Navigating Financial Obstacles: Leveraging Data in Vegetable Business

An End-Term report for the BDM capstone Project

Submitted by

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Contents

1 Executive Summary

Introduction:

'Raj Kishore Kumar Gupta and Sons', a renowned vegetable business in Nangloi, Delhi, serves a diverse clientele for 20 years. Yet, it faces challenges hindering financial growth. While integral to the local community, it aims to modernize financial decision-making.

Challenges:

The business struggles with inconsistent financial assessment, affecting monthly income and pricing strategies. Setting optimal pricing margins and credit allocation remains elusive, impacting profit maximization and informed decision-making. This has resulted in missed opportunities for profit maximization and has hindered the owner's ability to make informed business decisions, necessitating a structured approach to address these inefficiencies and capitalize on the business's potential.

Project Approach:

To combat these challenges, a thorough analysis of transaction data and credit practices is underway. The goal: refine pricing, enhance transaction recording, and establish clear credit practices. By implementing these strategies, the business aims to improve profitability and operational efficiency, securing its leadership in the market.

2 Detailed Explanation of Analysis Process/Method

2.1. Method for Financial Overview

To address the challenge of providing a comprehensive financial overview and turnover analysis for ‘Raj Kumar Kishore Gupta and Sons’, a systematic approach was undertaken. This involved the calculation of various key metrics to gain insights into the business's performance and profitability.

1. Total Cost Calculation:

- Vegetables Cost: This encompasses the total expenditure incurred in procuring all vegetables for the day. It includes the purchase cost from the Azadpur Mandi Sabzi and any associated expenses.
- Other Costs: These additional expenses comprise transportation costs, storage expenses, and any other overheads pertinent to the procurement and storage of vegetables.

2. Revenue Generation:

- Revenue: The revenue generated is calculated based on the selling price of vegetables. A predetermined pricing strategy is employed, where 40% of the revenue is derived from selling at the vegetable cost, and the remaining 60% is obtained from sales with margin. This method allows for a balanced approach to pricing, ensuring competitiveness while maintaining profitability and stock utilisation.

3. Profit Analysis:

- Profit Margin: Profit is the surplus amount obtained after deducting the total cost, including vegetable cost and other expenses, from the revenue generated. This metric provides a clear indication of the business's financial performance and its ability to generate profits amidst operational costs.

4. Spreadsheet Utilisation:

- Spreadsheets serve as the primary tool for performing calculations and organising data. They facilitate the manipulation of numerical values, allowing for efficient analysis and visualisation of financial metrics. Additionally, spreadsheets provide a structured format for presenting findings, enabling easy interpretation and decision-making.

By employing this methodical approach, the business can gain valuable insights into its financial performance, identify areas for improvement, and make informed decisions to enhance profitability and operational efficiency. This comprehensive analysis lays the

foundation for implementing strategic recommendations aimed at optimising pricing strategies, refining transaction recording processes, and establishing clear credit criteria to drive sustainable growth and competitiveness in the vegetable market.

	A	B	C	D	E	F	G	H
1	Date	Vegetables Cost	Sell with Margin	60% of Sell	40% of Sell	Revenue	Other Cost	Profit
2	16-01-2024	13530	17320	10392	5412	15804	800	1474
3	17-01-2024	13360	17170	10302	5344	15646	800	1486
4	18-01-2024	12665	16150	9690	5066	14756	800	1291
5	19-01-2024	12730	15900	9540	5092	14632	800	1102
6	20-01-2024	14110	17680	10608	5644	16252	800	1342
7	21-01-2024	13730	17380	10428	5492	15920	800	1390
8	22-01-2024	12830	16190	9714	5132	14846	800	1216

Fig 1. Daily Accumulative Vegetable Transaction Summary

Calculations done in Analysis:

Vegetables Cost = Total Cost Incurred while procuring all vegetables for the Day.

Revenue = (40/100)*Vegetable Cost + (60/100)*Sell with Margin

Other Costs = Expenses such as transportation costs, storage expenses, and any additional overheads related to the procurement and storage of vegetables.

Profit = Revenue - Vegetable Cost - Other Cost

2.2. Method for Margin Analysis

In order to provide actionable recommendations aimed at achieving a desirable monthly turnover, a meticulous margin analysis is conducted on each vegetable sold during the day. This analysis delves into the intricate balance between cost prices (CP) and selling prices (SP), offering insights crucial for optimizing pricing strategies and maximizing profits.

Margin Calculation:

The margin, a pivotal metric in understanding profitability, is computed for each vegetable by subtracting the cost price (CP) from the selling price (SP). This straightforward yet fundamental calculation unveils the profit margin associated with each unit of vegetable sold, serving as a barometer for assessing the financial viability of individual products within the business's inventory.

Daily Average Margin Calculation:

To gain a comprehensive understanding of the relationship between margins and profits, the daily average margin is calculated. This involves summing up the margins of all vegetables sold throughout the day and dividing the total by the number of vegetables sold. By quantifying the average margin per unit, this calculation offers valuable insights into the overall profitability of the business's daily operations.

	A	B	C	D	E	F	G	H	I	J
1	s.l	name	cp	sp	quantity	cost	sell	date	margin	% marg
2	1	ladyfinger	68	80	30	2040	2400	16-01-2024	=D2-C2	17.64706
3	2	Gooseberry	28	40	20	560	800	16-01-2024	12	42.85714
4	3	Peas	42	50	80	3360	4000	16-01-2024	8	19.04762
5	4	Red/Yellow	100	130	8	800	1040	16-01-2024	30	30
6	5	Green Caps	35	50	10	350	500	16-01-2024	15	42.85714
7	6	china cucur	30	40	22	660	880	16-01-2024	10	33.33333
8	7	Cucumber-l	20	30	20	400	600	16-01-2024	10	50
9	8	turnip	20	30	20	400	600	16-01-2024	10	50
10	9	beetroot	20	30	10	200	300	16-01-2024	10	50
11	10	Lemon	30	40	15	450	600	16-01-2024	10	33.33333
12	11	MUSHROO	90	110	5	450	550	16-01-2024	20	22.22222
13	12	MONGRA	40	60	8	320	480	16-01-2024	20	50
14	13	BABYCORN	70	90	3	210	270	16-01-2024	20	28.57143

Fig 2. Table showing Margin Calculations

Calculations done in Analysis:

Margin = CP - SP

Daily Margin = Σ Margin / No. of Vegetables Sold for the Day

% Margin = Margin / CP * 100

	A	B	C	D
1	date	margin	Profit	No of Vegetables Sold
2	16-01-2024	14.0625	1474	16
3	17-01-2024	13.33333	1486	15
4	18-01-2024	13.33333	1291	15
5	19-01-2024	12.33333	1102	15
6	20-01-2024	13.8	1342	15

Fig 3. Daily Accumulative Margin-Profit-Veggies Sold Summary

By using this simple method to analyse margins, we can get useful insights into the profitability of their products. They can then find ways to adjust margins to improve profits and achieve better monthly turnovers.

Python and various libraries are also used to delve into various analyses such as linear regression to find ideal margin, the results of which will be discussed in later sections.

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np

df = pd.read_csv('daily_averages.csv')
df = df[(df['Profit'] != 0) & (df['% margin'] != 0)]

# a scatter plot with a linear fit on top of it
sns.lmplot(x='% margin', y='Profit', data=df)

# the slope and intercept of the regression line
slope, intercept = np.polyfit(df['% margin'], df['Profit'], 1)

profit_at_35_margin = slope * 35 + intercept
print(f'The profit value at a 35% margin is {profit_at_35_margin}')
```

2.3. Method for Credit Analysis

Name	Total Credit	Total Repayment	Interest Cost (4%)
Rahul Rajora	21870	22980	874.8
Bajarangi	17520	17080	700.8
Sonu Madipur	27960	26080	1118.4
Kishore	35860	29400	1434.4
Anand	33560	34060	1342.4
Vanu	15940	17540	637.6

Fig 4. Table showing Accumulative Credit-Repayment Summary

Calculations done in Analysis:

Total Credit = Sum of Credit Amounts

Total Repayment = Sum of Repayment Amounts

Interest Cost = (Rate/100) * Total Credit

Profit = (60/100) * (Margin/100) * Total Credit

Earnings = Total Repayment + Profit - Total Credit - Interest Cost

Interest Rate = 4% per month

3 Results and Findings

Note: The analysis numbers/values do not account for business closure figures but are presented in the visualizations. For example, the mean and correlation calculations do not include rows with 0 values. However, these values will be included in the visualizations for comprehensive representation.

3.1. Financial Overview of the business

Vegetable-Cost: Cost incurred in procuring all vegetables for the day. It includes the purchase cost from the Azadpur Mandi Sabzi and any associated expenses.

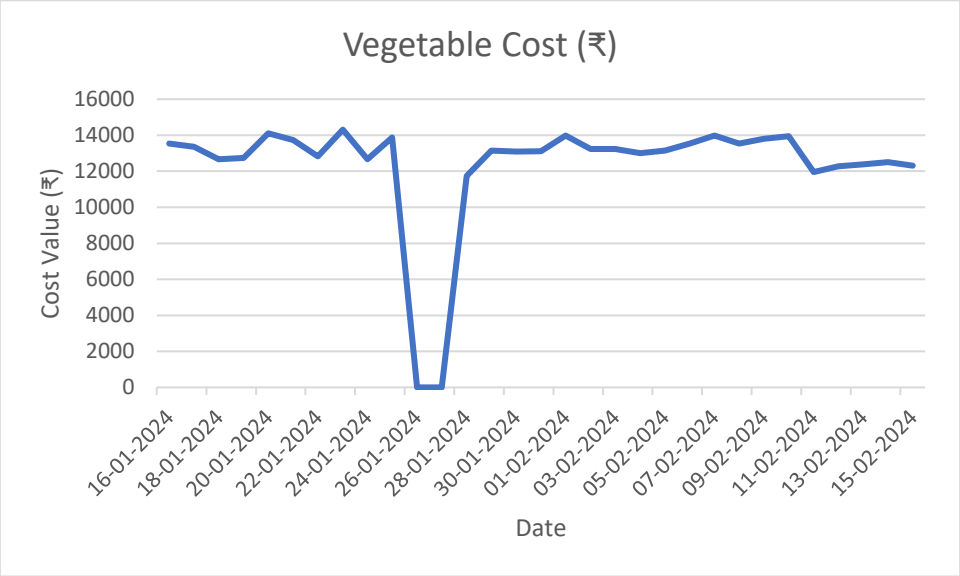

Fig 5. Vegetable Cost Trend

The above analysis shows:

- Mean Vegetable Cost: ₹13,161.69
  The average cost incurred in procuring vegetables for the day amounts to approximately ₹13,161.69. This figure serves as a central measure of the typical expenditure associated with daily procurement activities.
- Median Vegetable Cost: ₹13,140
  The median vegetable cost, standing at ₹13,140, indicates the middle value in the dataset.
- Mode Vegetable Cost: ₹13,530
  The mode, representing the most frequently occurring value in the dataset, is recorded at ₹13,530. This figure underscores a common recurring cost associated with vegetable procurement, offering insights into prevalent pricing trends.
- Standard Deviation of Vegetable Cost: ₹674.3573
  With a standard deviation of ₹674.3573, the variability in vegetable costs around the mean is quantified. This metric provides a measure of the dispersion or spread of the

data points from the average cost, indicating the degree of fluctuation in procurement expenses.

The dip in vegetable cost in mid-February can be attributed to the lower variety of vegetables sold during that period.

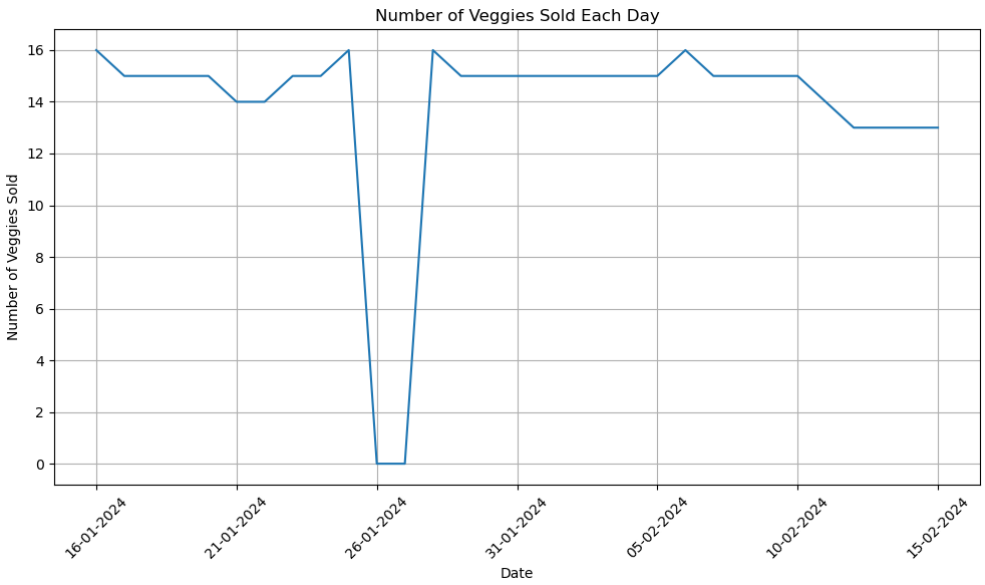

Fig 6. Number of Different Vegetables Sold each Day Trend

Mean Number of Different Vegetables sold on a Day: 14.75862069

Median & Mode Number of Different Vegetables sold on a Day: 15

Other Costs: Cost associated with additional expenses such as transportation costs, storage expenses, and any other overheads relevant to the procurement and storage of vegetables.

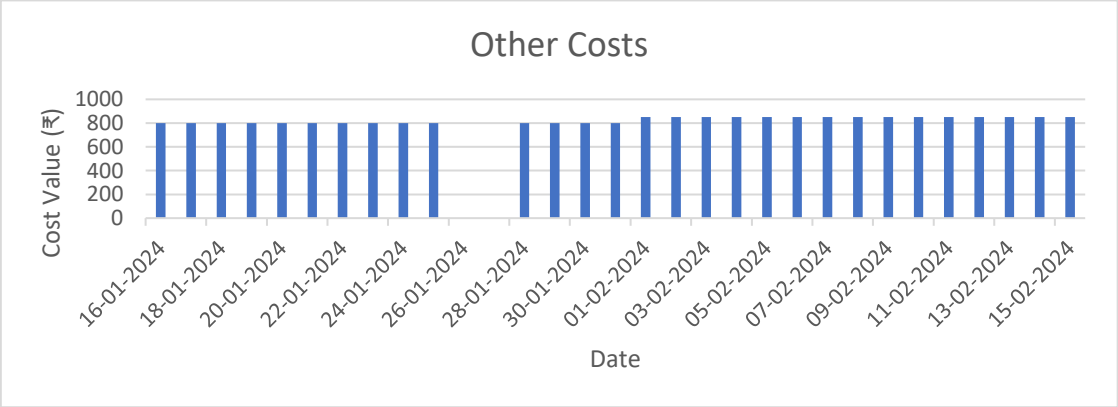

Fig 7. Other Cost Trend

In the month of January, Other Costs were fixed at Rs. 800, whereas in February, they amounted to Rs. 850. This variation underscores the dynamic nature of these expenses and the need for agile financial management practices to adapt to changing circumstances.

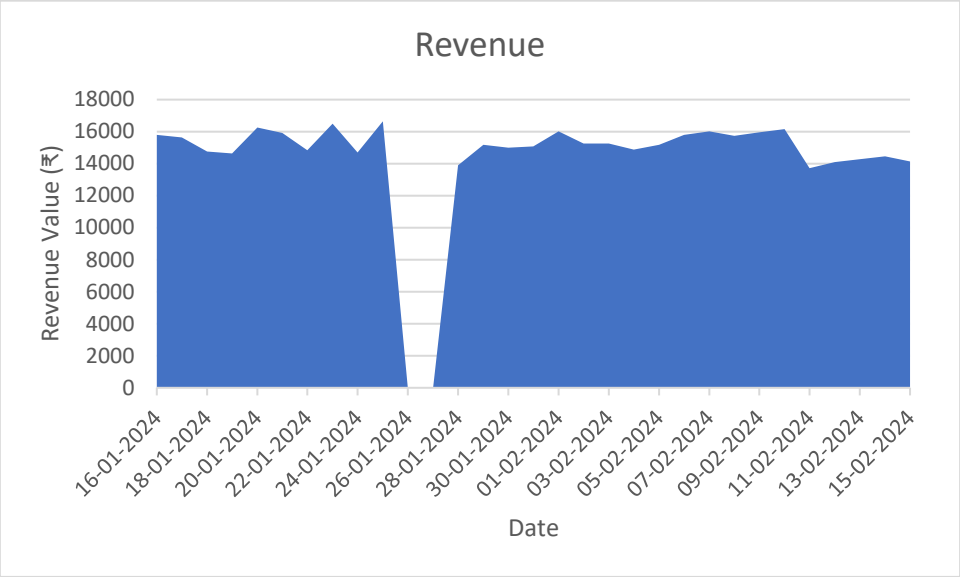

Fig 8. Revenue Trend

From the analysis we get:

- Mean Revenue: ₹15,233.99
  The average revenue generated per day amounts to approximately ₹15,233.99. This figure serves as a central measure of the typical income associated with daily sales activities.
- Median Revenue: ₹15,186
  The median revenue, standing at ₹15,186, indicates the middle value in the dataset. It represents the revenue level where half of the days' revenues are higher and half are lower.
- Mode Revenue: ₹15,804
  The mode, representing the most frequently occurring value in the dataset, is recorded at ₹15,804. This figure underscores a common recurring revenue level, offering insights into prevalent sales trends.
- Standard Deviation of Revenue: ₹804.1105
  With a standard deviation of ₹804.1105, the variability in daily revenue around the mean is quantified. This metric provides a measure of the dispersion or spread of the revenue data points from the average revenue, indicating the degree of fluctuation in sales income.

This analysis provides the business owner with valuable insights into the typical revenue generated per day, the consistency of revenue levels, and the degree of variability or uncertainty in daily sales income.

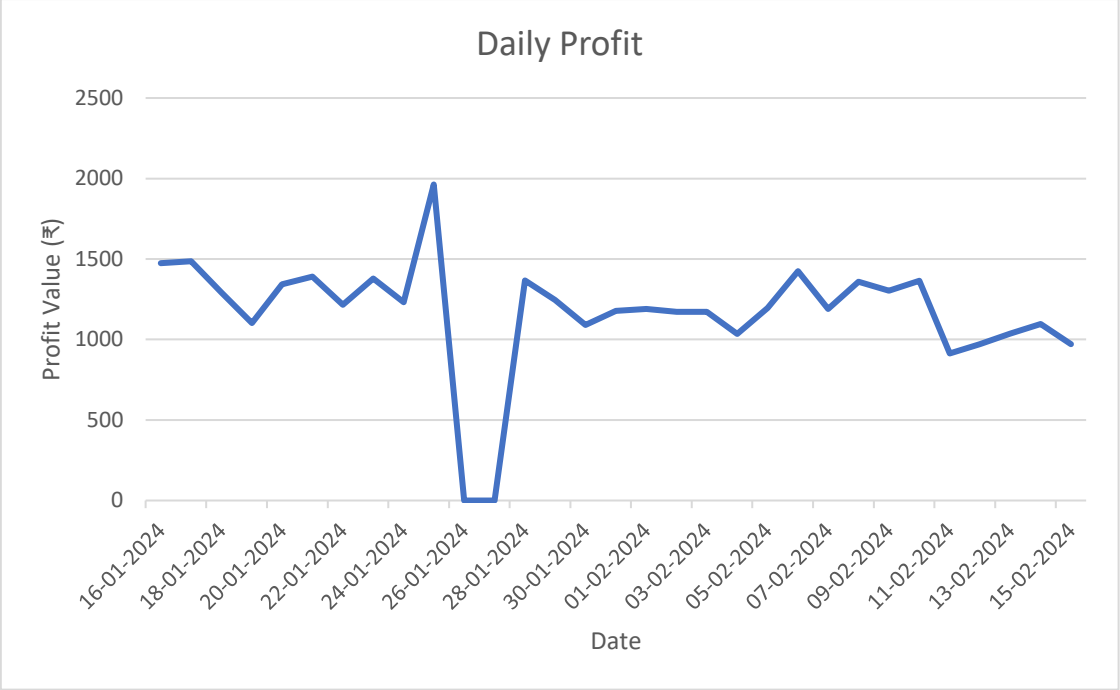

Fig 9. Profit Trend

Daily Profit Data Analysis:

- Mean: The average daily profit is approximately **₹1,246.43**.
- Standard Error: The standard error in the mean daily profit is about ₹38.32.
- Median: The median daily profit stands at ₹1,216.
- Mode: The most frequently occurring daily profit is ₹1,190.
- Standard Deviation: The variability in daily profits around the mean is quantified by a standard deviation of approximately **₹206.34**.
- Sample Variance: The variance in daily profits within the sample is about ₹42,575.39.
- Kurtosis: The kurtosis value indicates a distribution slightly more peaked than a normal distribution, with a value of approximately 4.01.
- Skewness: The skewness value of approximately 1.31 indicates a moderate right skewness in the distribution of daily profits.
- Range: The range of daily profits spans ₹1,049, from a minimum of ₹914 to a maximum of ₹1,963.
- Minimum: The lowest recorded daily profit is ₹914.
- Maximum: The highest recorded daily profit is ₹1,963.
- Sum: The total profit generated over the observed period is ₹36,146.6.
- Count: A total of 29 daily profit observations were used for the analysis.

3.2. Profit-Margin Analysis

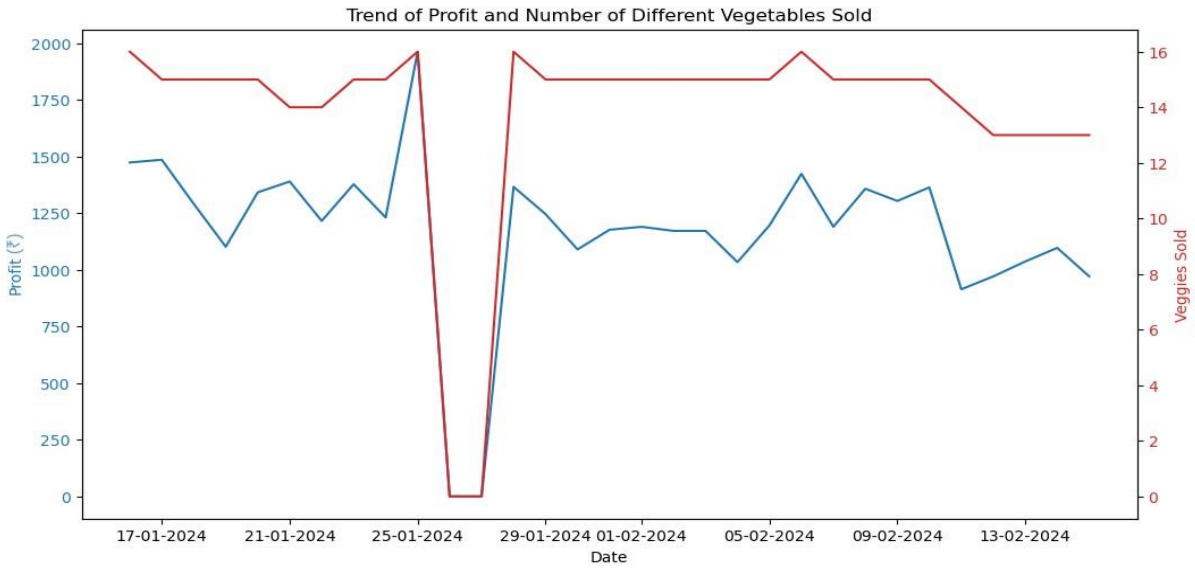

Fig 10. Profit-No. of Different Vegetables Sold Each Day Trend

The correlation score of 0.650886394 between the number of different vegetables sold and profit suggests a moderately strong positive relationship between these two variables. This indicates that as the variety of vegetables sold increases, there is a tendency for profits to also increase. Such a correlation may imply that offering a diverse range of vegetables attracts a larger customer base and enhances sales, thereby positively impacting profits.

However, it's essential to note that correlation does not imply causation, and other factors could contribute to both the variety of vegetables sold and the profit generated.

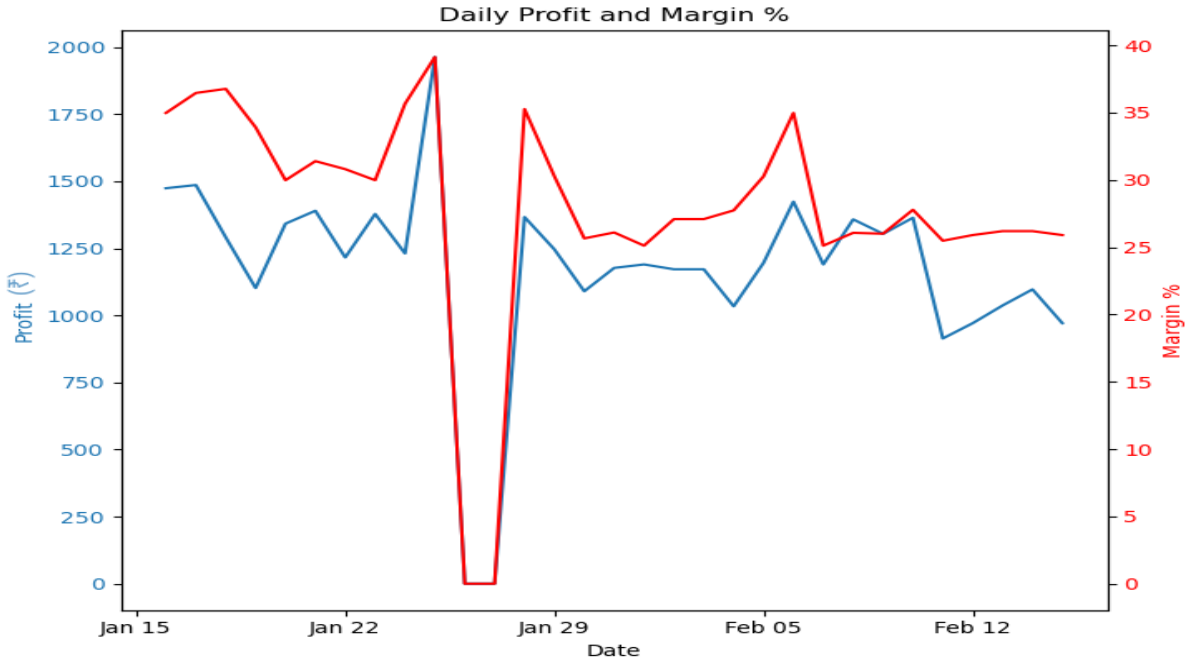

Fig 11. Profit-Margin % Trend

The correlation coefficient of 0.6893107309152109 between profit and percentage margin indicates a moderately strong positive relationship between these two variables. This suggests that as the percentage margin increases, there is a tendency for profits to also increase.

A higher profit margin typically signifies that a business is generating more revenue relative to its costs, which can positively impact overall profitability. Such a moderately high correlation underscores the importance of maintaining healthy profit margins for the business's financial success. It implies that effective pricing strategies, cost management practices, and revenue generation efforts directly influence the profitability of the business.

However, it's important to recognize that correlation does not imply causation, and other factors could influence both profit and percentage margin independently.

While a high correlation suggests a strong relationship, additional factors and external influences may also impact both variables. Therefore, a comprehensive examination of various business factors is essential to make well-informed decisions aimed at maximizing profitability and ensuring long-term sustainability.

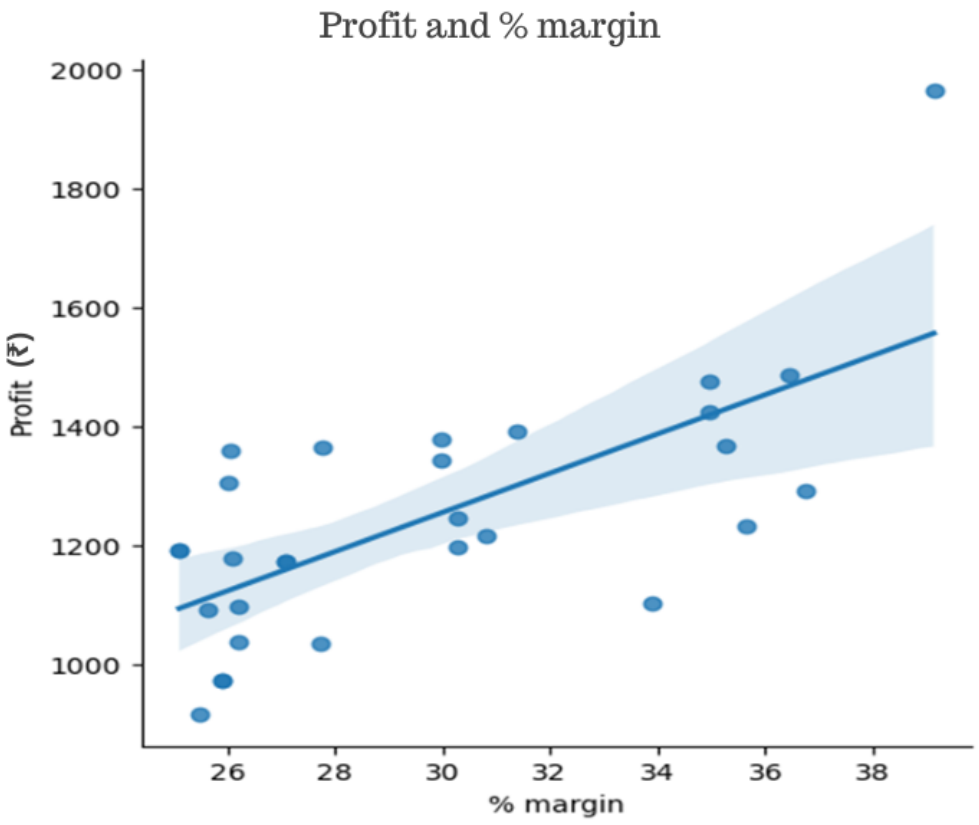

Fig 12. Scatter Plot along with Regression Line on Profit-Margin %

By fitting a regression line equation, we have determined that the profit value at a 35% margin is calculated to be ₹ 1419.31. This statistical analysis allows us to quantify the expected profit level corresponding to a specific profit margin percentage.

Furthermore, through comprehensive data analysis and discussions with the business proprietor, it has been discerned that maintaining an average margin percentage of approximately 35% is deemed ideal to achieve a daily profit ranging between ₹1350 to ₹1450 which amounts to ₹37800- 40600 monthly income.

This insight, derived from both statistical modelling and practical business knowledge, provides valuable guidance for optimizing profitability while ensuring sustainable operations.

With this information at hand, we can now delve into a more detailed examination of the days where the average margin percentage hovers around 36%. By scrutinizing these specific instances, we aim to delineate the margins associated with each vegetable sold. This granular analysis will enable us to identify potential opportunities for margin optimization and strategic pricing adjustments, thereby maximizing revenue potential and enhancing overall business performance.

	A	B	C	D	E	F
1	date	margin	% margi	Profit	Vegetables_Sold	
2	16-01-2024	14.0625	34.97289	1474	16	
10	24-01-2024	13	35.65079	1231	15	
14	28-01-2024	15.0625	35.26293	1366.6	16	
23	06-02-2024	14.0625	34.97289	1424	16	

Fig 13. Table showing Filtered Dates with Margin % within selected region

As we proceed to analyse the statistics of filtered days with margin percentages between 34-36, it becomes evident that the variety of vegetables sold also has a significant impact on profit. This underscores the importance of understanding the relationship between profit margins and product diversity in driving business success.

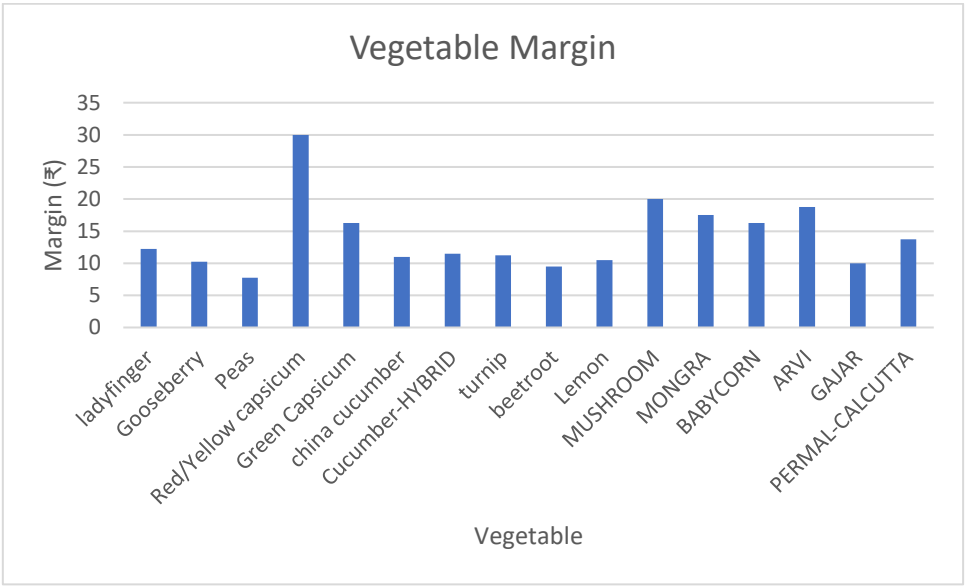

Fig 14. Average Margin of Vegetables on Filtered Dates

3.3 Credit Analysis

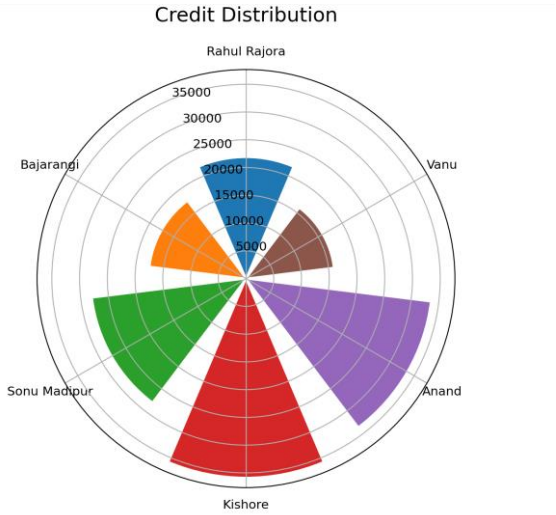

Fig 15. Circular Bar Chart: Total Credit Given among Customers

Clearly, Mr. Kishore has taken the highest credit from the business, indicating a significant reliance on credit facilities.

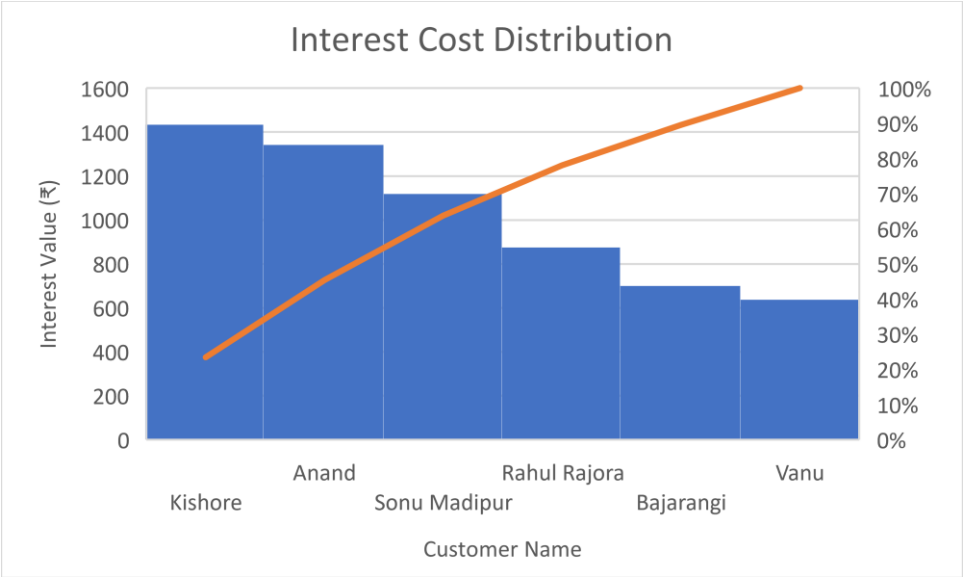

Fig 16. Pareto Chart: Interest Cost Incurred by Extending Credit to Customers

Consequently, this translates to the highest interest cost incurred by the business due to the extended credit terms.

However, it's essential to note that while Mr. Kishore's credit utilization may result in elevated interest expenses, it does not necessarily translate to higher earnings for the business.

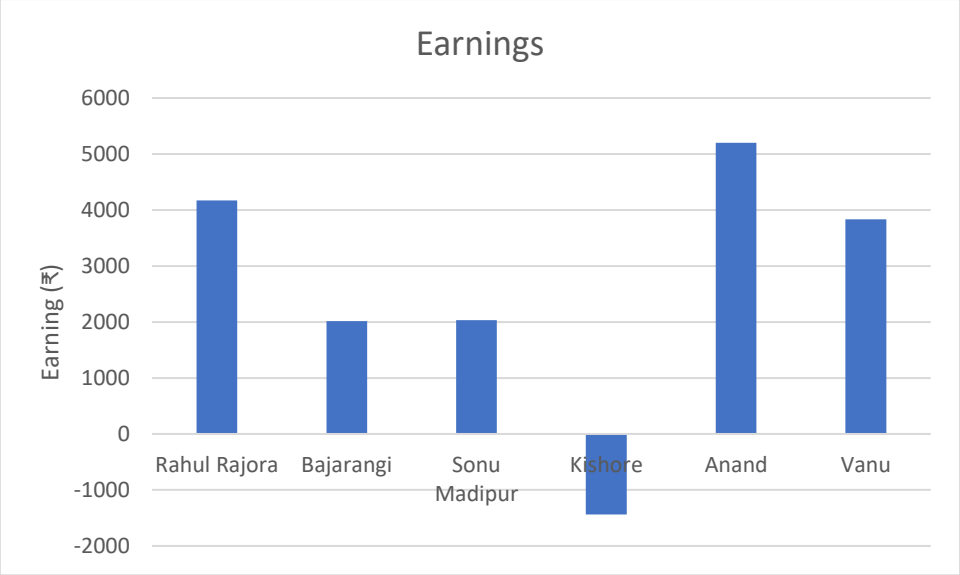

Fig 17. Earning due to Customers

Therefore, it becomes imperative for the business to implement measures such as setting a cap on outstanding balances and credit amounts. By imposing limits on credit utilization, the business can mitigate the risk of default, minimize interest costs, and ultimately enhance profitability.

These proactive steps not only ensure prudent financial management but also safeguard the business's financial health and sustainability in the face of uncertain economic conditions and fluctuating market dynamics.

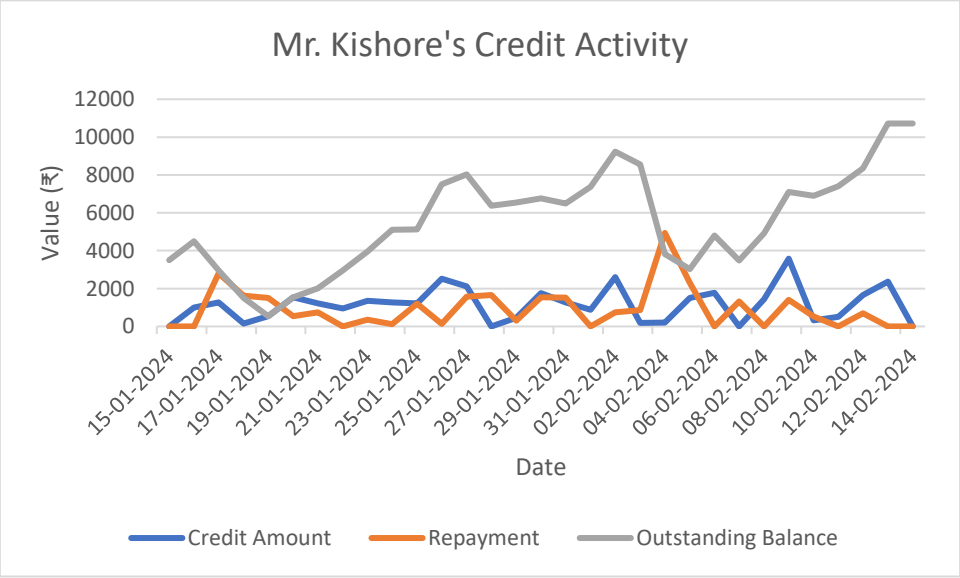

Fig 18. Trend of Mr. Kishore's Credit Activity

The irregularities, including skipped repayment dates and consistently low repayment amounts observed from February 6 to February 14, have significantly contributed to the notable increase in the outstanding balance. Such practices not only disrupt the expected cash flow but also elevate the financial risk for the business.

4 Interpretation of Results and Recommendations

4.1. Financial Overview of the Business

Turnover	₹ 36,146.60
Revenue	₹ 4,41,785.60
Cost	₹ 4,05,639
Average Daily Profit	₹ 1,246.43
Minimum Daily Profit	₹ 914
Maximum Daily Profit	₹ 1,963

The monthly income from the business amounts to **₹36,146.60**.

4.2. Credit Overview of the Business

Name	Total Credit (₹)	Total Repayment (₹)	Interest Cost (4%) (₹)	Profit (30% margin) (₹)	Earnings (₹)	Profit (35% margin) (₹)	Earnings (₹)
Rahul Rajora	21870	22980	874.8	3936.6	4171.8	4592.7	4827.9
Bajarangi	17520	17080	700.8	3153.6	2012.8	3679.2	2538.4
Sonu Madipur	27960	26080	1118.4	5032.8	2034.4	5871.6	2873.2
Kishore	35860	29400	1434.4	6454.8	-1439.6	7530.6	-363.8
Anand	33560	34060	1342.4	6040.8	5198.4	7047.6	6205.2
Vanu	15940	17540	637.6	2869.2	3831.6	3347.4	4309.8
					15809.4		20390.7

Overall, selling vegetables on credit proves to be a profitable venture, but maintaining profitability requires proper credit practices and accountability.

Increasing the profit margin on vegetables sold to Vendors from 30% to 35% can potentially result in earnings of **₹4,581.3**.

4.3. Ideal Margins for Desired Profit

Vegetable	Margin (₹)
Ladyfinger	12.25
Gooseberry	10.25
Peas	7.75
Red/Yellow capsicum	30
Green Capsicum	16.25
China Cucumber	11
Cucumber-HYBRID	11.5
Turnip	11.25
Beetroot	9.5
Lemon	10.5
Mushroom	20
Mongra	17.5
Babycorn	16.25
Arvi	18.75
Gajar	10
Permal Calcutta	13.75

However, it's imperative to acknowledge the irregular nature of profit margins in practice. Margins often deviate from standard percentage increments due to factors such as pricing strategies, market dynamics, and competitive pressures. For instance, if the cost price (CP) of a vegetable is ₹28, setting the selling price at ₹30 may result in an inadequate profit margin, rendering it unviable. Furthermore, non-rounded figures like ₹33 or ₹37 may not be practical due to their non-standard nature, which could potentially confuse customers and disrupt pricing consistency. In such cases, rounding-off considerations and business environment factors may necessitate setting the selling price at ₹40, which corresponds to a margin of approximately 42.85%. This highlights the dynamic nature of margin determination, where adjustments are made according to prevailing business conditions and external influences. As a result, maintaining a fixed margin at all times may not be practical or feasible, and flexibility in margin setting is essential to adapt to changing market dynamics and ensure competitiveness.

4.4. Expand Product Variety:

- Increase the variety of vegetables offered for sale to capitalize on the positive correlation between the number of different vegetables sold and profit. By diversifying the product range, the business can attract a broader customer base and cater to diverse preferences, thereby stimulating sales and enhancing profitability.
- Enhance customer satisfaction and loyalty by offering a wide selection of fresh, high-quality vegetables. Providing an extensive range of produce demonstrates the business's commitment to meeting the needs and preferences of its customers, fostering repeat business and positive word-of-mouth referrals.

- Differentiate from competitors and stand out in the market by offering unique and specialty vegetables that are not readily available elsewhere. By providing exclusive and in-demand items, the business can command premium pricing and increase overall revenue. For example, offering specialty vegetables such as red and yellow capsicum, which have high margins of Rs. 30, can be very beneficial. These unique offerings not only attract customers seeking specialty ingredients but also allow the business to capture higher margins, thereby contributing to enhanced profitability.

4.5. Implement a Structured Credit Management System:

- Set a cap on outstanding balances and credit amounts to mitigate the risk of default and minimize exposure to potential losses. Consider the individual's credit history and financial stability when determining credit limits to ensure responsible lending practices.
- Regularly review and monitor credit utilization and outstanding balances to identify and address potential risks in a timely manner. Utilize historical data and performance metrics to assess creditworthiness and proactively manage credit risk.
- Implement automated systems or software solutions (like Accounting Apps) to streamline credit management processes, including credit monitoring, and collections. Leverage technology to enhance efficiency and accuracy in credit assessment and management, while ensuring compliance with regulatory requirements and industry best practices.

4.6. Enforce Strict Repayment Practices:

- Establish a structured repayment schedule for credit customers, specifying due dates and payment terms to ensure timely repayment.
- Provide clear and transparent communication to customers regarding repayment obligations, including reminders and notifications for upcoming payments.
- Implement incentives for early repayment or penalties for late payments to encourage timely repayment behaviour among customers.
- Monitor repayment performance closely and take proactive measures to address any irregularities promptly.

5 Additional

Link: BDM PROJECT FOLDER