Optimizing inventory management and minimizing operational cost for enhancing business efficiency of a Cafeteria

BDM FINAL REPORT

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Declaration Statement

I am working on a Project titled “Optimizing inventory management and minimizing operational cost for enhancing business efficiency of a Cafeteria”. I extend my appreciation to TULASI BAKERY , for providing the necessary resources that enabled me to conduct my project.

I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered through primary sources and carefully analyzed to assure its reliability.

Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through thorough analytical procedures.

I am dedicated to adhering to the information of academic honesty and integrity, and I am receptive to any additional examination or validation of the data contained in this project report.

I understand that the execution of this project is intended for individual completion and is not to be undertaken collectively. I thus affirm that I am not engaged in any form of collaboration with other individuals, and that all the work undertaken has been solely conducted by me. In the event that plagiarism is detected in the report at any stage of the project's completion, I am fully aware and prepared to accept disciplinary measures imposed by the relevant authority.

I agree that all the recommendations are business-specific and limited to this project exclusively, and cannot be utilized for any other purpose with an IIT Madras tag. I understand that IIT Madras does not endorse this.

Soubhagya Nayak

1. Executive Summary and Title

The project titled "Optimizing Inventory Management and Minimizing Operational Costs for Enhancing Business Efficiency of a Cafeteria" focuses on improving the operational efficiency of TULASI BAKERY through data-driven methodologies. The primary objective is to streamline inventory management and reduce operational costs by leveraging targeted analysis and strategic decision-making.

The analysis revealed that prioritizing high-value items, such as cheese slices and cakes, is crucial for maintaining stock levels and minimizing waste. Key findings from the descriptive analysis indicated that cakes and foundational ingredients like puff pastry sheets and milk are significant in inventory management. Trend analysis showed stable sales quantities with minor fluctuations, and highlighted that while cakes and pastries are top-selling items, products like puff pastry sheets and milk experience notable wastage.

Recommendations include enhancing inventory control practices for high-value and perishable items to reduce waste and prevent stockouts. Adjusting purchasing strategies based on trend analysis insights can help forecast demand more accurately and align inventory levels with actual needs. Optimizing resource allocation by focusing on high-value items and managing lower-value items cost-effectively is also advised.

The project utilized Excel for descriptive and trend analysis, offering flexibility and visualization capabilities, while Python was employed for advanced data analysis, handling large datasets and performing complex calculations. This combination of tools demonstrated how strategic inventory management can enhance efficiency and reduce operational costs.

Ultimately, the project underscores the importance of integrating ABC Analysis, descriptive analysis, and trend analysis to optimize inventory practices, support profitability, and foster sustainable growth at TULASI BAKERY.

2. Detailed Explanation of Analysis Process/Methods

Data Acquisition: The process of data acquisition is a significant time-intensive endeavor that requires diligent efforts in laying the foundation of credibility with the businesses which requires cultivating trust and rapport with involved parties. My engagement spanned over 5 businesses, with initial meetings often limited to once or twice. An early misstep I recognized was approaching businesses with a direct request for data without having established a rapport which inadvertently led to resistance and reluctance in data sharing, highlighting the significance of building a relationship first.

Given the novelty of the situation, I faced difficulties in clarifying how I could be of assistance to them. This uncertainty extended to shaping my ability to provide precise guidance on data requirements that could translate into actionable insights for their business. The lack of clarity curtailed my ability to confidently explain how my analysis could contribute to their operational enhancement. Most stakeholders believed they comprehended their needs but encountered complexities in real-world scenarios that data analysis could not effectively address. Many were hesitant, convinced data analysis wouldn't offer novel insights.

Considering these challenges, I am committed to enhancing my preparatory efforts, allotting a substantial period for relationship-building and shared understanding. This includes dedicating ample time to immerse myself in the businesses, demonstrating genuine interest, and iteratively defining how data insights can enhance decision-making. Through regular engagements and an empathetic approach, I aim to establish a foundation of trust that underpins effective data acquisition and analysis. Finally, I successfully acquired data from a cooperative business owner, establishing one of the most important milestones in the journey of data analysis: data acquisition.

Identifying Challenges: The subsequent phase involved inquiring into the fundamental aspects of the business to identify specific challenges that required attention. Upon obtaining the initial dataset outlining the essential components of the business, it became evident that the owner was content with customer retention and profits. Consequently, the focus shifted towards analyzing the inventory management aspects of the business. The original files were backed up as a precautionary measure in case the data was accidentally deleted or lost.

Process of Data Analysis:
For this project, I focused on three main methods to improve inventory management at TULASI BAKERY: ABC Analysis, Descriptive Analysis, and Trend Analysis. These methods helped me break down the data in a practical way and pinpoint areas where we could optimize inventory control and reduce waste.

ABC Analysis: This was the first step I took to categorize the bakery's inventory into three groups—A, B, and C.
A items: These are the most valuable and essential products, like cheese slices and cakes. These items make up a big portion of the inventory costs, so I made sure they were always in stock and managed closely.
B items: These are moderately valuable products, which require a balanced approach—neither too much control nor too little.
C items: These are lower-value items that don’t need as much strict management, but we still need to keep an eye on them.

Using ABC Analysis, I prioritized where to allocate resources—focusing more on A items to prevent stockouts or wastage, while being more relaxed with C items.

Descriptive Analysis: I then moved on to descriptive analysis to get a clear picture of how inventory and sales had been performing.

I used historical data to understand things like stock levels, sales volumes, and turnover rates. For example, I could see how much cheese or flour was being sold over a period and whether certain items were being wasted more than others.
By analyzing these patterns, I could pinpoint issues, such as high wastage in certain perishable items, and understand which products were driving the most sales.

Trend Analysis: Finally, I used trend analysis to look for patterns in the data over time.
This helped me forecast future demand more accurately. For instance, I could see that sales of cakes stayed fairly steady but that there were some fluctuations in items like puff pastry sheets, which were wasted more often.
By looking at the trends, I also evaluated how well the bakery's inventory strategies were performing over time. This helped me figure out where adjustments were needed—like buying less of certain items or restocking high-demand products faster.

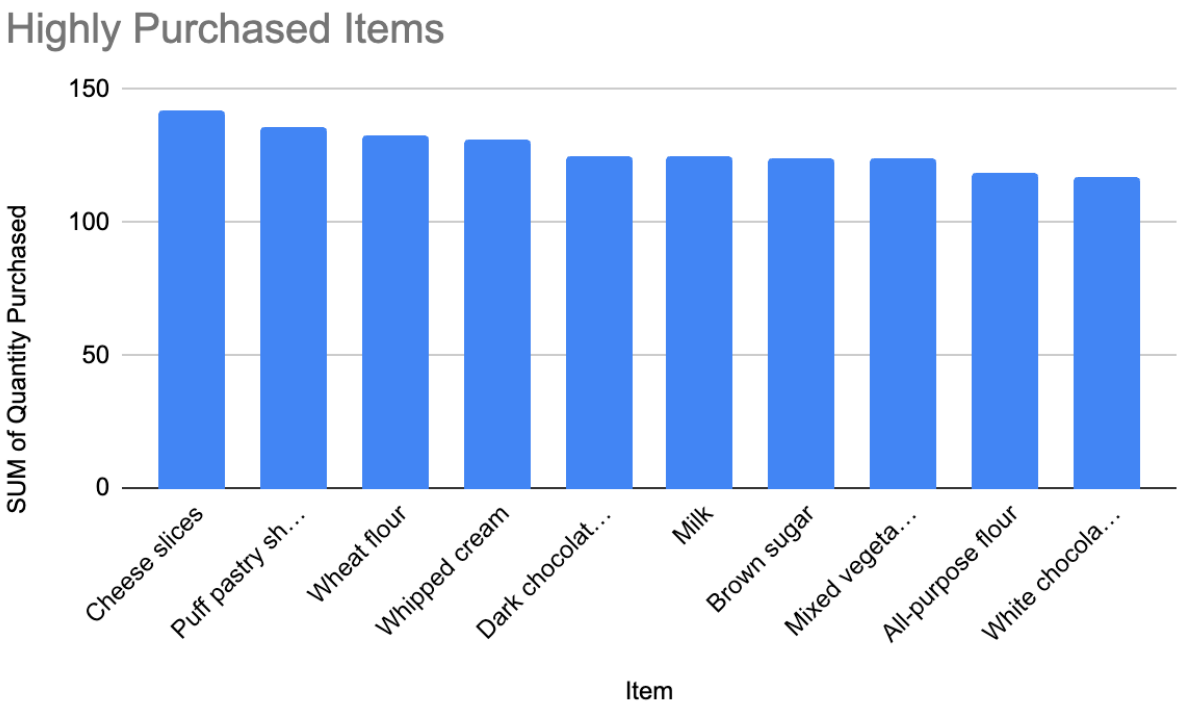
Tools I Used:
For the analysis, I worked with both Excel and Python.

Excel was great for quick summaries, charts, and visualizing data in a simple way, like seeing how stock levels changed over time. I used pivot tables and graphs to get a clearer understanding of the current inventory state and trends.
Python was super useful when I had to deal with larger datasets and more complex calculations. With libraries like Pandas and Matplotlib, I could dive deeper into the data and perform more advanced analysis, like predicting future sales based on past trends.
Putting It All Together:

By combining ABC Analysis with descriptive and trend analyses, I created a well-rounded approach to managing the bakery's inventory. This way, I could prioritize high-value items, spot waste issues early, and adjust the stock levels based on what the trends were telling me. Both Excel and Python worked together to provide a good mix of simple insights and more detailed predictions.

In the end, this approach helped TULASI BAKERY save on costs by reducing waste and making sure they always had the right amount of stock—especially for the products that mattered most.

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

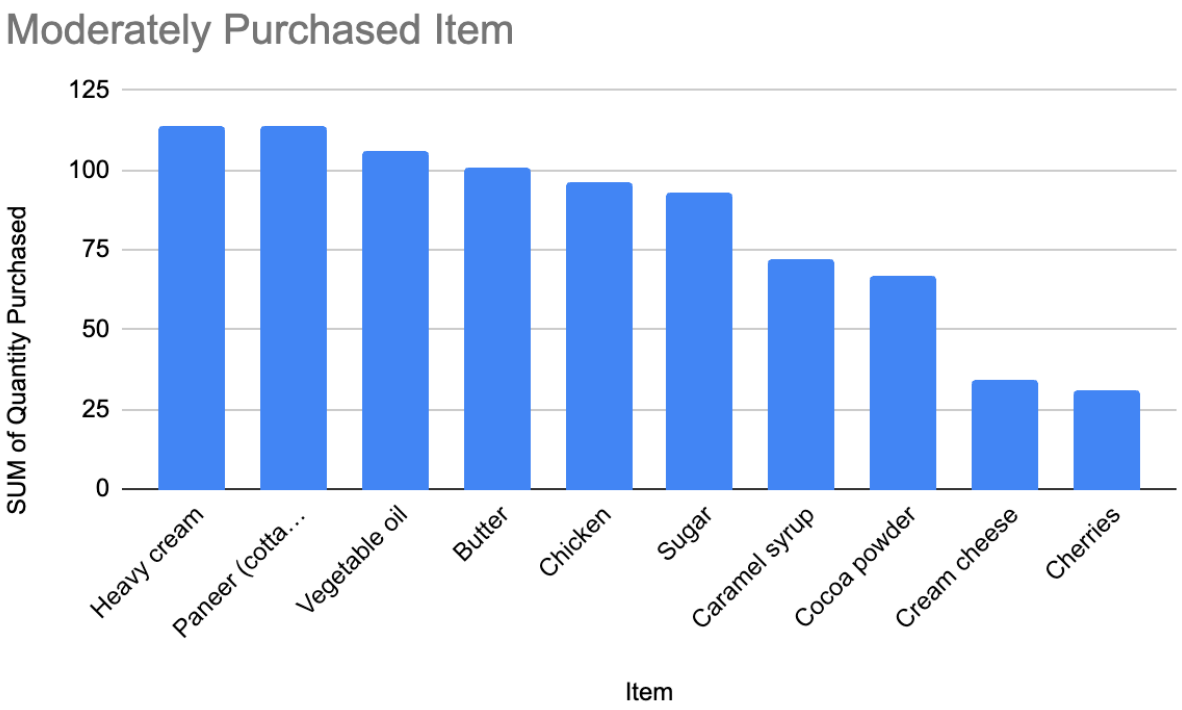


- "Cheese slices" are the most purchased item, making them a critical component for the bakery's operations, reflecting the popularity of cheese-based offerings.

- The purchase quantities of the top 10 items are quite similar, ranging from 100 to 140 units, indicating that all these items are essential and consistently in demand.

- After cheese slices, "Puff pastry sheets" and "Wheat flour" are the next most-purchased items, showcasing the bakery's reliance on foundational baking ingredients.
- The highly purchased list includes a variety of ingredients, such as dairy (whipped cream, milk), baking staples (wheat and all-purpose flour), and other essentials like brown sugar and mixed vegetables, highlighting the need for versatile inventory management.

- Both "Dark chocolate" and "White chocolate" make it to the top 10, underlining the importance of chocolate-based products in the bakery's offerings.



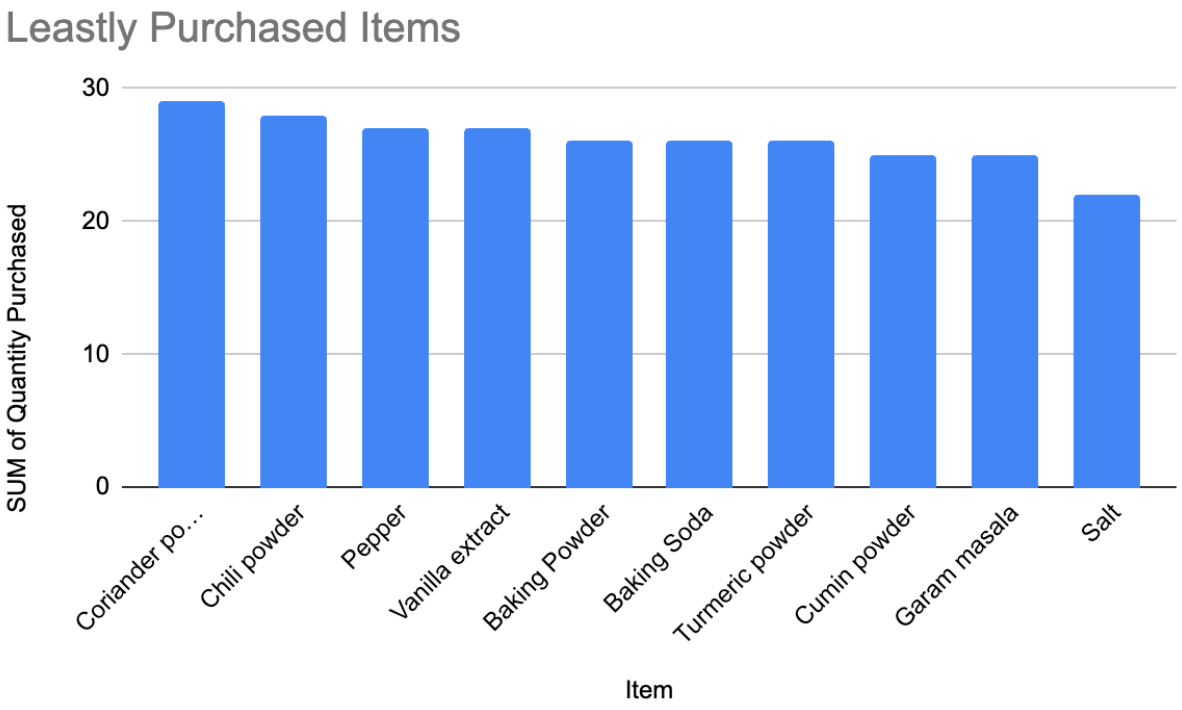
- "Heavy cream" is the top moderately purchased item, reflecting its importance for various baked goods and desserts, even though it is not among the top-tier items.

- "Paneer" (cottage cheese) and "Vegetable oil" are also highly purchased, indicating that these items play a key role in savory dishes and general food preparation.

- The list includes both baking essentials like butter and sugar, alongside cooking ingredients such as chicken and vegetable oil, highlighting the dual focus on both baked and cooked items.

- Items like "Caramel syrup" and "Cocoa powder" feature on the list, which suggests that specialty sweets and confections requiring these ingredients are a regular part of the bakery's offerings.

- "Cream cheese" and "Cherries" are at the lower end of moderately purchased items, implying they are used less frequently but still necessary for certain niche products.



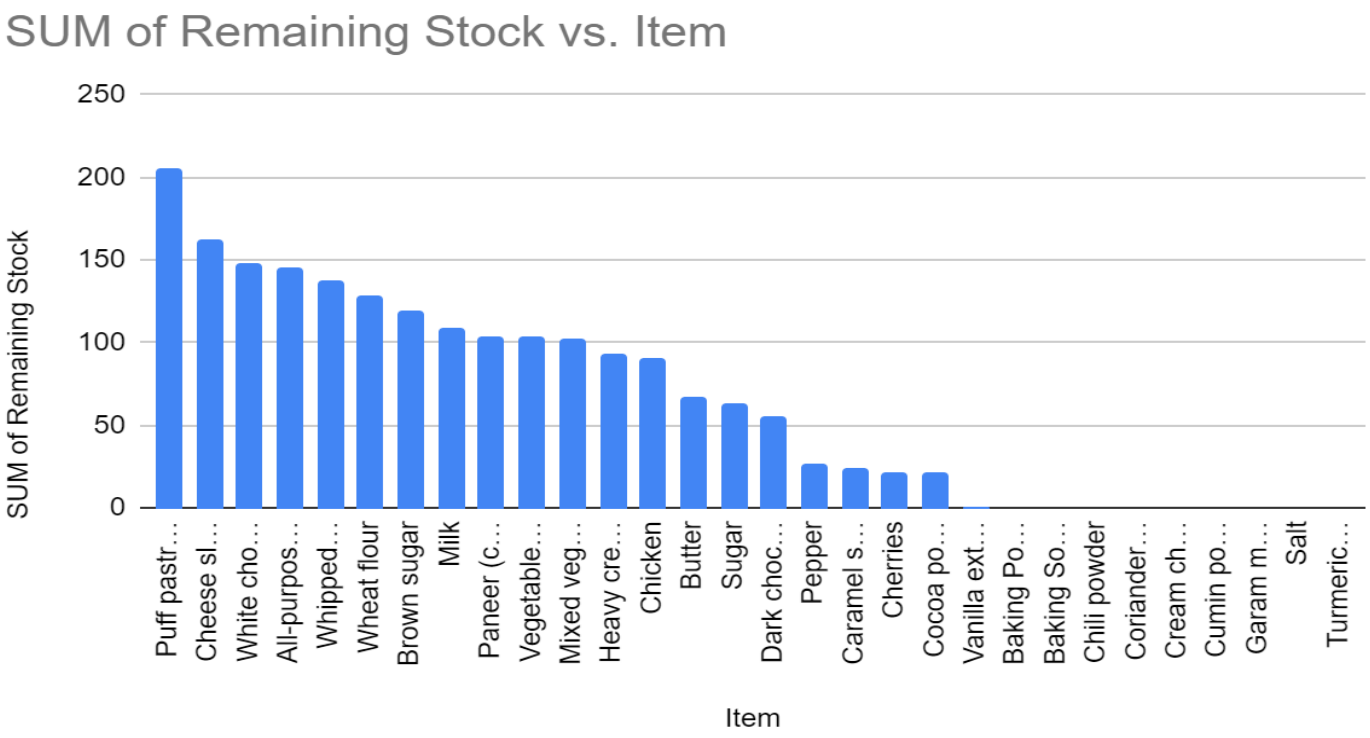
- "Coriander powder" is the least purchased item, but it still leads this group, indicating it has occasional use in recipes, though not as frequently as other spices.

- Items like "Chili powder," "Pepper," "Cumin powder," and "Garam masala" are purchased in nearly the same quantity, reflecting a balanced demand for these spices in smaller quantities.

- Items such as "Vanilla extract," "Baking powder," and "Baking soda" are moderately purchased, suggesting their role in desserts and baking, though less frequent compared to other ingredients.

- Items like "Turmeric powder" and "Cumin powder" are essential for certain dishes but are not as frequently purchased, indicating they may last longer or are used in smaller quantities.

- Interestingly, "Salt" is the lowest on the list, likely because it is bought in bulk and consumed slowly, or it is restocked less frequently than other ingredients.



- "Puff pastry sheets" hold the largest remaining stock at 206 units that is 10.66% of overall remaining stock , indicating that they are the most abundant item in stock.

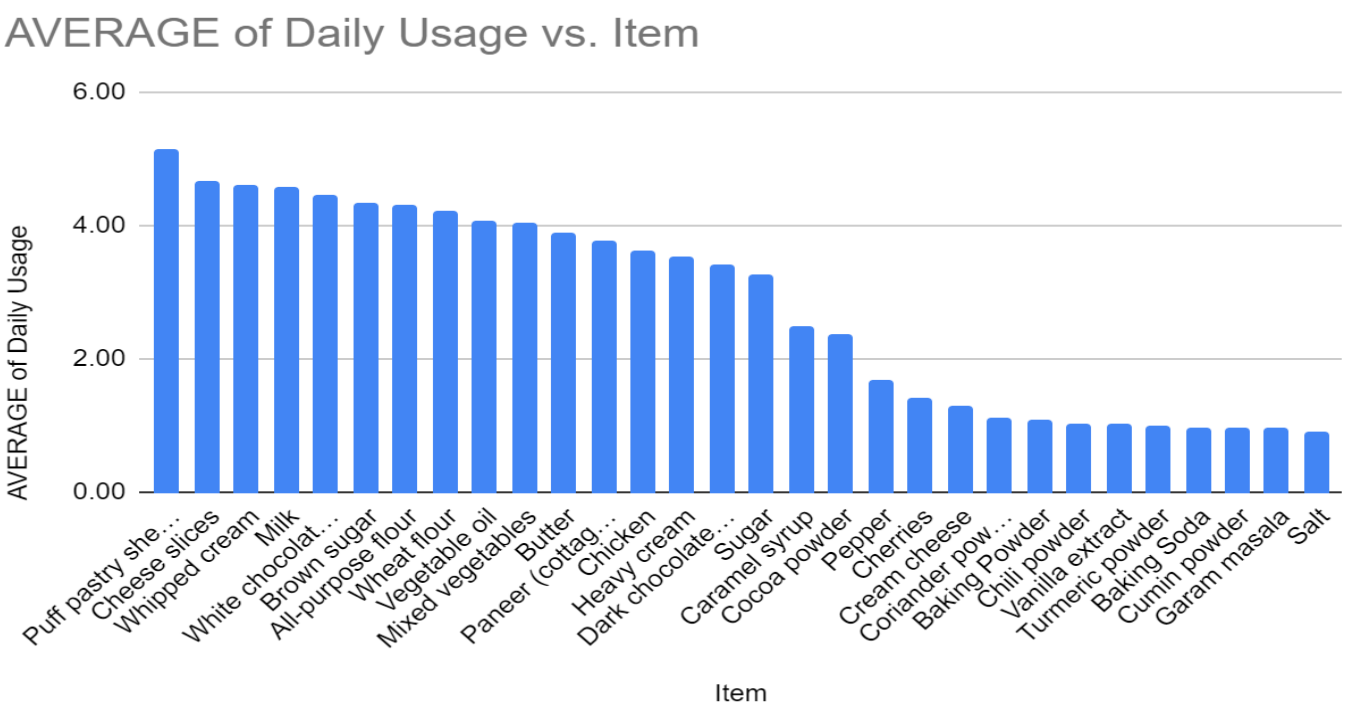
- The stock includes a variety of dairy products, such as "Cheese slices" with 162 units that is 8.38% of remaining stock and other items like "Milk" and "Paneer," showing their steady presence in the inventory.

- Baking items such as "Flour" and "Brown sugar" are among the remaining stock, ensuring essential ingredients for baking are well-stocked.

- Cooking ingredients like "Vegetable oil" and "Mixed vegetables" are also part of the stock, contributing to the versatility of available ingredients for cooking.

- Items belonging to spices category such as “cumin powder”,”coriander powder” etc and items from baking category like “vanilla extract” have negligible amount of remaining stocks indicating that they are frequently used .

- This indicated that most of the items have nearly even remaining stocks exculding some extremities like “ puff pastery sheets ”, spices etc..



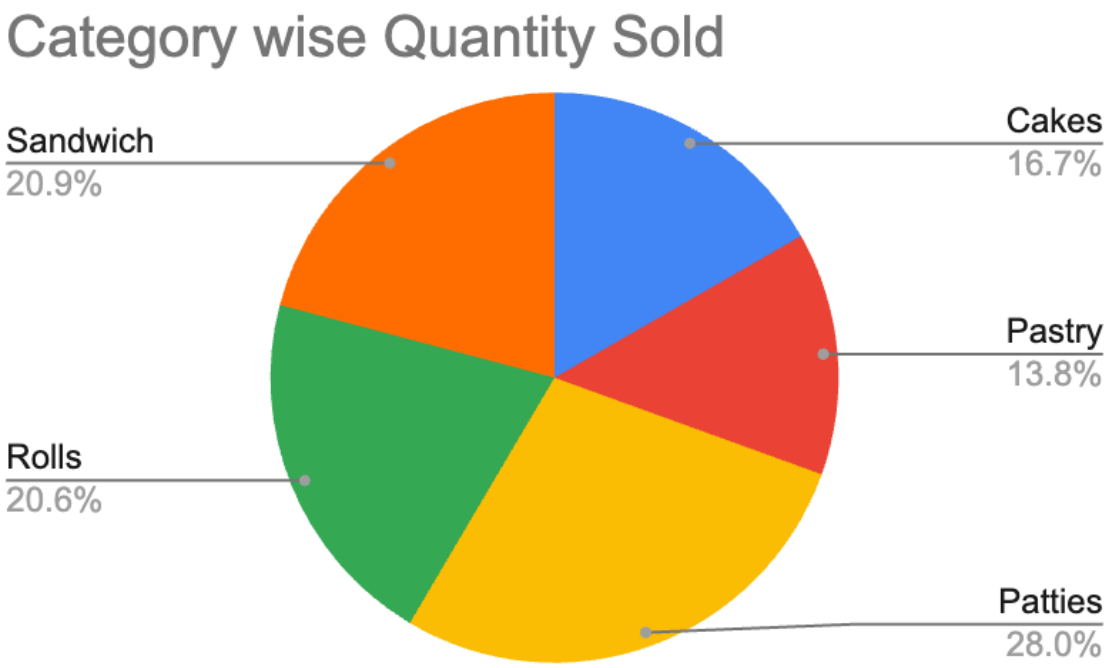
- Puff pastry sheets have the highest average daily usage, making them the most consumed item compared to others.

- Items belonging to category of “Spices” like “cumin powder” ,”garam masala” etc. and “Baking” like “vanilla extract” etc. have the least average but similar daily usage making then the least consumed items.

- Items like cheese slices, whipped cream, milk, and white chocolate chips show very similar average daily usage, with only slight variations.

- Most items exhibit steady and balanced daily usage, showing no extreme variations in consumption.

- The differences in daily consumption between most of the items are minimal , suggesting an even distribution in their use across operations.



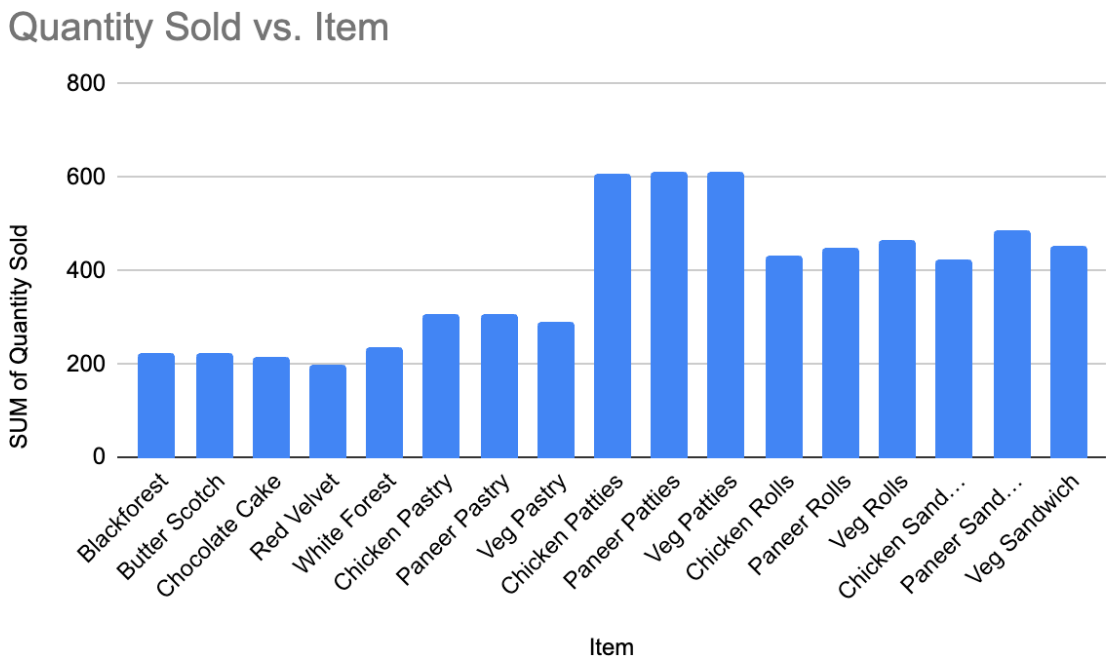
- Patties contribute the largest portion to the total sales, making up 28.0%, which highlights their popularity among the cafeteria's offerings.

- Sandwiches and Rolls are also key items, contributing significantly with 20.9% and 20.6% of the total sales, respectively, reflecting their steady demand.

- Together, these three categories—Patties, Sandwiches, and Rolls—account for a major share of the overall sales, showing that these are the most popular choices among customers.

- Cakes and Pastries, while not as dominant, still have substantial contributions at 16.7% and 13.8% respectively, indicating that they play an important role in the variety offered at the cafeteria.

- Overall, the sales distribution is well-balanced, with no single item overwhelmingly dominating the chart. This suggests a diverse menu where multiple items are popular with customers.



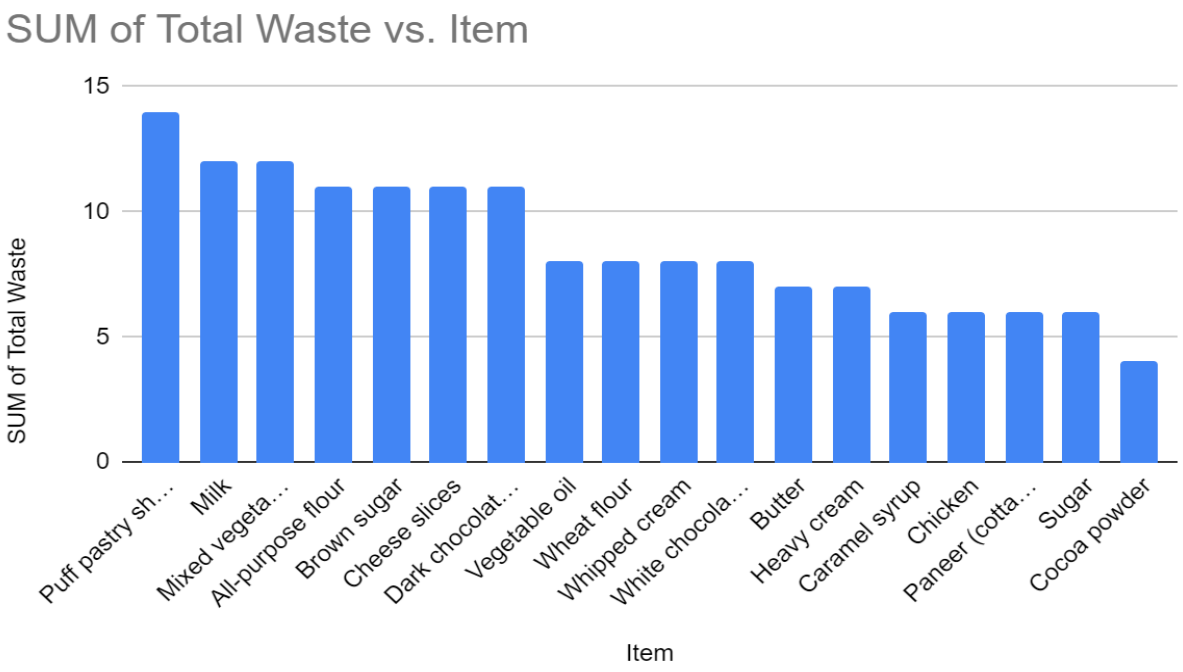
- Paneer Patties, Veg Patties, and Paneer Sandwich stand out as the top-selling items, with each item either reaching or exceeding 600 units sold, highlighting their strong popularity.

- Chicken Rolls, Paneer Rolls, and Veg Rolls also perform well, maintaining sales figures between 400 and 500 units, suggesting these items are consistently popular with customers.

- In contrast, items like Red Velvet, White Forest, and Chicken Pastry have lower sales figures, with each selling fewer than 300 units, indicating they are in relatively lower demand.

- The graph shows a clear distinction between the top-selling items and the lower-performing ones, emphasizing which items dominate customer preferences.

- Overall, the sales trends reflect a strong demand for savory items such as patties and rolls, while desserts like Red Velvet and White Forest cakes have a more modest appeal in the cafeteria's menu.



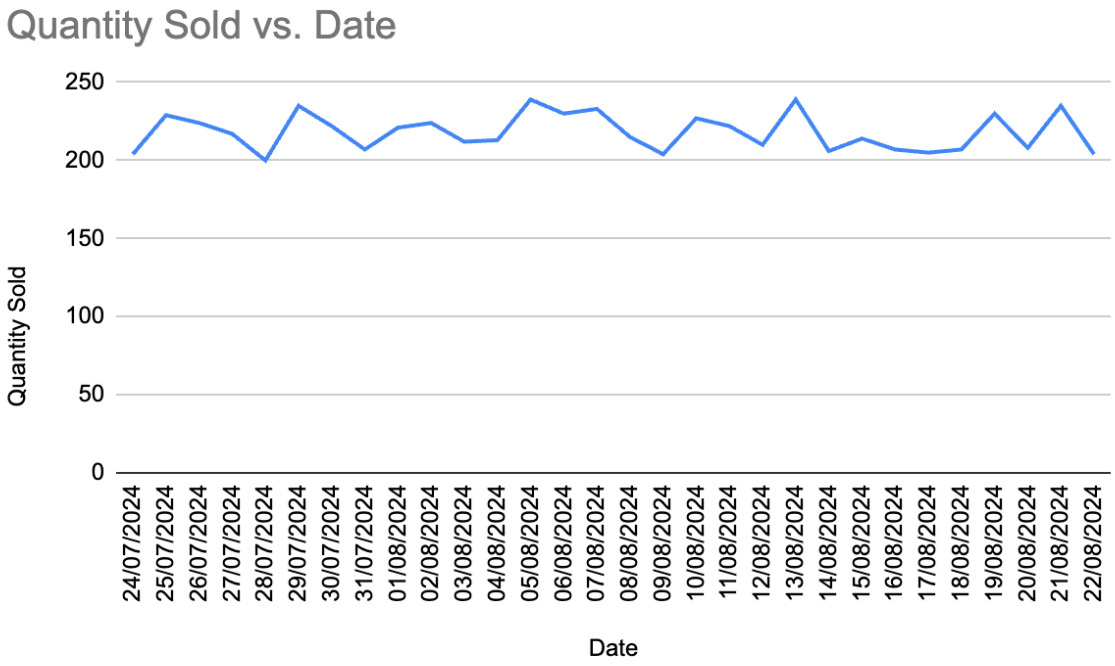
- Puff pastry sheets show the highest percentage of wastage at 14 units that is 7.69%,indicating the need for improved inventory control or more efficient usage planning for this item.

- Milk and mixed vegetables both contribute 6.59% that is 12 units each to the wastage, highlighting the challenges of managing perishable goods with shorter shelf lives in the cafeteria.

- Other items such as whipped cream, vegetable oil, and wheat flour, each contribute to 6 units of the wastage, showing relatively efficient inventory management for these ingredients.

- From the graph it's clear that most of the categories have evenly distributed total waste indicating that they are well manages and more efficiently used compared to other products.

- The overall trend indicates that perishable and delicate items like puff pastry sheets and milk tend to have higher wastage rates.



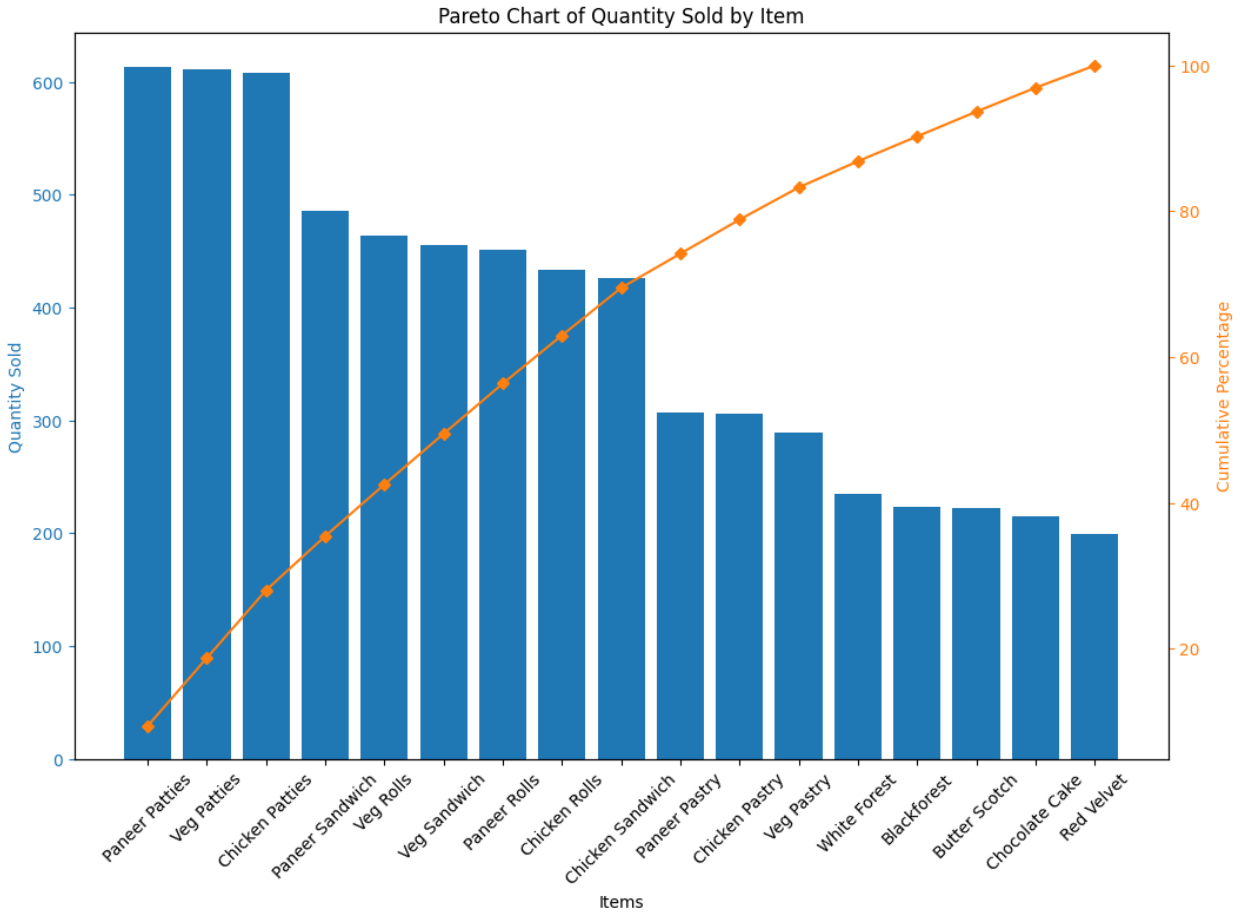
- The graph indicates that the quantity sold remained fairly stable, consistently hovering around the 200 mark throughout the observed period.

- Although there were minor fluctuations with occasional peaks and troughs, these variations were relatively slight and did not show any drastic shifts in sales quantities.

- Over the span from July 24, 2024, to August 22, 2024, sales quantities demonstrated a consistent pattern without significant changes.

- There were no notable declines or increases in the quantity sold during this timeframe, reflecting a stable trend.

- This overall stability in sales figures suggests that there was a steady and reliable demand for the product throughout the month.



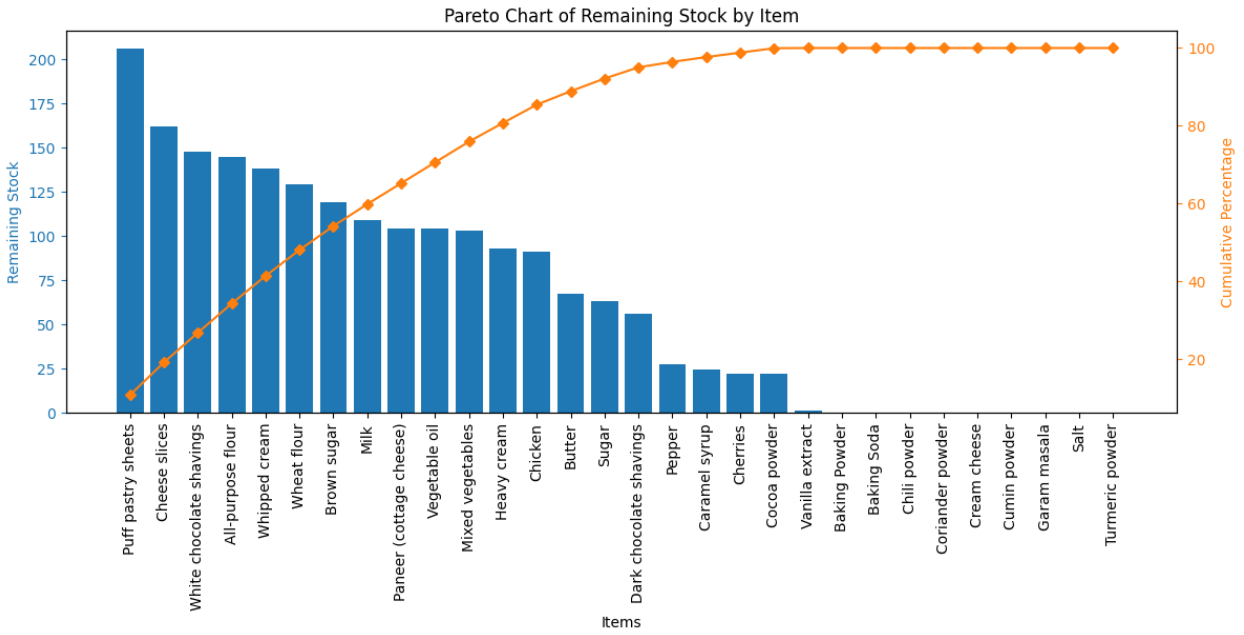
- Paneer Patties, Veg Patties, and Chicken Patties are the highest-selling items, each reaching a quantity of 600 units, indicating their strong customer preference.

- The cumulative percentage line shows that the top 5-6 items contribute to around 50-60% of the total sales, suggesting that a few items dominate the sales volume.

- Items such as Red Velvet and Chocolate Cake show significantly lower sales, indicating that desserts are less popular compared to savory items like patties and sandwiches.

- There is a noticeable drop in sales quantities after the top-selling items, with the lower-ranked items contributing less to total sales, emphasizing a smaller variety in demand for these products.

- Pareto Principle: The chart visualizes the Pareto Principle (80/20 rule), where a small percentage of items contribute to the majority of the total sales, helping the bakery prioritize inventory management for top-selling products.



- Puff pastry sheets have the highest remaining stock, with more than 200 units. This could indicate overstocking or lower usage/sales of products using puff pastry sheets.

- Items like cheese slices, white chocolate shavings, and all-purpose flour also have high remaining quantities, showing they are commonly stocked ingredients, likely used across various bakery items.

- Ingredients like brown sugar, whipped cream, milk, and vegetables have balanced stock levels. They may be critical but are being used at a consistent rate.

- Items like spices (turmeric, garam masala, cumin powder), baking soda, and cocoa powder have significantly lower remaining stocks. This may indicate either a higher rate of usage or lower purchase volumes.

- Similar to the previous chart, the cumulative line shows that a small number of items (likely the top 5-6) account for a large portion of the total remaining stock. Properly managing these key items could greatly optimize overall inventory control.

4. Interpretation of Results and Recommendation

4.1 Interpretation of Results:

Stable Sales Performance: The sales data shows that the quantity sold remained relatively stable, consistently around the 200 mark, with minor fluctuations. This stability suggests that demand for the products is steady and predictable, which is beneficial for inventory planning and operational consistency.

High-Volume Items: Key items such as cheese slices, puff pastry sheets, and wheat flour are crucial to the bakery's operations, as they represent a significant portion of purchases. The high volume of these items indicates their importance in the bakery's product offerings and suggests a need for reliable inventory management for these critical items.

Wastage Concerns: The analysis reveals that certain items, such as puff pastry sheets and milk, have higher wastage rates, which points to inefficiencies in inventory control or usage planning. This wastage is particularly concerning for perishable goods with shorter shelf lives, which require more precise inventory management to reduce losses.

Sales Distribution: The sales distribution highlights that savory items, such as patties, sandwiches, and rolls, dominate the total sales, while desserts like cakes and pastries have a smaller but still significant contribution. This indicates that the bakery's menu is well-balanced, catering to a diverse customer base with a strong preference for savory options.

Inventory Utilization: The average daily usage data shows that most items have consistent consumption rates, with puff pastry sheets having the highest usage and butter the lowest. This consistency supports the need for balanced inventory levels and highlights areas where inventory management can be improved.

4.2 Recommendations:

Optimize Inventory Management: Focus on improving inventory management practices for high-volume and critical items such as cheese slices, puff pastry sheets, and wheat flour. Implement strategies to ensure these items are always in stock while avoiding overstocking, particularly for perishable goods.

Reduce Wastage: Develop strategies to minimize wastage, especially for items with high wastage rates like puff pastry sheets and milk. This could involve refining inventory forecasting, adjusting ordering quantities, and improving storage conditions to extend shelf life.

Leverage Sales Data for Forecasting: Utilize sales trends and historical data to forecast future demand more accurately. This will help in adjusting purchasing strategies to prevent stockouts and overstocking, particularly for seasonal or trend-sensitive items.

Enhance Inventory Monitoring: Implement regular inventory audits and monitoring systems to track stock levels and usage more closely. This will help in identifying discrepancies early and taking corrective actions to maintain optimal inventory levels.

Diversify Product Offerings: Based on the sales distribution, consider diversifying the product range to include more high-demand items while continuing to offer a balanced menu. Pay attention to customer preferences and adjust the product mix accordingly to maximize sales and customer satisfaction.

Improve Waste Management Practices: Investigate the root causes of high wastage rates and implement targeted interventions to address them. This could include better staff training on handling and storage, optimizing portion sizes, and improving inventory rotation practices.

By adopting these recommendations, TULASI BAKERY can enhance its operational efficiency, reduce unnecessary costs, and ensure that inventory management aligns with demand patterns and sales trends, ultimately supporting long-term business growth and profitability.

The data and the analysis I did can be seen through here :
https://docs.google.com/spreadsheets/d/1xM9epwlyZ4__nixR-954W4pGoOd_vaLYLEkb6MrtHvE/edit?gid=1569607641#gid=1569607641