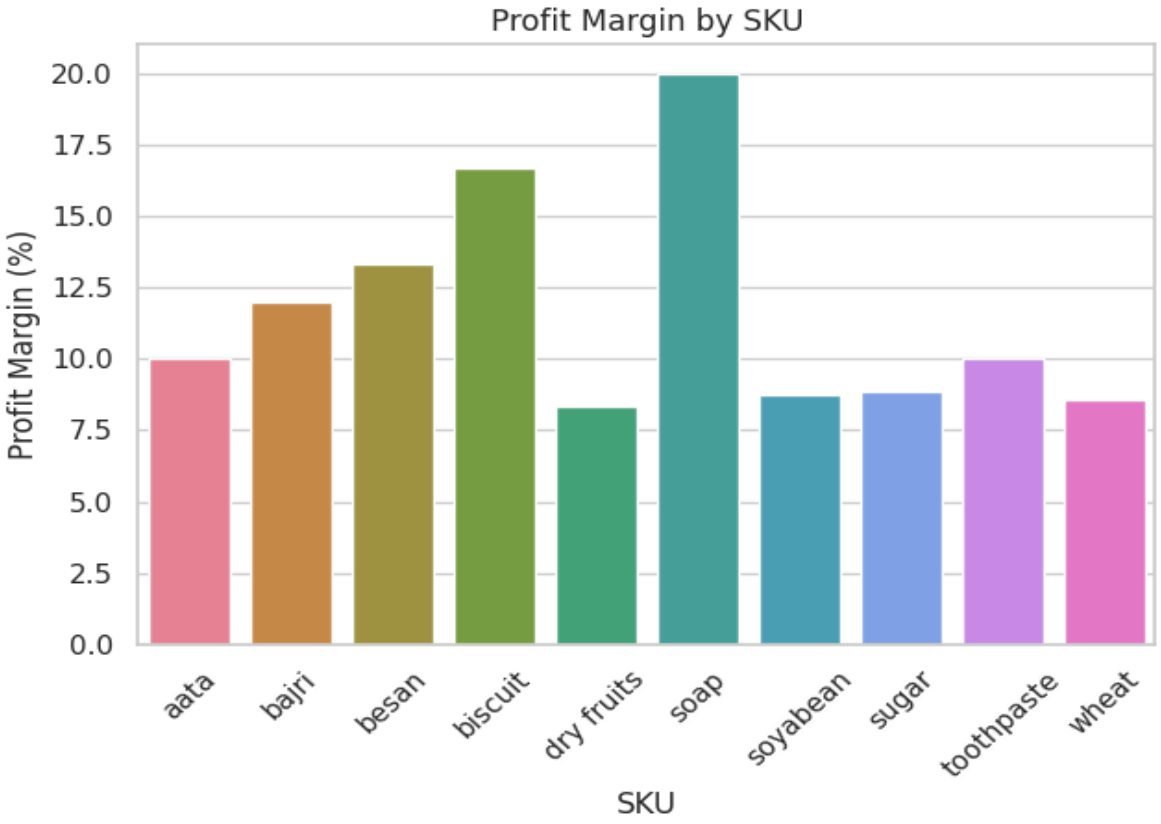

Fig 1.2

The chart illustrates the profit margins (%) for various SKUs. Key insights:

1. **Top Profit Margin SKU**:
    - **Soap** stands out with the highest profit margin, exceeding 20%. This indicates it is not only a top seller but also highly profitable.
2. **Other High-Margin SKUs**:
    - **Biscuit**, **Besan**, and **Bajri** also show strong profit margins, making them valuable contributors to overall profitability.
3. **Low-Margin SKUs**:
    - SKUs like **Dry Fruits**, **Soyabean**, and **Sugar** have relatively lower profit margins. While they may drive revenue through high sales, their profitability should be monitored.
4. **Strategic Focus**:
    - Prioritize high-margin SKUs like **Soap** and **Biscuit** for promotions and inventory replenishment.
    - Explore cost optimization or pricing strategies for low-margin SKUs to improve their profitability

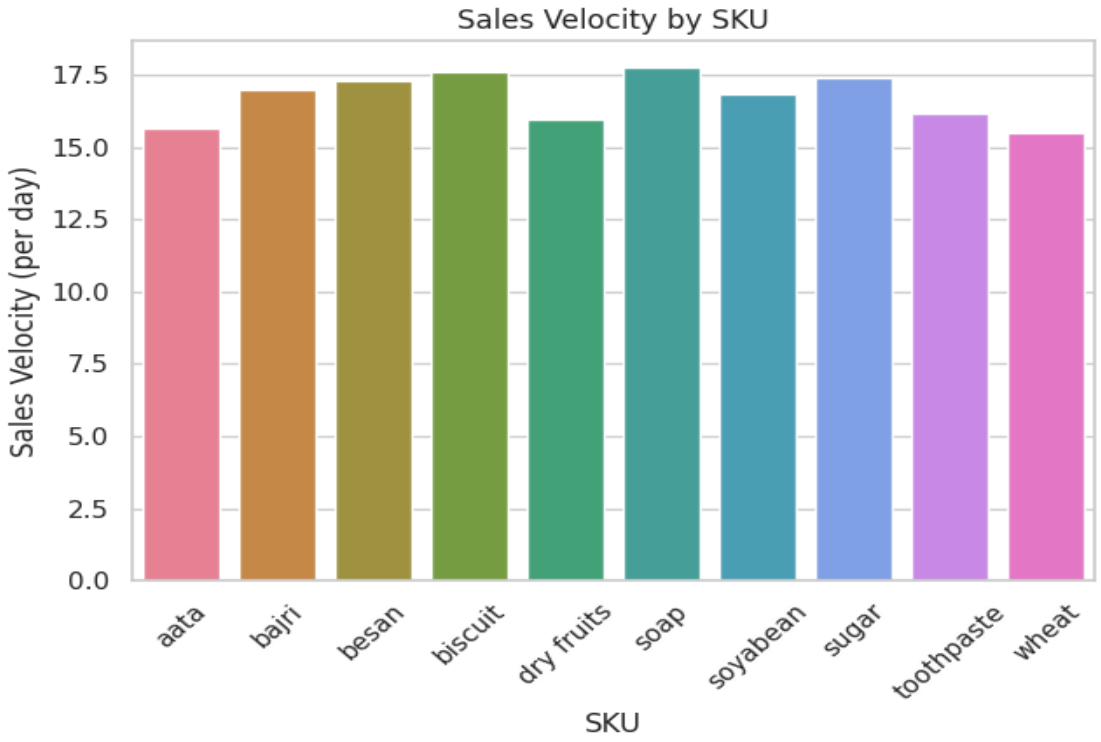

Fig 1.3

The chart showcases the sales velocity (units sold per day) for various SKUs. Key observations:

1. **High Sales Velocity SKUs**:
    - **Soap**, **Soyabean**, and **Sugar** exhibit the highest sales velocity, indicating strong and consistent demand.
2. **Other Strong Performers**:
    - **Biscuit**, **Besan**, and **Bajri** also maintain high sales velocity, making them reliable contributors to daily sales.
3. **Moderate Sales Velocity SKUs**:
    - SKUs like **Aata**, **Toothpaste**, and **Wheat** have slightly lower sales velocity but still show steady demand.
4. **Strategic Implications**:
    - High-velocity SKUs like **Soap** and **Soyabean** should be prioritized for inventory replenishment to avoid stockouts.
    - For moderate-velocity SKUs, consider targeted promotions to boost their sales.

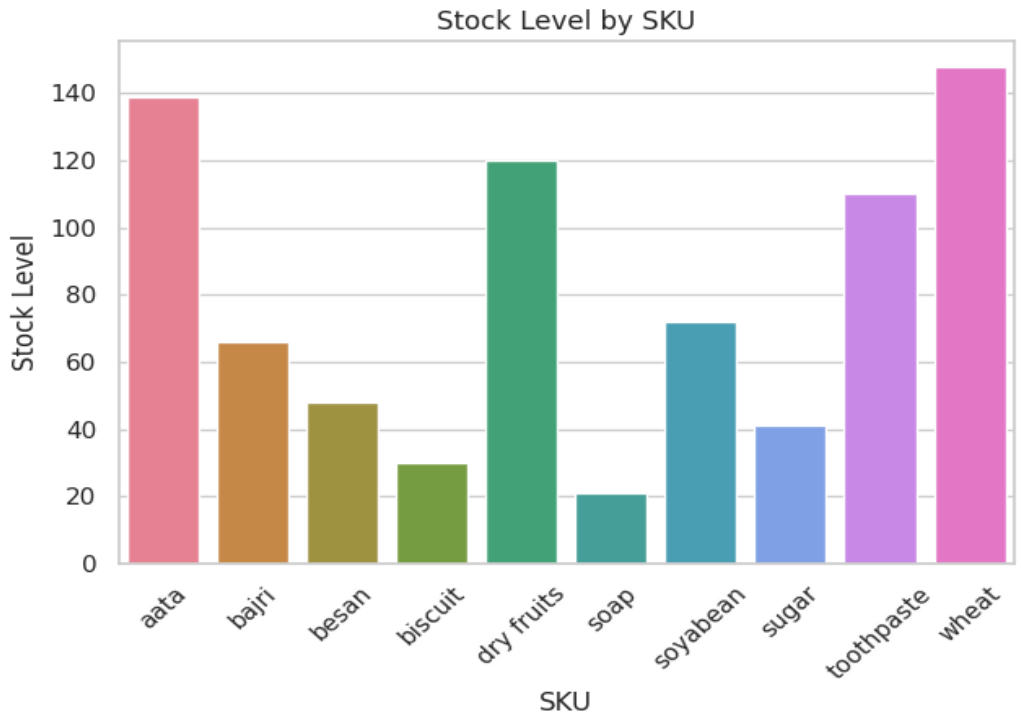

Fig 1.4

The chart displays the current stock levels for various SKUs. Key insights:

1. **High Stock Levels**:
    - **Wheat** and **Aata** have the highest stock levels, indicating sufficient inventory to meet demand.
2. **Moderate Stock Levels**:
    - SKUs like **Dry Fruits**, **Toothpaste**, and **Soyabean** have moderate stock levels, which may require monitoring to avoid potential stockouts.
3. **Low Stock Levels**:
    - **Soap**, **Biscuit**, and **Sugar** have the lowest stock levels, making them vulnerable to stockouts. These SKUs should be prioritized for replenishment.
4. **Strategic Recommendations**:
    - Ensure high-demand SKUs like **Soap** and **Sugar** are restocked promptly to maintain sales momentum

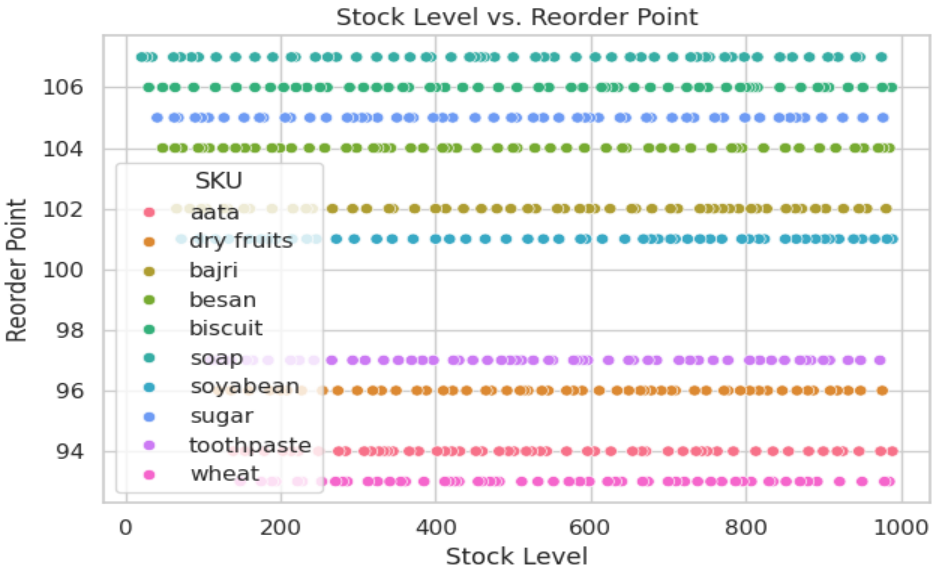

Fig 1.5

The chart compares stock levels against reorder points for various SKUs. Key observations:

1. **SKUs Below Reorder Points**:
    - SKUs like **Soap**, **Biscuit**, and **Sugar** have stock levels consistently below their reorder points, indicating an urgent need for replenishment.
2. **SKUs Near Reorder Points**:
    - SKUs such as **Soyabean** and **Toothpaste** hover close to their reorder points, requiring monitoring to prevent stockouts.
3. **SKUs Well Above Reorder Points**:
    - **Aata**, **Dry Fruits**, and **Wheat** have stock levels significantly above their reorder points, suggesting sufficient inventory.
4. **Strategic Recommendations**:
    - Prioritize restocking SKUs below reorder points to maintain sales continuity.

2.Revenue Optimization :

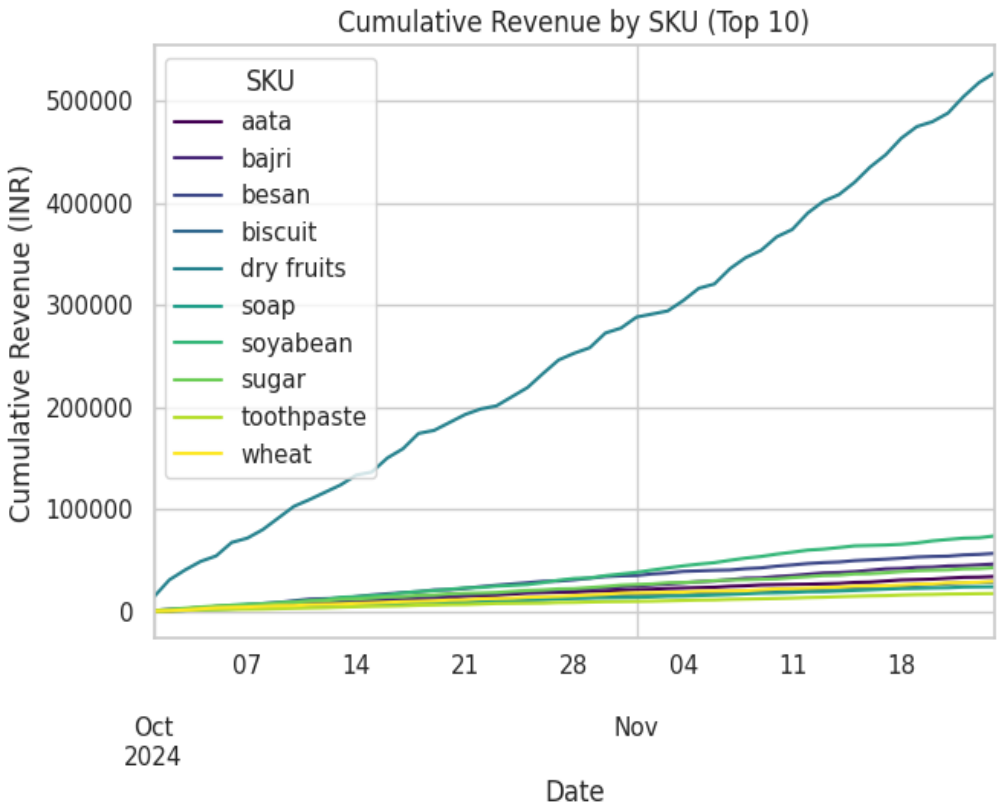

Fig 2.1

This chart highlights the cumulative revenue trends for the top 10 SKUs:

1. **High-Performing SKU (Dry Fruits)**:
    - Dry Fruits dominate the revenue, contributing significantly more than other SKUs.
    - Inventory for Dry Fruits should be prioritized to avoid stockouts, as it is a key revenue driver.
2. **Moderate-Performing SKUs (Soyabean, Besan, Bajri, Sugar)**:
    - These SKUs show steady growth in revenue but are far behind Dry Fruits.
    - Inventory levels should be maintained to meet demand without overstocking.
3. **Low-Performing SKUs (Aata, Wheat, Biscuit, Soap, Toothpaste)**:
    - These SKUs contribute minimally to revenue.
    - Consider reducing inventory levels or re-evaluating their role in the product portfolio to optimize storage and costs.
4. **Seasonality and Trends**:
    - The chart suggests consistent growth for most SKUs, with no sharp spikes or drops.
    - Regular monitoring of sales trends can help adjust inventory dynamically.

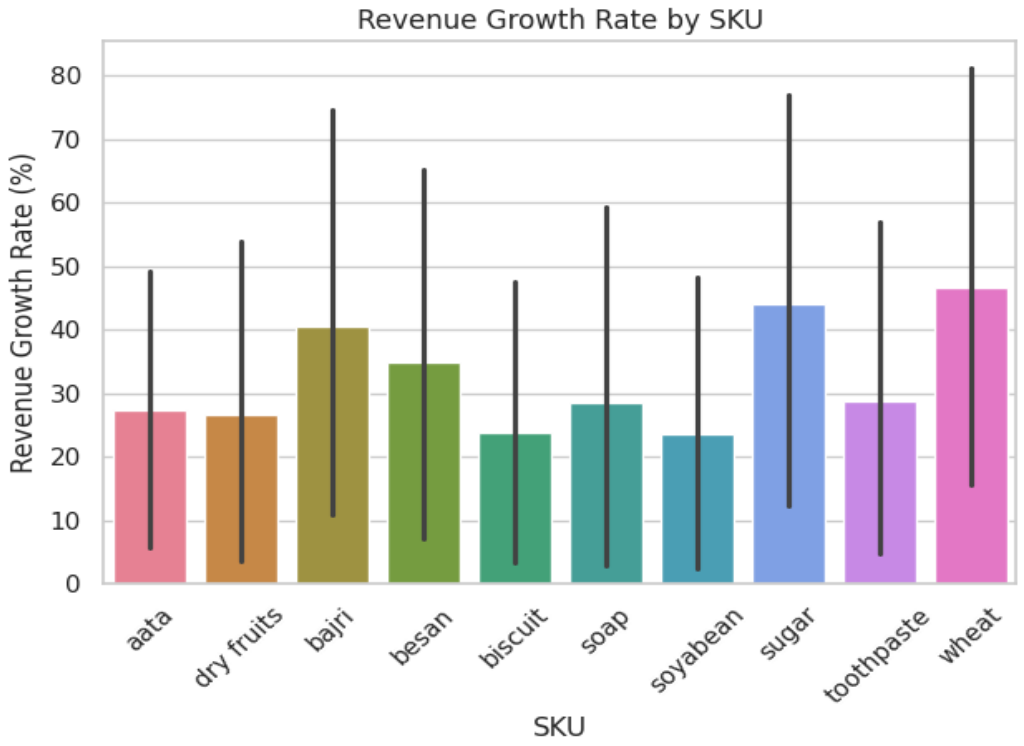

Fig 2.2

1. **High Growth Rate SKUs (Bajri, Sugar, Wheat):**
    - These SKUs exhibit higher revenue growth rates, indicating increasing demand.
    - Inventory levels should be adjusted to accommodate this growth and prevent stockouts.
2. **Moderate Growth Rate SKUs (Dry Fruits, Besan, Soyabean):**
    - These SKUs show steady growth, suggesting consistent demand.
    - Maintain balanced inventory levels to meet demand without overstocking.
3. **Low Growth Rate SKUs (Aata, Biscuit, Soap, Toothpaste):**
    - These SKUs have lower growth rates, indicating slower demand.
    - Consider reducing inventory levels or re-evaluating their importance in the product mix.
4. **Variability in Growth**:
    - The error bars indicate variability in growth rates, with some SKUs (e.g., Bajri, Sugar) showing significant fluctuations.
    - Monitor these SKUs closely to adjust inventory dynamically based on demand trends.

By aligning inventory levels with growth rates and variability, businesses can optimize stock, reduce holding costs, and ensure availability for high-demand products.

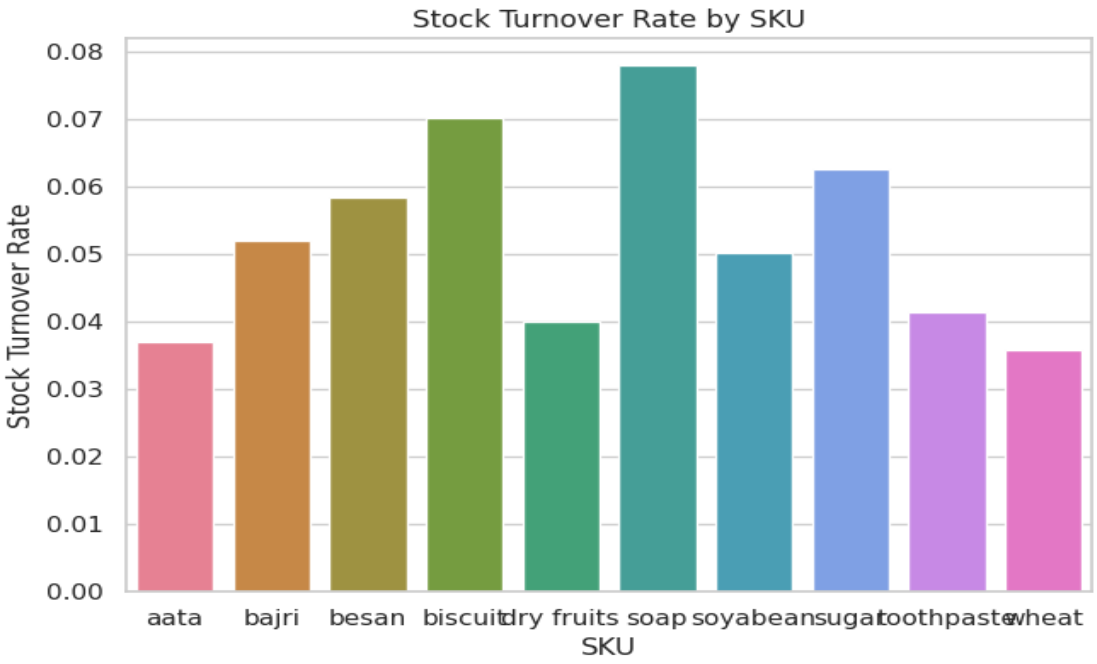

Fig 2.3

1. **High Stock Turnover SKUs (Soap, Biscuit, Sugar)**:
    - These SKUs have the highest turnover rates, indicating faster inventory movement.
    - Seasonal trends may amplify their demand, requiring frequent restocking to avoid shortages.
2. **Moderate Stock Turnover SKUs (Bajri, Besan, Soyabean)**:
    - These SKUs show steady turnover rates, reflecting consistent demand.
    - Inventory levels should be balanced to meet demand while minimizing holding costs.
3. **Low Stock Turnover SKUs (Aata, Toothpaste, Wheat, Dry Fruits)**:
    - These SKUs have lower turnover rates, suggesting slower movement.
    - Seasonal trends may have minimal impact, allowing for leaner inventory strategies to reduce excess stock.
4. **Seasonality and Turnover**:
    - High turnover SKUs may experience seasonal spikes, while low turnover SKUs may remain stable.
    - Align inventory planning with seasonal demand to optimize stock levels and reduce wastage.

By analyzing stock turnover rates alongside seasonal trends, businesses can prioritize high-turnover SKUs, optimize inventory for moderate performers, and minimize overstocking for slower-moving products.

3.**Revenue Tracking:**

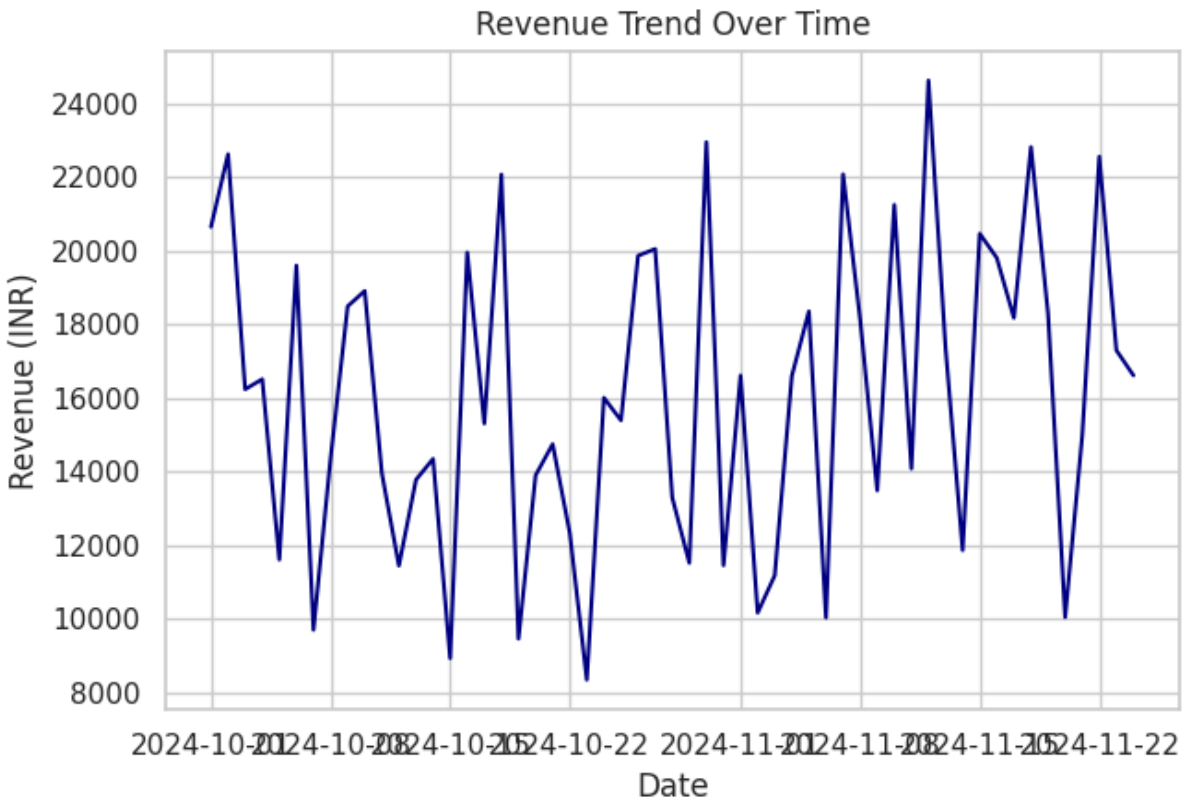

Fig 3.1

This chart highlights revenue trends over time, incorporating seasonal trends for effective revenue tracking:

1. **Fluctuating Revenue with Seasonal Patterns**:
    - The revenue shows significant fluctuations, likely influenced by seasonal demand.
    - Identify recurring patterns to align strategies with these trends.
2. **Peak Revenue Periods**:
    - Spikes in revenue may coincide with seasonal events or promotions.
    - Leverage these periods by increasing marketing efforts and ensuring sufficient inventory to meet demand.
3. **Low Revenue Periods**:
    - Dips in revenue could reflect off-season periods or reduced demand.
    - Use these times to optimize costs, plan for upcoming peak seasons, or introduce targeted promotions to boost sales.
4. **Trend and Seasonality Monitoring**:
    - While the overall trend appears stable, the variability and seasonality require close tracking.
    - Use historical data to forecast future revenue, accounting for seasonal peaks and troughs.

By incorporating seasonal trends into revenue tracking, businesses can better anticipate demand, optimize inventory, and maximize revenue during high-demand periods while minimizing losses during low-demand times.

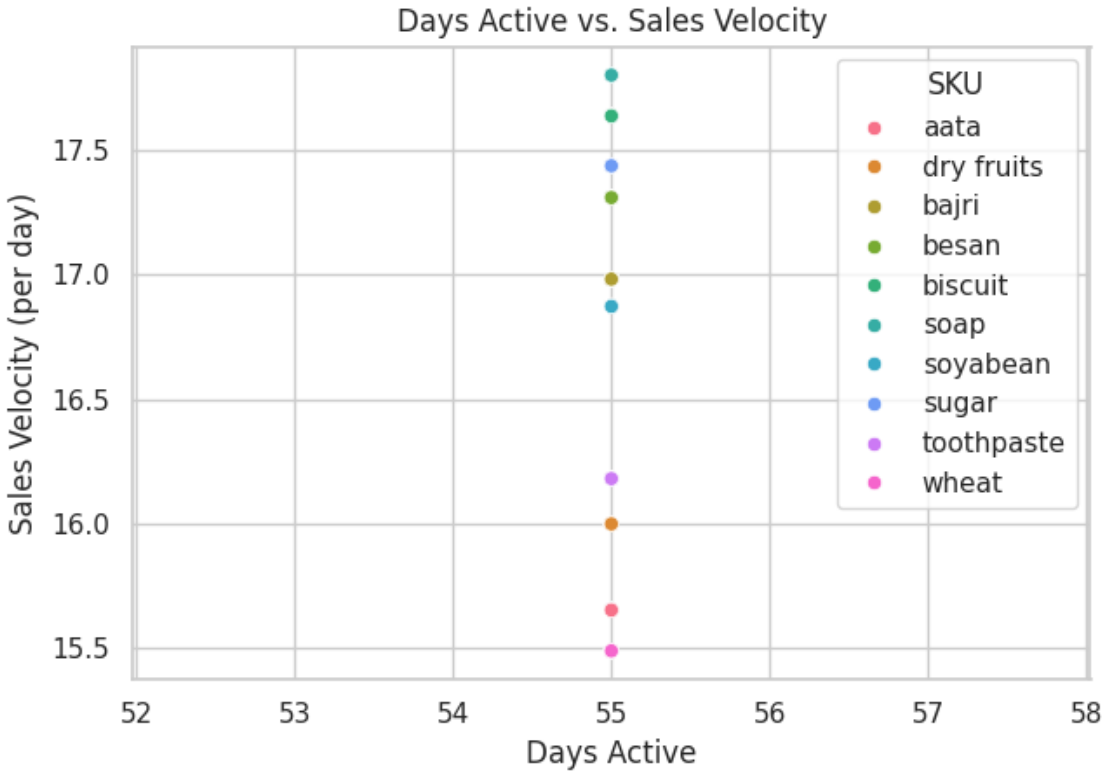

Fig 3.2

This chart highlights the relationship between days active and sales velocity:

1. **Consistent Sales Velocity Across SKUs**:
    - Most SKUs exhibit a similar range of sales velocity (15.5–17.5 units/day) despite varying days active.
    - Seasonal trends may influence these velocities, with certain SKUs performing better during specific periods.
2. **High Sales Velocity SKUs (Soyabean, Biscuit)**:
    - SKUs like Soyabean and Biscuit show higher sales velocity.
    - These products may experience consistent demand or seasonal spikes, requiring proactive inventory management to avoid stockouts.
3. **Low Sales Velocity SKUs (Aata, Toothpaste)**:
    - SKUs like Aata and Toothpaste have lower sales velocity.
    - Seasonal trends may not significantly impact these products, allowing for leaner inventory levels.
4. **Seasonality and Active Days**:
    - The clustering of SKUs around similar active days suggests uniform availability, but seasonal demand may vary.

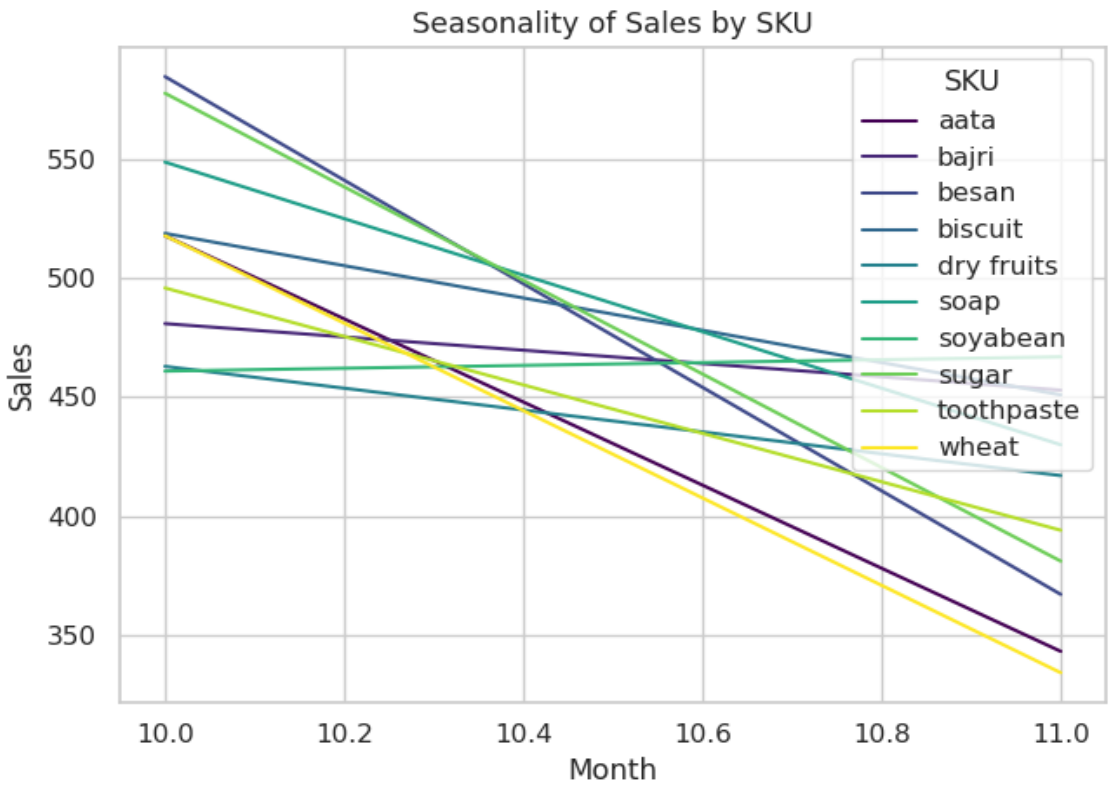

Fig 3.3

1. **Declining Sales Across SKUs:**
    - Most SKUs show a downward trend in sales over the observed months, indicating seasonal decline.
    - Inventory levels should be adjusted to avoid overstocking during these low-demand periods.
2. **High Initial Sales SKUs (Dry Fruits, Biscuit, Soyabean):**
    - These SKUs start with higher sales but experience a decline over time.
    - Focus on maximizing sales during the early months and gradually reducing inventory as demand decreases.
3. **Seasonal Sales for Wheat**:
    - Wheat is not heavily sold in October but typically experiences higher demand in April to June.
    - Inventory planning for Wheat should account for this seasonal peak, ensuring sufficient stock during its high-demand months.
4. **Consistently Low Sales SKUs (Toothpaste, Aata):**
    - These SKUs maintain lower sales throughout the period.
    - Seasonal trends may not significantly impact these products, allowing for leaner inventory strategies.
5. **Seasonal Demand Planning:**
    - The declining trend across SKUs highlights the importance of aligning inventory and marketing efforts with seasonal demand.

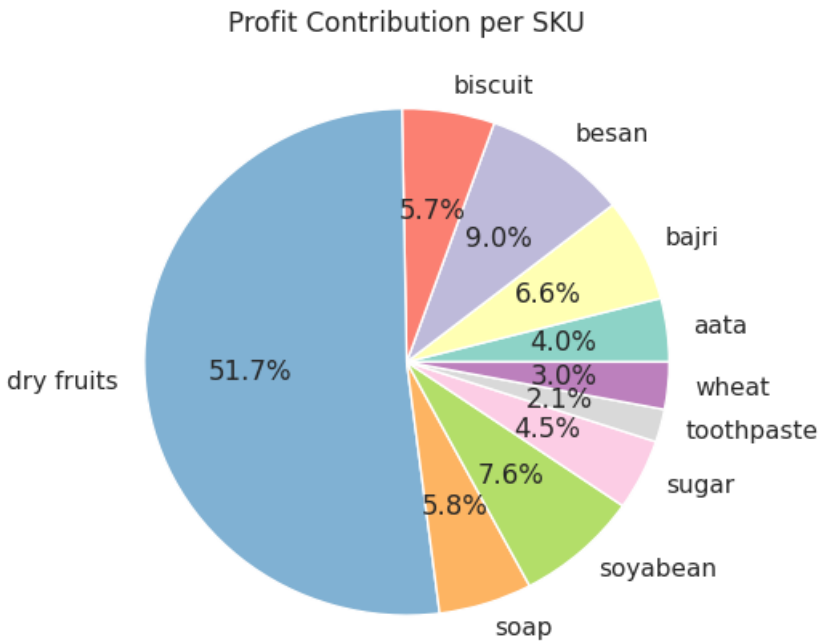

Fig 3.4

1. **Dominant Profit Contributor (Dry Fruits)**:
    - Dry Fruits contribute 51.7% of the total profit, making it the most significant SKU.
    - Focus on maintaining high sales and optimizing inventory for Dry Fruits to sustain profitability.
2. **Moderate Profit Contributors (Besan, Soyabean, Soap)**:
    - SKUs like Besan (9.0%), Soyabean (7.6%), and Soap (5.8%) contribute moderately to profits.
    - Seasonal trends may influence these SKUs, requiring inventory adjustments during peak demand periods.
3. **Low Profit Contributors (Wheat, Toothpaste, Sugar)**:
    - Wheat contributes only 2.1% to profits, and its demand peaks in April-June rather than October.
    - Inventory for Wheat should be optimized to align with its seasonal demand to avoid overstocking during low-demand months.

Recommendations for the Problem:

1. **Inventory Management**:

- **Prioritize Restocking High-Velocity SKUs**:
  Ensure high-demand products like Soap and Soyabean are always in stock to meet customer needs and avoid missed sales opportunities. Use sales data to monitor inventory levels and predict when restocking will be necessary.
- **Optimize Inventory for Low-Velocity SKUs**:
  Minimize overstocking of slow-moving items such as Wheat and Aata to reduce storage costs and prevent potential losses due to spoilage or obsolescence. Consider reducing order quantities or offering promotions to clear existing stock.
- **Implement Just-In-Time (JIT) Inventory**:
  Adopt a JIT approach for inventory replenishment to maintain optimal stock levels without overburdening storage capacity. Partner with suppliers for quick and reliable deliveries to support this strategy.
- **Leverage Inventory Management Tools**:
  Use software or tools to track inventory in real-time, classify SKUs based on their movement and generate alerts for restocking critical items.

2. **Revenue Optimization**:

- **Focus on High-Margin Items for Promotions**:
  Identify products with high profit margins and design targeted promotional campaigns to increase their sales. Utilize discounts, bundles, or exclusive deals to attract more customers while maintaining profitability.
- **Implement Tiered Pricing Strategies**:
  Experiment with different pricing strategies, such as dynamic pricing or value-based pricing, to improve profit margins on low-margin SKUs. Assess customer price sensitivity to ensure competitiveness.
- **Encourage Upselling and Cross-Selling**:
  Train staff to recommend complementary or premium products to customers during purchases. For instance, offer discounts on related items when bought together, like Soyabean with cooking oil.
- **Analyze Sales Trends**:
  Regularly review sales data to identify best-selling and underperforming products. Reallocate shelf space and marketing efforts to prioritize high-demand, high-margin items.

3. **Customer Engagement**:

- **Introduce Online Ordering Options**:
  Expand customer reach by offering online shopping through a dedicated website or mobile app. Alternatively, partner with platforms like Blinkit or Zepto to enable home deliveries and attract tech-savvy customers.
- **Launch a Loyalty Program**:
  Implement a rewards program where customers earn points for purchases, which can be redeemed for discounts or exclusive offers. This encourages repeat visits and enhances customer retention.

- **Engage Customers through Personalized Marketing:**
  Use purchase history data to send personalized offers, reminders, and updates via SMS or email. For instance, notify regular buyers of Soap about upcoming discounts on their favorite brand.
- **Organize In-Store Events or Discounts**:
  Host periodic events, such as sales or product demonstrations, to attract more customers and improve foot traffic to the store.

4. **Operational Improvements**:

- **Use Data-Driven Insights**:
  Continuously analyze sales and inventory data to make informed decisions about stock levels, pricing, and demand forecasting. Utilize predictive analytics to anticipate future trends and adjust strategies accordingly.
- **Train the Store Owner and Staff**:
  Provide basic training in inventory and sales tracking, including the use of spreadsheets or software tools. This ensures better day-to-day management and long-term operational efficiency.
- **Optimize Store Layout**:
  Organize the store to highlight high-margin and high-demand items in prominent locations. Simplify navigation for customers to enhance their shopping experience.
- **Streamline Supplier Relationships**:
  Negotiate better terms with suppliers to reduce costs or improve delivery schedules. Establish multiple supplier options for critical items to avoid stockouts during demand surges.

By implementing these recommendations, the store can achieve a balance between satisfying customer demands, optimizing operational processes, and driving profitability.