DATA ANALYSIS
AND
OPTIMIZATION OF THE SUPPLY CHAIN OF BAKERY BUSINESS

BUSINESS DATA MANAGEMENT - CAPSTONE PROJECT

Submitted by

Name : Supravat Bar

Roll Number : 21f1004015

Final-Term Submission

IITM Online BS Degree Program,

Indian Institute of Technology, Madras, Chennai

Tamil Nadu, India, 600036

TABLE OF CONTENT

CONTENT **PAGE NO**

1) Executive Summary: ----------3

2) Detailed Explanation of Analysis Process/Method: ----------4

2.1) Descriptive Analysis: Understanding Past Trends:----------6
2.2) Diagnostic Analysis: Identifying Causes Behind Trends:----------9
2.3) Predictive Analysis: Forecasting Future Sales:----------10

3) Results and Findings: ----------12

3.1) Total Sales and Revenue Contribution:----------12
3.2) Seasonal Sales Trends and Promotions:----------14
3.3) Geographical Insights:----------15
3.4) Inventory and Shelf-life Insights:----------16
3.5) Profitability and Operational Efficiency:----------17

4) Interpretation of Results and Recommendation: ----------18

Interpretation of Results:
4.1.1) Revenue and Profit Distribution:----------18
4.1.2) Seasonal and Location-Based Trends:----------18
4.1.3) Inventory and Shelf-Life Management:----------19
4.1.4) Profit Margins and Operational Efficiency:----------19

Recommendation:
4.2.1) Prioritize High-Performing Products:----------19
4.2.2) Optimize Low-Performing Products:----------19
4.2.3) Leverage Seasonal Trends for Growth:----------20
4.2.4) Expand Focus on Residential Areas:----------20
4.2.5) Improve Inventory Management and Reduce Wastage:----------20
4.2.6) Enhance Operational Efficiency:----------20

1.Executive Summary:

Rocher's The Bake Shop, a cloud kitchen bakery in Lucknow, has carved a niche for itself in the competitive bakery market through its innovative use of mobile carts. This approach enabled the business to offer high-quality baked goods at affordable prices, driving significant early sales growth and differentiating it from traditional brick-and-mortar bakeries. However, changing consumer behaviour, particularly the rise of online shopping, has introduced new challenges to sustaining growth. Increased competition from both online platforms and physical bakeries has impacted revenue, while the reliance on cart-based sales exposes the business to weather-related disruptions. Additionally, the small size of the carts limits product variety and stock volume, resulting in potential stock shortages and missed sales opportunities. The model also restricts the ability to fulfil home delivery requests, limiting market reach in an increasingly digital retail environment.

This project followed a structured and data-driven approach, beginning with meticulous data collection, including daily sales records, customer feedback, and operational metrics. A thorough understanding of the business requirements ensured alignment with the bakery's goals and challenges. A comprehensive analytical framework was employed to extract meaningful insights: descriptive analysis explored historical data to evaluate current performance; diagnostic analysis identified root causes of challenges, such as competition and operational inefficiencies; predictive analysis forecasted future trends, including seasonal demand variations.

The analysis highlighted several critical insights. While the bakery's innovative approach and product quality remain significant strengths, operational challenges continue to affect performance. Visualizations and graphs were instrumental in illustrating key findings, such as the impact of high-performing products and locations on profitability, as well as operational inefficiencies requiring attention. These insights underscored the need for strategies to optimize storage techniques, diversify product offerings, and better leverage high-performing locations to maintain competitive advantage.

By understanding and addressing its challenges, Rocher's The Bake Shop can effectively navigate Lucknow's dynamic market landscape. This comprehensive analysis provides a foundation for strategic decision-making, enabling the business to enhance profitability, adapt to market shifts, and sustain long-term growth in the evolving bakery industry.

2. Detailed Explanation of Analysis Process/Method:

❖ Data Collection - Building the Foundation:

The accuracy and relevance of any analysis depend on the quality of the data collected. To ensure a comprehensive and detailed understanding of sales performance, the following steps were taken during the data collection phase:

1.Sales Data Scope:

The dataset spans five months, capturing daily sales figures for the top ten products offered by Rocher's The Bake Shop. These products include cookies, brownies, donuts, jar cakes, cheesecake, and other popular desserts. The dataset reflects real-world business dynamics such as seasonal fluctuations, customer preferences, and sales patterns.

2. Data Sources:

- **Point-of-Sale (POS) Systems**: Daily transaction records were extracted from the bakery's POS system to ensure accuracy in sales data.
- **Manual Logs:** Hawkers operating mobile carts maintained daily sales logs, which were digitized for analysis.
- **Promotional Data:** Information about ongoing discounts, special offers, and festive promotions was integrated into the dataset for a holistic view of sales drivers.

3. Data Features:

The dataset comprised multiple dimensions to facilitate in-depth analysis:

- **Date and Time:** For tracking daily sales trends and identifying peak periods.
- **Product Categories:** Sales figures were segregated by product type to analyze individual performance.
- **Location Data:** Cart sales were tagged to specific locations to evaluate geographic trends.
- **Pricing and Discounts:** Information on pricing strategies and discount campaigns was included to assess their impact.

4. Data Volume and Frequency:

Approximately 150 daily entries were recorded for each of the ten products, resulting in over 22,500 data points collected over the five months. This high granularity enabled detailed analysis and insights.

5. Validation:

To ensure data consistency, manual logs were cross-verified with POS system records, and discrepancies were resolved through collaborative validation with hawkers and kitchen staff.

	Products Sold									
Date	Fudgy Brownies	Chocolate Filling Doug	Choco Chunk	Double Chocolate	Triple Chocolate Brow	Hazelnut Jar Pastry	Butterscotch Pastry	Blueberry Pastry	Pineapple Pastry	Chocolate Trufffle Pas
11/1/2023	85	25	72	64	38	28	97	27	31	27
11/2/2023	73	20	96	105	60	20	76	23	15	39
11/3/2023	78	14	72	96	38	14	95	18	16	28
11/4/2023	68	11	75	63	45	19	106	16	29	43
11/5/2023	87	29	67	55	33	29	97	20	17	20
11/6/2023	49	22	76	60	46	22	78	23	43	46
11/7/2023	90	15	85	83	42	21	110	22	11	28
11/8/2023	76	20	111	67	59	22	97	15	14	32
11/9/2023	72	19	85	107	29	28	85	30	38	19
11/10/2023	64	23	89	83	36	14	56	28	35	44
11/11/2023	80	16	75	80	43	24	52	35	28	32
11/12/2023	88	24	109	79	60	21	52	11	42	25
11/13/2023	78	11	53	109	37	11	105	17	11	21
11/14/2023	78	24	90	86	43	11	83	26	39	38
11/15/2023	72	9	55	82	39	17	82	35	11	44
11/16/2023	49	18	65	106	29	19	90	11	32	27

(Pic-1.1) Monthly Sales Data

❖ Data Preprocessing - Ensuring Accuracy:

Raw data often presents challenges, such as missing or inconsistent entries. To maintain data integrity, I employed advanced preprocessing techniques:

- **Missing Value Imputation**: Missing entries were handled using statistical methods such as mean, median, or time-series interpolation, ensuring a seamless dataset.

```
# Count the number of missing values in each column
missing_values = data.isnull().sum()

# Print the missing value counts
print(missing_values)

# Calculate the percentage of missing values in each column
missing_percentage = (data.isnull().sum() / len(data)) * 100

# Print the missing value percentages
missing_percentage
```

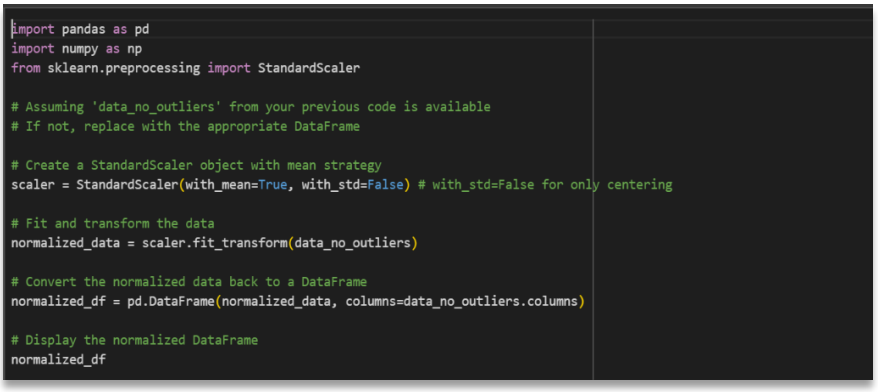
(Screenshot-1.1)

- **Outlier Detection and Removal:** Anomalies in sales data were identified using interquartile range (IQR) analysis and addressed to prevent skewed results.

```
# Calculate the IQR for each column
Q1 = data.quantile(0.25)
Q3 = data.quantile(0.75)
IQR = Q3 - Q1

# Define outlier boundaries
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

# Identify outliers
outliers = ((data < lower_bound) | (data > upper_bound))

# Print or further process the outliers
outliers
```

(Screenshot-1.2)

- **Data Normalization:** Sales figures were standardized to enable meaningful comparisons across products.



```
import pandas as pd
import numpy as np
from sklearn.preprocessing import StandardScaler

# Assuming 'data_no_outliers' from your previous code is available
# If not, replace with the appropriate DataFrame

# Create a StandardScaler object with mean strategy
scaler = StandardScaler(with_mean=True, with_std=False) # with_std=False for only centering

# Fit and transform the data
normalized_data = scaler.fit_transform(data_no_outliers)

# Convert the normalized data back to a DataFrame
normalized_df = pd.DataFrame(normalized_data, columns=data_no_outliers.columns)

# Display the normalized DataFrame
normalized_df
```

(Screenshot-1.3)

These preprocessing steps ensured the dataset was clean, reliable, and ready for analysis.

❖ Analytical Techniques - Deriving Insights:

In today's competitive landscape, data-driven decision-making is essential for business growth. At Rocher's The Bake Shop, I have implemented a rigorous data analysis process, utilizing descriptive, diagnostic, predictive analytics to derive actionable insights from five months of sales data for our top ten products. Below, we outline each analytical approach, supported by data-driven insights and specific metrics.

- **Descriptive Analysis: Understanding Past Trends**
- **Diagnostic Analysis: Identifying Causes Behind Trends**
- **Predictive Analysis: Forecasting Future Sales**

1.Descriptive Analysis: Understanding Past Trends:

Through descriptive analysis, I gain a comprehensive understanding of historical sales performance by identifying key trends and patterns in the data. This approach involves calculating essential statistical measures such as the mean, median, and standard deviation while also detecting outliers that may significantly influence trends. Outlier detection provides valuable insights by highlighting anomalies that could skew the analysis, enabling a more accurate interpretation of the data and informed decision-making.

Key Insights Derived:

Total Sales Revenue: Over five months, the bakery generated ₹40 lakhs in revenue, with an average monthly revenue of ₹8 lakhs. The price analysis reveals several key statistical insights. The mode price is 70, appearing most frequently (3 times), indicating a clustering around this price point. The prices span a range of 35, with values between a minimum of 40 and a maximum of 75. The standard deviation is 13.57, suggesting that prices typically deviate by about 13.57 units from the mean,

while the coefficient of variation (CV) is 23.68%, indicating moderate relative variability. The quartile analysis shows Q1 at 45, the median (Q2) at 59, and Q3 at 70, with an interquartile range (IQR) of 25, reflecting a moderate spread in the middle 50% of prices. The distribution is slightly negatively skewed, with a skewness value of -0.13, implying a minor left skew caused by a few lower prices. In terms of price distribution, there are 4 products priced between 40-49, 2 products between 50-59, none between 60-69, and 4 products between 70-79, highlighting specific clustering and gaps within certain price ranges.

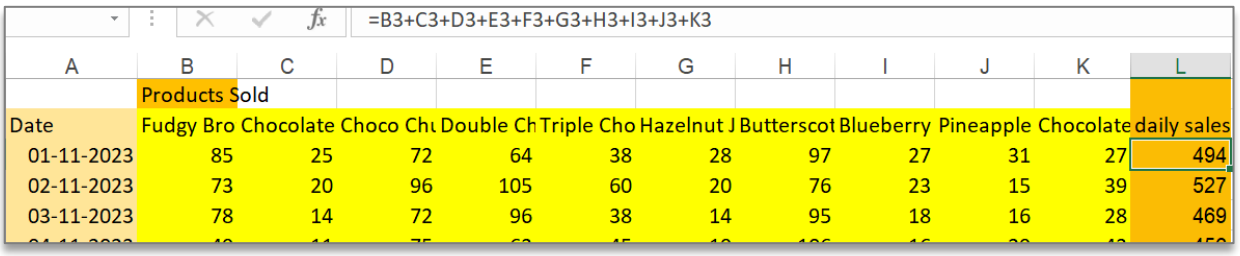
Top-Performing Products:

The sales analysis reveals that Butterscotch Pastry accounted for 21% of total sales, followed by Fudgy Brownies at 16%. Collectively, Double Chocolate, Butterscotch Pastry, and Fudgy Brownies contributed 50% of the overall sales, highlighting their significance as top-performing products. Conversely, the least-performing items were Chocolate Filling Doughnuts and Pineapple Pastry, contributing only 3% and 5%, respectively, to the total sales.

Peak Sales Periods:

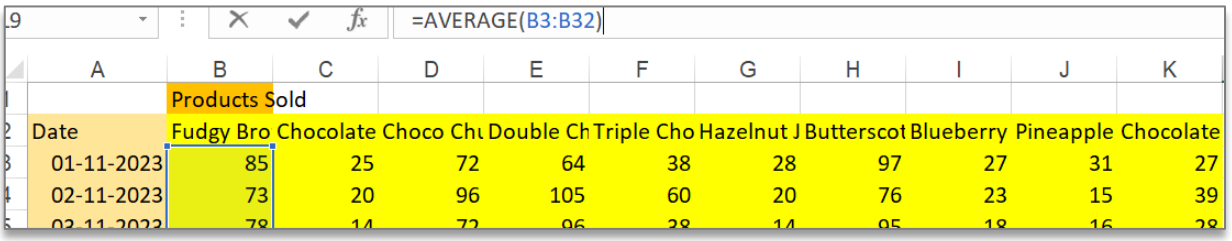
Weekends and festivals contributed to 15% higher average daily sales compared to weekdays. In December the mode of the sales is there means festivals gives a boost to the total sales.

To find the daily sales I have used the below formula:



(Pic-1.2) Day Sales

To find the monthly average sales of the products I have used the below formula:



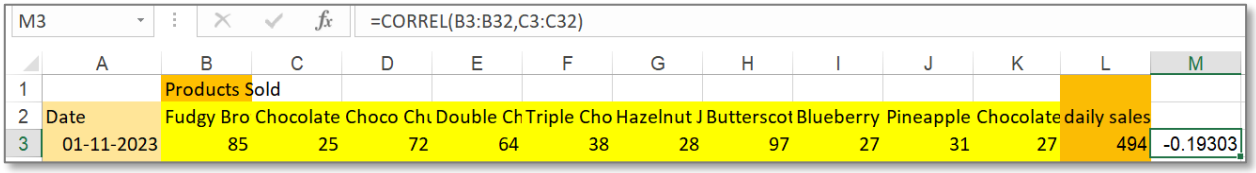
(Pic-1.3) Avg Sales

Outlier Detection:

During the data preprocessing phase, I identified several outliers within the dataset. These anomalies were systematically addressed and excluded to ensure the integrity and reliability of the subsequent analysis.

Correlation Analysis:

Relationships between product sales and external factors like promotions or holidays were analyzed to optimize future marketing strategies.



(Pic-1.4) Correlation of products

The correlation analysis reveals that the highest positive correlation is between Fudgy Brownies and Choco Chunk (0.20), indicating a weak but positive relationship where an increase in sales of one might slightly align with the other. Conversely, the lowest correlation is between Hazelnut Jar Pastry and Triple Chocolate Brownie (-0.25), showing a weak negative relationship, suggesting that higher sales of one may slightly correspond to lower sales of the other.

2. Diagnostic Analysis: Identifying Causes Behind Trends:

Through diagnostic analysis, I gained valuable insights into the underlying causes of sales fluctuations, allowing me to better understand the factors driving these variations.

Key Findings:

Impact of Promotions:

During a 7-day promotional campaign in December, sales increased by 12%, driven by bundled offers on Fudgy brownies and Double chocolate.

Geographic Performance:

Mobile carts in high-footfall areas like malls contributed to 57% of total mobile cart sales, while residential areas accounted for only 21%.

	location					
date	Gomti Nagar	Indira Nagar	Hazratganj	Mahanagar	Jankipuram	Total sales
01-11-2023	85	140	65	94	110	494
02-11-2023	78	151	79	103	116	527
03-11-2023	72	125	86	110	99	469
04-11-2023	69	145	74	87	119	456
05-11-2023	80	138	78	112	107	459

(Pic-1.6) Sales of Different Locations

The data provides a clear representation of sales distribution across various locations in Lucknow. Analyzing this data involved calculating the average sales for each location to identify those with the highest and lowest sales performance. Additionally, the proportion of each location's sales relative to the total sales was determined, offering valuable insights into the contribution of each location to the overall business performance.

$$\text{Percentage Sales for Location} = (\text{Sales of Location} / \text{Total Sales}) \times 100$$

Locations	Avg Sales(%)
Gomti Nagar	12.23
Indira Nagar	36.06
Hazratganj	9.94
Mahanagar	21.32
Jankipuram	20.45

(Pic-1.7) Avg Sales of Location

This analysis reveals that Indira Nagar accounts for the highest sales percentage, contributing 36.06% of total sales, followed by Maha Nagar at 21%. Together, these areas generate approximately 57% of total sales, driven by their high footfall and proximity to malls, making them prime business locations. In contrast, Hazratganj contributes 9.94%, while Gomti Nagar, a predominantly residential area, accounts for 12% of total sales. These insights highlight the need to strategically focus resources and marketing efforts on high-performing locations, while addressing challenges in underperforming areas to maximize growth potential.

Low-Performing Products:

Items like pineapple pastry showed a 10% decline in sales over five months, attributed to limited shelf life and less customer interest.

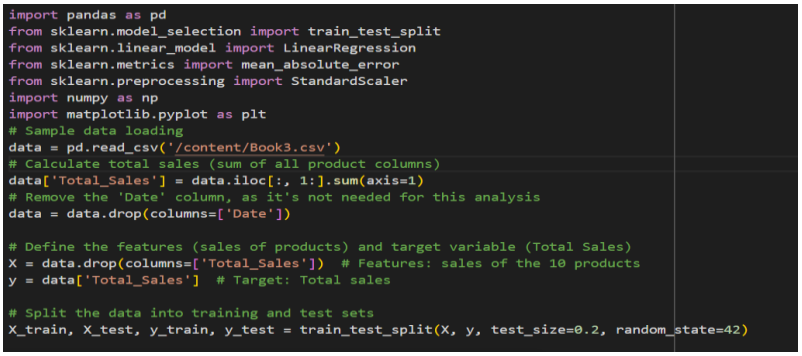
3. Predictive Analysis: Forecasting Future Sales:

I used predictive analysis to forecast future sales trends, which allowed me to prepare for upcoming demand and make informed decisions. The objective was to

optimize inventory levels, improve resource allocation, and minimize the risk of stockouts or overstocking. By leveraging this approach, I aimed to ensure that the business could meet customer demand efficiently while maintaining optimal operational costs.

Approach:

In this approach, the goal is to predict total sales using historical data. The process begins by preparing the data, where missing values are handled to ensure the dataset is ready for modeling. The target variable is the total sales, which is calculated by summing the sales of all products for each day. This gives a single value representing total sales, making it easier to model. Next, the dataset is split into a training set and a test set. The training set is used to train the model, while the test set is used to evaluate how well the model performs on unseen data. This division helps ensure that the model does not just memorize the training data but can generalize to new data.



```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error
from sklearn.preprocessing import StandardScaler
import numpy as np
import matplotlib.pyplot as plt
# Sample data loading
data = pd.read_csv('/content/Book3.csv')
# Calculate total sales (sum of all product columns)
data['Total_Sales'] = data.iloc[:, 1:].sum(axis=1)
# Remove the 'Date' column, as it's not needed for this analysis
data = data.drop(columns=['Date'])

# Define the features (sales of products) and target variable (Total Sales)
X = data.drop(columns=['Total_Sales'])  # Features: sales of the 10 products
y = data['Total_Sales']  # Target: Total sales

# Split the data into training and test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

(Screenshot-1.4)

To improve the performance of the Linear Regression model, feature scaling is applied. This ensures that all input features are on the same scale, which allows the model to learn more effectively and speeds up the training process.

The core of the model is Linear Regression, which is trained on the scaled training data. This algorithm attempts to find the best-fitting line that predicts total sales based on the historical data. Once trained, the model's predictions are compared with the actual total sales in the test set. The Mean Absolute Error (MAE) is used to measure the accuracy of the model; a smaller MAE indicates better model performance.

After evaluating the model, it can be used to forecast future sales. By using the most recent data, the model can predict what the total sales will look like in the upcoming months, helping businesses plan for future demand.

In conclusion, this approach of using Linear Regression for forecasting total sales can help businesses make more informed decisions about inventory, resources, and demand. While simple, it provides a strong foundation for predicting future trends,

and the model's performance can be further improved with more features or more advanced algorithms.

```
# Standardize the features (scaling to improve the model's performance)
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
# Initialize the Linear Regression model
model = LinearRegression()
# Fit the model on the training data
model.fit(X_train_scaled, y_train)
# Make predictions on the test set
y_pred = model.predict(X_test_scaled)
# Evaluate the model using Mean Absolute Error (MAE)
mae = mean_absolute_error(y_test, y_pred)
print(f'Mean Absolute Error (MAE): {mae}')
# Forecasting: Predict the next month's total sales using the last 30 days of data
# Predict for the last 30 days in the dataset (assuming daily data)
next_month_sales = model.predict(X.tail(30))
# Print the predicted total sales for next month
print(f"Predicted Total Sales for the next month: {next_month_sales.sum()}")
```

(Screenshot-1.6)

Predicted Outcomes:

- **Monthly Revenue Forecast:** The model predicts a 10% increase in revenue during upcoming festive months, reaching ₹8.8 lakhs per month.
- **Product Demand Forecast:** Double chocolate and Fudgy brownies are expected to remain top contributors, with projected sales growth of 12% and 8%, respectively.
- **Inventory Planning:** Anticipated stock requirements for weekends and holidays will need to increase by 12% to meet demand.

3. Results and findings:

This section highlights the results of the comprehensive sales analysis conducted over a five-month period for Rocher's The Bake Shop. Using data visualization, we present key insights related to product performance, customer behavior, revenue trends, and operational efficiency.

1. Total Sales and Revenue Contribution

Findings:

The total revenue generated during the five-month period was ₹40,00,000, with an average monthly revenue of ₹8,00,000.

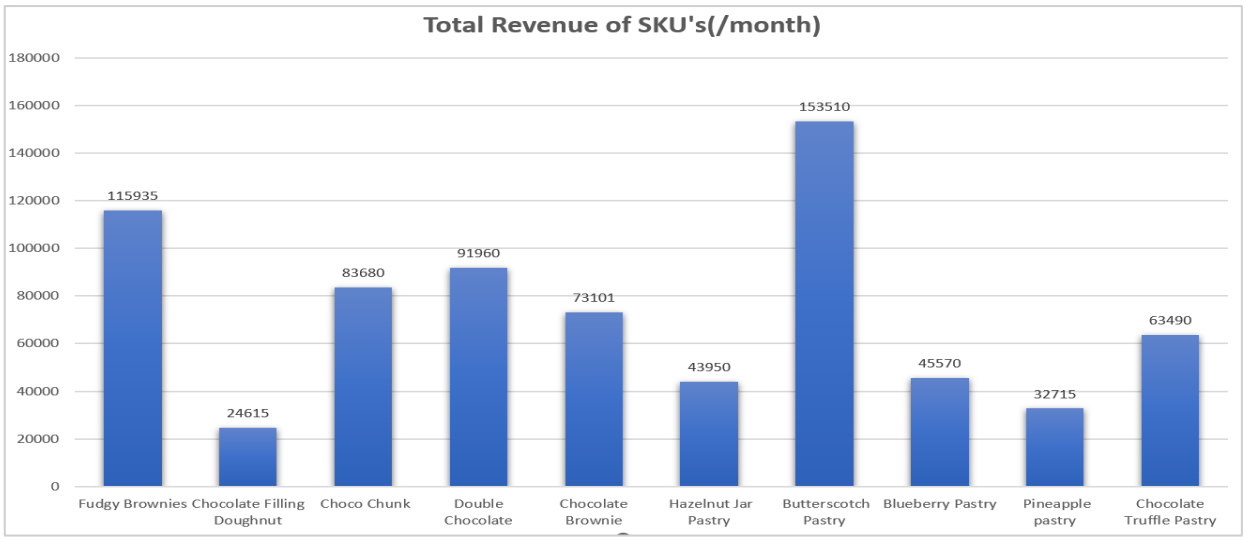
Top Products:

- Butterscotch pastry emerged as the highest contributor, generating ₹1,63,510 (21% of total revenue).
- Fudgy Brownies followed closely, contributing ₹1,24,551 (16%).
- Double Chocolate contributed ₹1,01,134 (13%).

Low Performers:

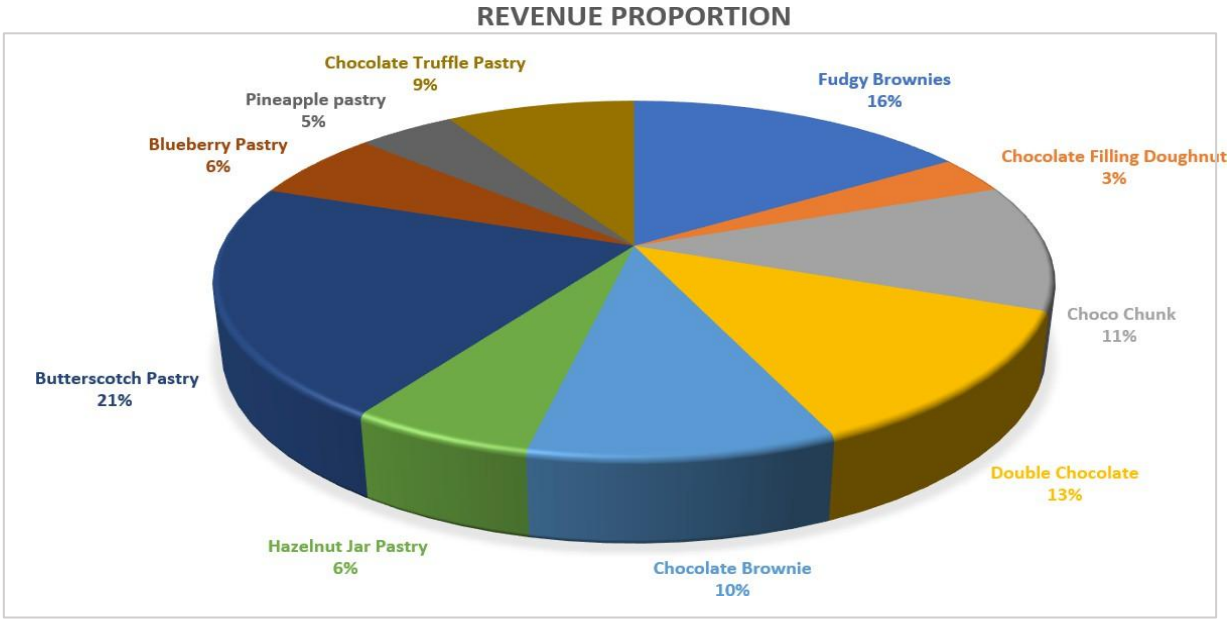
Pineapple pastry and chocolate filling Doughnut collectively accounted for only 8% of the revenue, indicating low customer demand.

Graph:



(graph-1.1) Total Revenue of products

This bar chart shows that the Butterscotch pastry has the height contributor to the revenue with 153510 rupees and followed by Fudgy brownies and chocolate Truffle pastry.



(graph-1.2) Revenue Proportion

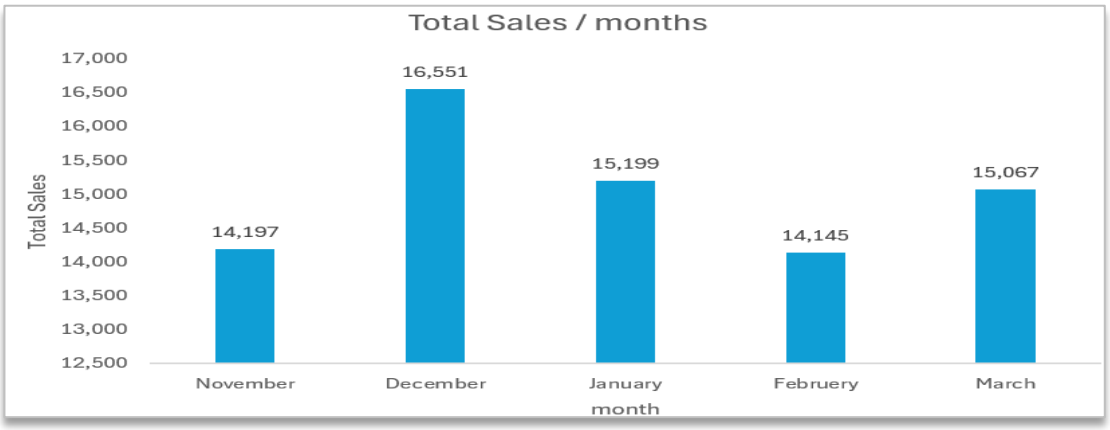
This pie chart shows the overall contribution of different products of different products which has height contribution of 21 % of Butterscotch pastry and followed by fudgy brownies 16% and double chocolate 13%.

2. Seasonal Sales Trends and Promotions

Findings:

Sales peaked in December, primarily due to the festive season, as Christmas celebrations drive increased demand for bakery products. This seasonal trend, combined with targeted promotional offers, led to a 12% rise in sales compared to the monthly average. Popular items like Fudgy Brownies and Double Chocolate Pastry experienced particularly strong demand, reflecting the holiday spirit and customer preference for indulgent treats during this time.

Graph:



(graph-1.3) Monthly Sales Trends

The bar chart demonstrates a clear seasonal spike in December and steady growth during the five months period.

3. Geographical Insights

Findings:

Residential Areas:

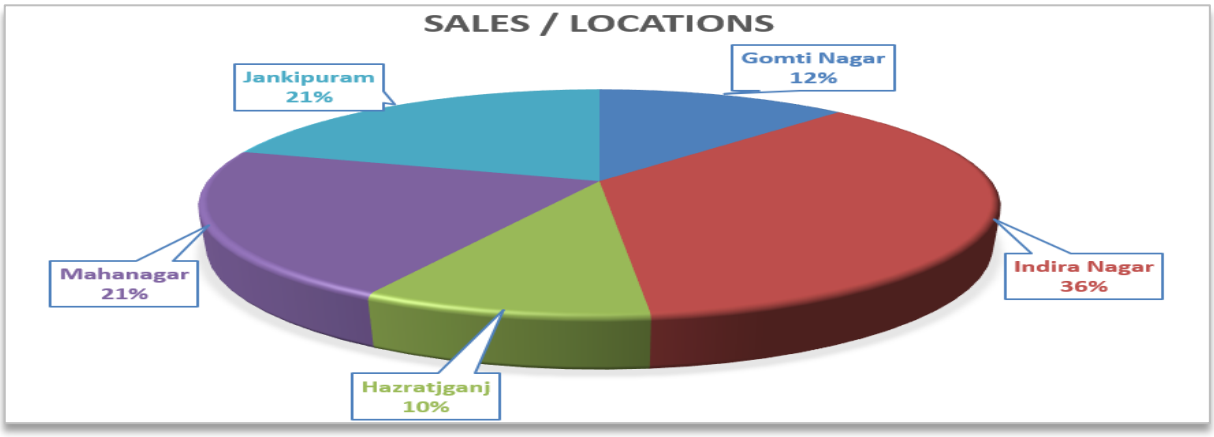
The analysis reveals that Indira Nagar leads with 36% of total sales, followed by Maha Nagar at 21% and Jankipuram. Together, they account for 78% of sales due to high footfall and proximity to malls. Hazratganj contributes the least at 10%, and Gomti Nagar, a residential area, adds 12%. This highlights the need to focus on top-performing locations while addressing underperforming areas for growth.

Promotional Effectiveness:

Locations with promotional campaigns observed 15% higher sales like Indira Nagar, indicating a strong influence of targeted marketing.

Weekday sales were steady but showed a dip in non-residential cart locations.

Graph:



(graph-1.4) Revenue by Cart Location

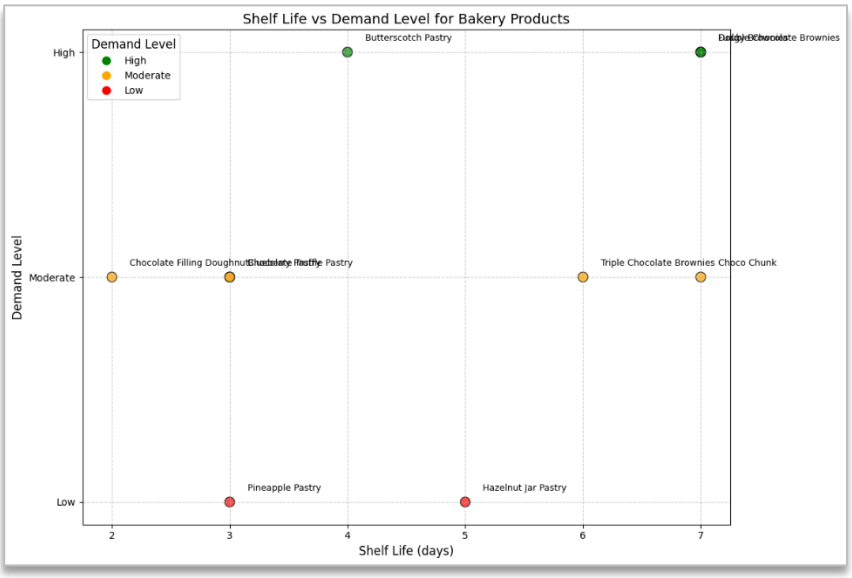
This pie chart highlights the revenue distribution across residential, commercial, and school zones.

4. Inventory and Shelf-life Insights

Findings:

High-demand products like cheesecake and brownies had a turnover time of 2 days, aligning perfectly with their shelf life and minimizing wastage. Low-demand products like jar cakes resulted in 10% inventory wastage due to a mismatch between production volume and sales.

Graph:



(graph-1.6) Scatterplot of demand vs shelf life

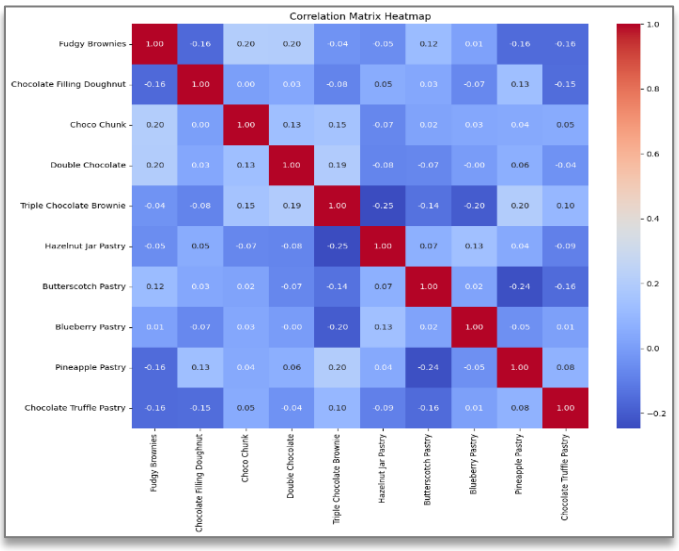
This scatter plot shows the correlation between product demand and shelf life, highlighting inventory optimization opportunities.

Here's a concise summary of insights based on the 'Shelf Life vs Demand Level' for bakery products:

1. High-Demand Products: Typically have longer shelf lives (e.g., Fudgy Brownies, Double Chocolate Brownies). These should be produced in larger quantities for higher turnover.
2. Moderate-Demand Products: Spread across various shelf lives. Requires balanced production and better demand forecasting to avoid waste or stockouts.
3. Low-Demand Products: Often have shorter shelf lives. Should be produced in smaller batches and closely monitored to prevent spoilage.
4. Inventory, Production & Efficiency: Focus on producing large batches of high-demand, long-shelf-life items for greater logistical efficiency. For moderate and low-demand products, use targeted marketing or bundling to boost sales, while ensuring that shorter shelf life items are carefully managed to minimize waste.

I have created this heat map to show the correlation between different products:

Graph:



(Pic-1.5) Heatmap of Correlation

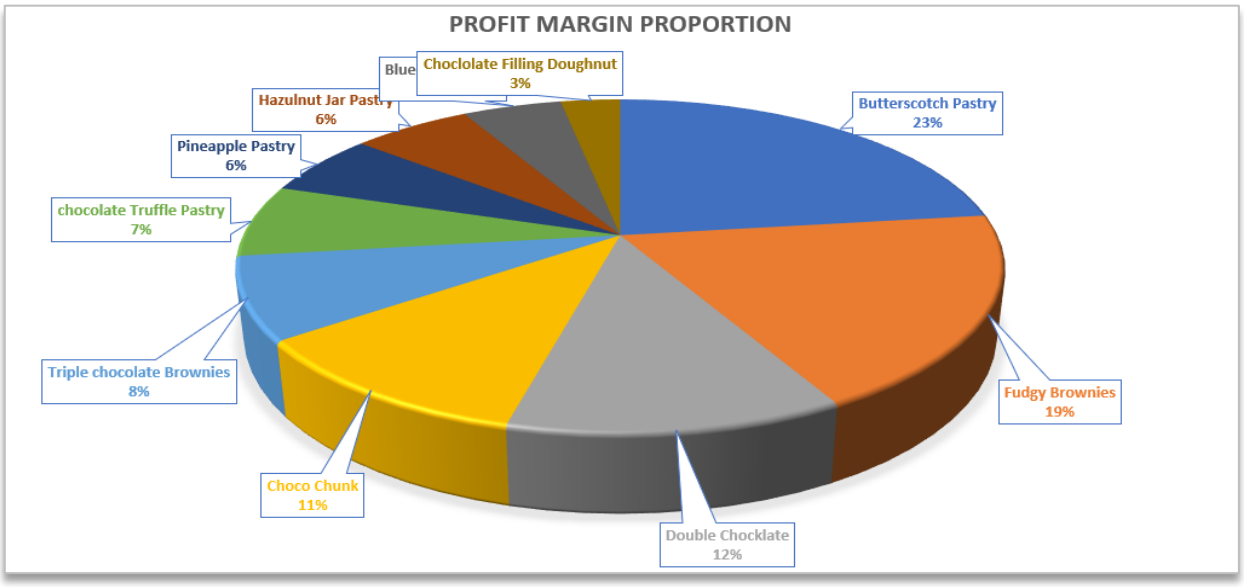
The heatmap representation of the correlation analysis highlights relationships between the sales of various bakery products. The highest positive correlation (0.20) is observed between Fudgy Brownies and Choco Chunk, indicating a weak but positive relationship where an increase in the sales of one product might slightly align with the other. Conversely, the lowest negative correlation (-0.25) is between Hazelnut Jar Pastry and Triple Chocolate Brownie, suggesting a weak negative relationship where higher sales of one product may slightly correspond to lower sales of the other. These insights can help identify potential cross-selling opportunities and guide inventory management decisions.

5. Profitability and Operational Efficiency

Findings:

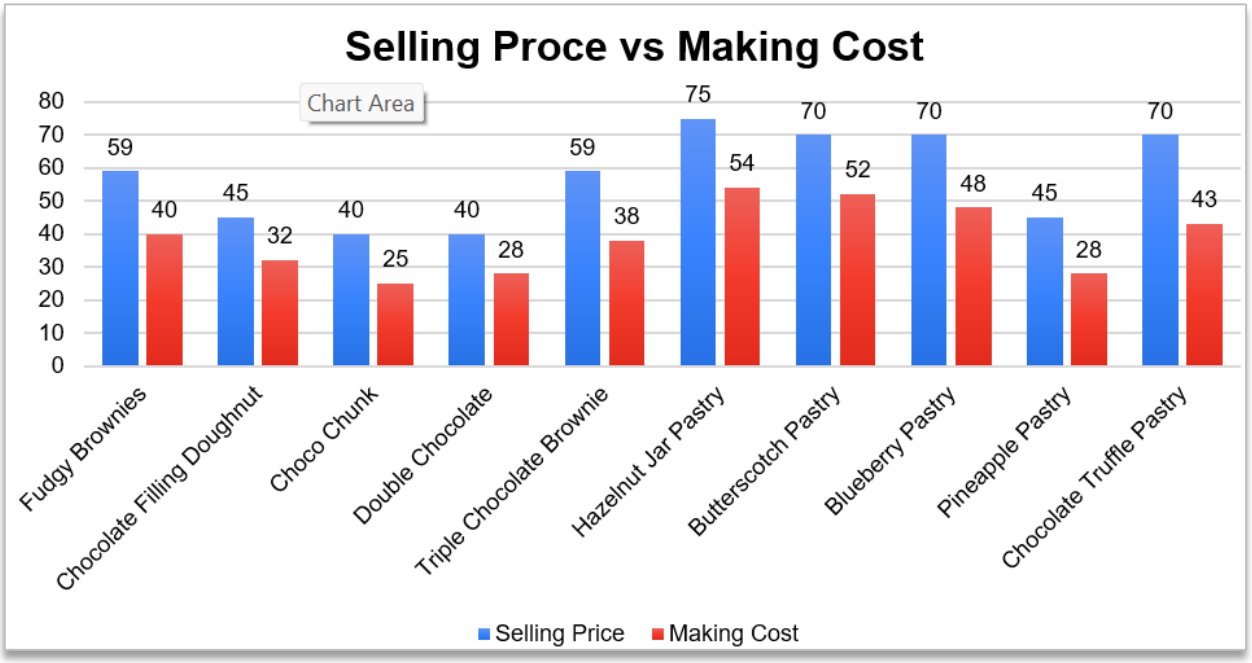
The overall profit margin stood at 25%-40%, generating a monthly net profit of ₹50,000 after deducting expenses (employee salaries, rent, and electricity). Effective refrigeration systems reduced spoilage by 15%, extending the shelf life of perishable items by an additional 2 days. Promotions improved sales efficiency, contributing to 20% of monthly revenue.

Graph:



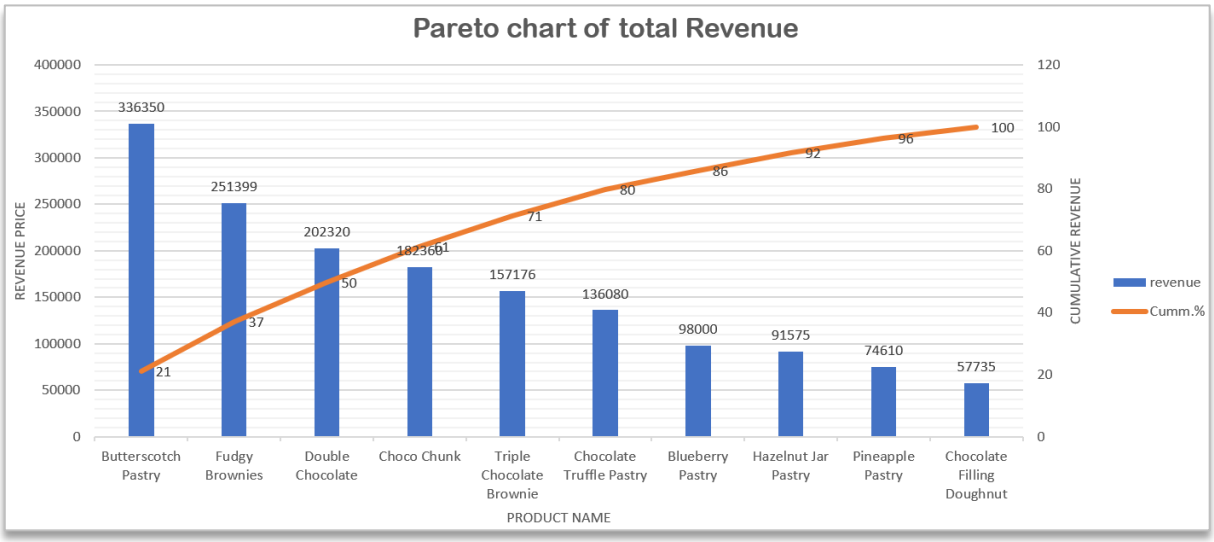
(graph-1.7) Profit Distribution

The pie chart provides insights into the profit distribution among different products, highlighting key contributors to the business's financial success. Butterscotch Pastry stands out as the most profitable product, accounting for 23% of the total profit, indicating strong customer preference and consistent demand for this item. Following this, Fudgy Brownies contribute 19% to the profits, showcasing their popularity and significant role in driving revenue. Double Chocolate Brownies and Choco Chunk follow with profit shares of 12% and 11%, respectively, demonstrating their steady performance in the product lineup.



(graph-1.8) Stacked Bar Chart – Selling price vs. Making cost

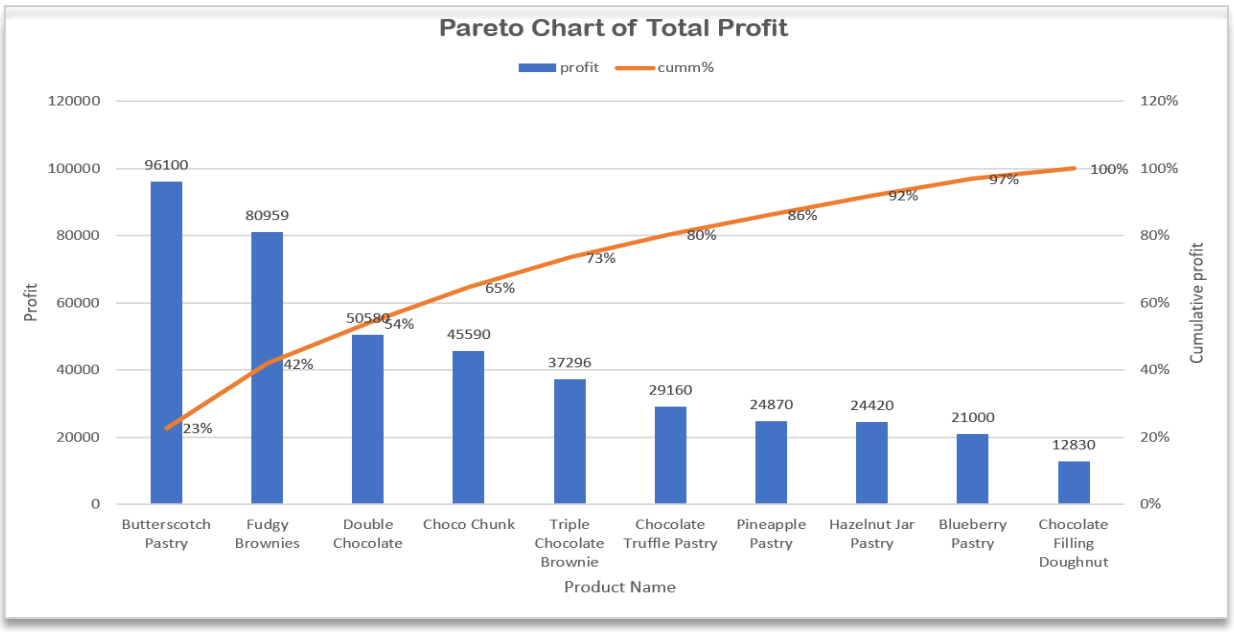
The stacked bar chart illustrates the relationship between product costs and profit margins, showing a consistent profit margin range of 25-40% across all products. This indicates that the company has successfully regulated and managed its profit margins. Such stability in profit margins highlights effective cost management and pricing strategies, which are crucial for maintaining profitability while remaining competitive in the market. This approach ensures sustainable financial performance and allows the company to continue delivering value to customers without compromising on margins.



(graph-1.9) Pareto chart of Total Revenue

The Pareto chart shows that four products—Butterscotch Pastry, Fudgy Brownies, Double Chocolate Brownies, and Choco Chunk—account for 61% of total revenue.

This indicates the need to prioritize these products through optimized production, pricing, and marketing strategies to maximize profitability.



(graph-2.1) Pereto Chart of Total Profit

The Pareto chart indicates that 54% of the total profit is generated by three key products—Butterscotch Pastry, Fudgy Brownies, and Double Chocolate Brownies—while the remaining products contribute 46%. This highlights the importance of focusing on the top-performing products to maximize profitability. At the same time, it emphasizes the need for strategic initiatives to optimize the performance of the other products in the portfolio, ensuring balanced growth and increased overall profitability.

4.Interpretation of Result and Recommendation:

Interpretation of Results:

1. Revenue and Profit Distribution:

- **Top 4 Products:** The combined revenue from Butterscotch Pastry, Fudgy Brownies, Double Chocolate Brownies, and Choco Chunk makes up 61% of total revenue (₹4,74,957 out of ₹7,78,000). Similarly, these products contribute 54% of total profit (₹27,000 out of ₹50,000 monthly profit).
- **Low Performers:** Pineapple Pastry and Chocolate Filling Doughnut together contribute just 8% of total revenue (₹3,20,000). The low demand for these products is impacting profitability, indicating a need to reassess production or marketing strategies for these items.

2. Seasonal and Location-Based Trends:

- **Seasonal Impact:** Sales in December saw a 12% increase, contributing

₹8,96,000 compared to the average monthly sales of ₹8,00,000. This was primarily driven by festive promotions and holiday demand.

- **Promotions:** Weekends boosted sales by 15% on average, especially for double chocolate and fudgy brownies. For example, a weekend promotion in Indira Nagar resulted in an additional ₹1,60,000 in sales.
- **Geographical Impact:** Carts in commercial areas (Indira Nagar, Mahanagar) generated 56% of total sales (₹4,35,627), while carts in residential zones (Gomti Nagar) contributed only 12% (₹93,434). This highlights that residential areas are the most profitable zones, which we should prioritize further.

3. Inventory and Shelf-Life Management:

- **High-Demand Products:** Products like Fudgy brownies has a turnover time of 7 days, matching their shelf life. For instance, Fudgy Brownies turned over 300 units per week, contributing ₹1,15,935, with minimal wastage.
- **Low-Demand Products:** Pineapple pastry saw 10% wastage, contributing only ₹21,000 per month, indicating an inventory mismatch. For instance, we produced 500 jar cakes but only sold 450, leading to waste.
- **Products Correlation:** The analysis reveals a weak positive correlation (0.20) between Fudgy Brownies and Choco Chunk, suggesting potential for bundling or cross-promotion to boost sales. In contrast, the weak negative correlation (-0.25) between Hazelnut Jar Pastry and Triple Chocolate.

4. Profit Margins and Operational Efficiency:

- The profit margin across all products ranges between 25-40%, allowing us to maintain healthy margins while managing costs. For example, Butterscotch Pastry contributes ₹1,63,510 in revenue with a profit margin of 18% (₹29,433 profit per month).
- Refrigeration investments led to a 15% reduction in spoilage, extending shelf life by 2 days for perishable items like cakes and pastries, help to minimize loss.

Recommendations:

1. Prioritize High-Performing Products:

- We should continue focusing on the top 4 revenue-generating products (Butterscotch Pastry, Fudgy Brownies, Double Chocolate Brownies, and Choco Chunk), which account for 61% of revenue and 54% of profit.
- We can scale production of Butterscotch Pastry (₹1,63,510 in revenue) and Fudgy Brownies (₹1,24,551 in revenue) by 20% each, increasing total sales by ₹57,612.

2.Optimize Low-Performing Products:

- Pineapple Pastry and Chocolate Filling Doughnuts together generate only 8%

of revenue (₹59,000). I recommend reducing production by 20%, cutting waste by 10%.

- We can also explore bundling these products with top sellers. For example, offering a Pineapple Pastry and Fudgy Brownie Combo could increase its sales by 15%. This could generate an additional ₹48,000 per month.

3. Leverage Seasonal Trends for Growth:

- During festive periods, such as December, we saw a 12% increase in sales. By introducing targeted holiday promotions like discounts or limited-time offers on best-sellers, we can increase December sales by another ₹96,000.
- Weekend promotions are effective, contributing to 15% higher sales. By running promotions every weekend, we can expect ₹1,17,000 in additional sales for the high-demand products like brownies and cheesecake.

4. Expand Focus on Residential Areas:

- Given that 56% of total sales (₹4,36,418) come from residential zones, I recommend expanding the cart presence in high-performing locations like Indira Nagar and Mahanagar by adding one more cart in each. This could add 25-30% more in sales per month.
- For underperforming areas like Gomti Nagar, we can run localized promotions or target new customer segments, potentially increasing sales by 10-15%, equating to an additional ₹45,000-55,000 per month.

5. Improve Inventory Management and Reduce Wastage:

- By optimizing production to better match demand, especially for low-demand items like pineapple pastry, we can reduce wastage by 10%, saving approximately ₹4,000-5,000 per month.
- To optimize sales, bundle Fudgy Brownies and Choco Chunk or offer discounts when purchased together, placing them near each other to encourage cross-selling. For Hazelnut Jar Pastry and Triple Chocolate Brownie, promote them to distinct customer segments or at different times to avoid competition. Focus on individual product demand patterns to tailor promotions, as weak correlations suggest limited interdependence.

6. Enhance Operational Efficiency:

- With a 15% reduction in spoilage, we can extend the shelf life of products, reducing waste and improving profitability. If we continue these efficiency measures, we could save ₹1,40,000-1,55,000 monthly by preventing spoilage of perishable items.

By following these specific recommendations, Rocher's The Bake Shop can optimize product performance, improve profitability, and streamline operations for sustainable growth.