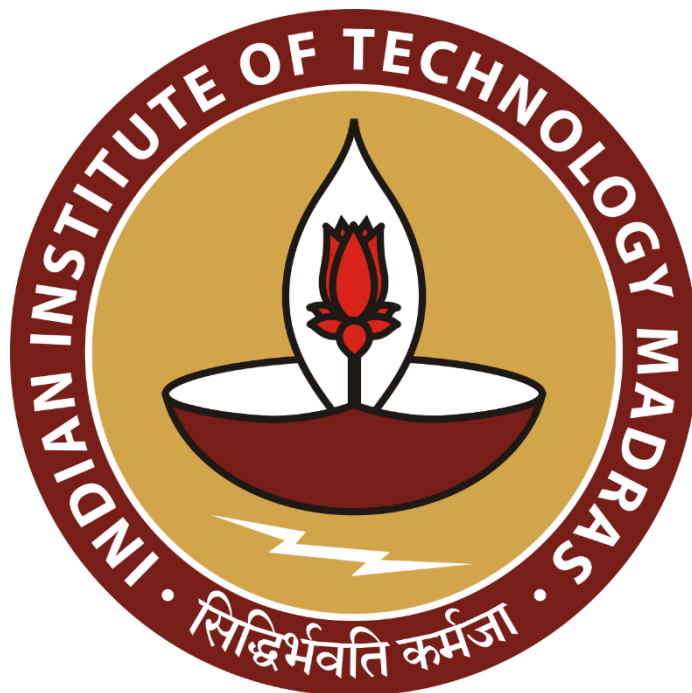# PRICE TREND ANALYSIS & DEMAND FORECASTING FOR A WHOLESALE BUSINESS

A Mid Term report for the BDM capstone Project

Submitted by

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Contents

1   Executive Summary

Mr Saday Shankar started the operations in 2000, it is a local level wholesale store located near Arwal more, Jehanabad, Bihar. He is serving the local community of the city over the radius of approx 3 to 4 Km, with his wholesale business which has products like sugar, edible oil, Rice and flour etc .It is a B2B business. He runs the store by himself, every morning at 9 a.m he opens the store and closes it at around 5 to 6 p.m.

A few years ago, many people started similar businesses which had approximately 5 to 6 shops, leading to increase in competition around him, but in the current time due to limited capital and price volatility of product(sugar) which fluctuate daily. They are not able to maintain the profit margin and stocks at the right level, which is affecting their revenue and also their growth. The business is struggling a lot, Which is affecting the management of the business. From the start, he was selling only sugar, he added other products last year due to increased business competition.

With The help of historical sales data, analyzing the price trend, which relies heavily on past price data, Identifying Trends, patterns by using tools like trend lines, Moving average and then forecasting the future demand of products through Demand forecasting, using Time Series Analysis methods like moving average, exponential smoothing. In that way the problem of business is addressed and, this analysis helps maintain optimal stock levels and pricing. For this analysis we took around 3 months sales data for calculating the average inventory days to maintain the inventory with the right amount of products.

This will help the business to make the right decision to maintain the right product stock up, grow, run efficiently and profitably with limited resources and capital, and not facing problems of profit margins and stock up and focus on growing the business and generating high revenue.

2   Proof of originality of the Data

There are 5 types of SKU in the wholesale store. After interacting and discussing with the store owner, I took the 2 months of available Sales & Revenue data and 1 month of current data. After that I prepared a notebook and noted all the data and updated them over time.

Here are some sample photos of data that I have collected.

दिनांक	चीनी (50kg) मात्रा	दर	शर्मा मैदा (15kg) मात्रा	दर	शेखर मैदा (13kg) मात्रा	दर	आटा (50kg) मात्रा	दर	चोकर (26kg) मात्रा	दर
मार्च 15	5	2180	2	1920	3	1720	12	1320	2	1560
मार्च 16	5	2160	9	1920	4	1720	6	1320	1	1560
मार्च 17	6	2180	6	1920	3	1720	11	1320	2	1560
" 18	12	2200	3	1920	7	1720	6	1320	2	1560
" 19	1	2260	6	1920	4	1720	1	1320	1	1560
" 20	1	2180	8	1920	5	1720	2	1320	21	1560
" 21	5	2180	6	1920	3	1720	7	1320	1	1560
" 22	6	2260	2	1920	2	1720	6	1320	0	
" 23	10	2300	9	1920	4	1720	8	1320	0	
" 24	7	2180	10	1920	5	1720	9	1320	1	1560
" 25	18	2300	5	1920	4	1720	8	1320	3	1560
" 26	x	x	x	x	x	x	x	x	x	x
" 27	4	2175	5	1920	5	1720	7	1320	5	1560
" 28	2	2250	7	1870	7	1720	5	1320	1	1560
" 29	10	2200	8	1930	8	1720	6	1320	2	1560
" 30	x	x	x	x	x	x	x	x	x	x
" 31	1	2180	4	1930	3	1720	6	1270	2	1560
अप्रैल 1	10	2300	5	1920	<1	1720	6	1270	1	1560
अप्रैल 2	18	2300	7	1930	3	1720	6	1270	1	1560
" 3	9	2225	6	1930	5	1720	14	1270	1	1560
" 4	x	x	x	x	x	x	x	x	x	x
" 5	x	x	x	x	x	x	x	x	x	x
" 6	x	x	x	x	x	x	x	x	x	x
" 7	x	x	x	x	x	x	x	x	x	x
" 8	x	x	x	x	x	x	x	x	x	x
" 9	10	2300	3	1930	2	1740	7	1270	2	1560
" 10	6	2180	9	1930	6	1740	9	1270	3	1560
" 11	2	2250	4	1930	1	1740	6	1270	3	1560
" 12	4	2200	3	1980	3	1740	9	1270	2	1560
" 13	x	x	x	x	x	x	x	x	x	x

I also collected all the receipts of the products that he purchased and stock up in the inventory.

ORIGINAL FOR RECIPIENT

Subject to GOPALGANJ Jurisdiction Only.
MAGADH SUGAR & ENERGY LTD.
Unit: Bharat Sugar Mills
(P.O.Sidhwalia, Dist. Gopalganj, GOPALGANJ, Bihar, PIN- 841423)

e-Waybill No. : 871395147753
e-Waybill Date/Time : 2024-03-15 12:24:00
IRN : 9649551439ec0a94d288ed2ca42276d43ca44e136b278f7a5482f54ba86b348d

Phone No. : 06151-285425	Regd Office	GSTIN : 10AAJCM6633R1Z2
Fax No. : 06151-285423	Post Office : Hargaon	CIN : L15122UP2015PLC069632
Web Site : www.birla-sugar.com	District : Sitapur	PAN : AAJCM6633R
Email : sidhwalia@birla-sugar.com	State : Uttar Pradesh-261121	TAN : PTNM08368D
		FSSAI Lic. No: 10012033000138

TAX INVOICE

Invoice No. : SU61302324103908	Means of Transport : Truck
Invoice Date : 15.03.2024	R.R./G.R. No. : 6892
Place of Supply :-	Wagon/Vehicle No. : BR28GA9288
State Name : BIHAR	Transporter Name : NAVEEN TRANSPORT AGENCY
State Code : 10	Sugar Selling Agent : SIDDHARTH SUGAR COMPANY

Bill To :-
SIDHESWAR PRASAD
Arwal More
Jahanabad
Jahanabad
PIN:804408
State Code / Name : 10 / BIHAR
GSTIN : 10AFDPP4368N1Z8
PAN : AFDPP4368N

Ship To :-
SIDHESWAR PRASAD
Arwal More
Jahanabad
Jahanabad
PIN:804408
State Code / Name : 10 / BIHAR
GSTIN : 10AFDPP4368N1Z8
PAN : AFDPP4368N

Sl. No.	HSN Code	Description of Goods	No. Of Bags	Season	Qty	UQC	Rate	Amount (INR)
1	170114	Sugar L-31 50 Kg. HDPE	300	2023-24	150.00	QTL	3,820.00	573,000.00
	Total		300		150.00	QTL		573,000.00

Add :-		
Total Value of Supply		573,000.00
Taxable Value of Supply		573,000.00
Add GST :-		
Central Tax	2.50 %	14,325.00
State Tax	2.50 %	14,325.00
Total of GST		28,650.00
Add TCS (u/s 206C of the Income Tax Act, 1961)	0.100 %	602.00
Grand Total		602,252.00

Total Invoice Value (INR) - Six lakh two thousand two hundred fifty two Only.
- Whether Tax is Payable under reverse charge - NO
- Delivery is on Ex-Works basis.

For:MAGADH SUGAR & ENERGY LTD
Unit:Bharat Sugar Mills

Prepared by

Checked by

Authorised Signatory

Unfortunately the store owner did not have the stock up or purchase bill of other SKU except sugar. But I have collected the estimated data of it.

I have attached all the photos of original data, store, and interaction video of me with the store owner, to the Google drive link below.

Here:-https://drive.google.com/drive/folders/1laS4lPY5gUnvfDEp7U7Rqpwc1HlbRtRR?usp=share_link

3 Metadata

This data is collected for 111 days, from 15th of march to 3rd of july. There are three types of table.

1. **Sales data**

   This table contains six columns.

   - Date - (It contains date from 15th march to 3rd july, and also used as primary key)
   - Sugar(50 Kg) - (Integer type value which is showing the quantity of bags per 50 Kg)
   - Mustard Oil(15 lit) - (Integer type value which is showing the quantity of jars per 15 Liters)
   - Refined Oil(15 lit) - (Integer type value which is showing the quantity of jars per 15 Liters)
   - Wheat Flour(50 Kg) - (Integer type value which is showing the quantity of bags per 50 Kg)
   - Rice(26 Kg) - (Integer type value which is showing the quantity of bags per 26 Kg)

	A	B	C	D	E	F
1	Date	Sugar (50 Kg)	Mustard Oil (15 lit)	Refined Oil (15 lit)	Wheat flour (50 Kg)	Rice (26 Kg)
2	March 15	5	2	3	12	2
3	March 16	5	9	4	6	1
4	March 17	6	6	3	11	2
5	March 18	12	3	7	6	2
6	March 19	1	6	4	1	1
7	March 20	1	8	5	7	1
8	March 21	5	6	3	7	1
9	March 22	6	2	4	6	0
10	March 23	10	9	4	8	0
11	March 24	7	10	5	9	1
12	March 25	18	5	4	8	3
13	March 26	10	5	3	6	2
14	March 27	4	5	5	7	5
15	March 28	2	7	7	5	1
16	March 29	10	8	8	6	2
17	March 30	10	5	3	6	2
18	March 31	1	4	3	6	2

2. Revenue data

This Table contains six columns.

- Date - (It contains date from 15th march to 3rd july, and also used as primary key)
- Column - 'Sugar', 'Mustard Oil', 'Refined Oil', 'Wheat Flour', 'Rice' all containing integer values showing the price of each product.

	A	B	C	D	E	F
1	Date	Sugar (50 Kg)	Mustard Oil (15 lit)	Refined Oil (15 lit)	Wheat flour (50 Kg)	Rice (26 Kg)
2	March 15	₹2,180	₹1,920	₹1,720	₹1,320	₹1,560
3	March 16	₹2,160	₹1,920	₹1,720	₹1,320	₹1,560
4	March 17	₹2,180	₹1,920	₹1,720	₹1,320	₹1,560
5	March 18	₹2,200	₹1,920	₹1,720	₹1,320	₹1,560
6	March 19	₹2,260	₹1,920	₹1,720	₹1,320	₹1,560
7	March 20	₹2,180	₹1,920	₹1,720	₹1,320	₹1,560
8	March 21	₹2,180	₹1,920	₹1,720	₹1,320	₹1,560
9	March 22	₹2,260	₹1,920	₹1,720	₹1,320	₹1,560
10	March 23	₹2,300	₹1,920	₹1,720	₹1,320	₹1,560
11	March 24	₹2,180	₹1,920	₹1,720	₹1,320	₹1,560
12	March 25	₹2,300	₹1,920	₹1,720	₹1,320	₹1,560
13	March 26	₹2,237	₹1,920	₹1,720	₹1,320	₹1,560
14	March 27	₹2,175	₹1,920	₹1,720	₹1,320	₹1,560
15	March 28	₹2,250	₹1,920	₹1,720	₹1,320	₹1,560
16	March 29	₹2,200	₹1,930	₹1,720	₹1,320	₹1,560
17	March 30	₹2,190	₹1,930	₹1,720	₹1,320	₹1,560
18	March 31	₹2,180	₹1,930	₹1,720	₹1,270	₹1,560
19	April 1	₹2,300	₹1,930	₹1,720	₹1,270	₹1,560

3. Stock up data

This Table contains eight columns.

- Products - (It contains different types of items, It's data type is String)
- Stock up data - (It shows the time period of product's refill, It's data type is String)
- Order quantity - (it contains the quantity of each product that were filled during Stock up, It's data type is Integer)
- Purchase cost - (it shows the purchase price of each product per quantity, It's data type is Float)
- Transport cost - (it shows the transport price for each product per quantity that cost to transfer the product, It's data type is Float)
- Labour cost - (it shows the labor price for each product per quantity that cost load & unload the products, It's data type is Float)
- Cost price - (It shows the final price of each product that cost after all expenses, It's data type is Float)

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- Total Capital - (It shows the total price of all products,It's data type is Float)

March-to-April

Products	Stock up days	Order quantity	Purchase cost (each)	Transport cost	Labour cost	Cost price	Total Capital
Sugar (50 Kg)	monthly	300	₹2,007.50	₹116.66	₹16.00	₹2,140.16	₹642,048.00
Mustard Oil (15 lit)	weekly	40	₹1,885.00	₹12.00	₹3.00	₹1,900.00	₹76,000.00
Refined Oil (15 lit)	weekly	40	₹1,685.00	₹12.00	₹3.00	₹1,700.00	₹68,000.00
Wheat flour (50 Kg)	weekly	50	₹1,285.00	₹15.00	₹5.00	₹1,305.00	₹65,250.00
Rice (26 Kg)	weekly	15	₹1,515.00	₹12.00	₹3.00	₹1,530.00	₹22,950.00
							₹874,248.00

April-to-June

Products	Stock up days	Order quantity	Purchase cost (each)	Transport cost	Labour cost	Cost price	Total Capital
Sugar (50 Kg)	monthly	300	₹1,991.75	₹116.66	₹16.00	₹2,124.41	₹637,323.00
Mustard Oil (15 lit)	weekly	40	₹1,905.00	₹12.00	₹3.00	₹1,920.00	₹76,800.00
Refined Oil (15 lit)	weekly	40	₹1,705.00	₹12.00	₹3.00	₹1,720.00	₹68,800.00
Wheat flour (50 Kg)	weekly	50	₹1,185.00	₹15.00	₹5.00	₹1,205.00	₹60,250.00
Rice (26 Kg)	weekly	15	₹1,505.00	₹12.00	₹3.00	₹1,520.00	₹22,800.00
							₹865,973.00

June-to-July

Products	Stock up days	Order quantity	Purchase cost (each)	Transport cost	Labour cost	Cost price	Total Capital
Sugar (50 Kg)	monthly	300	₹2,081.08	₹120.00	₹16.00	₹2,217.08	₹665,124.00
Mustard Oil (15 lit)	weekly	40	₹1,885.00	₹12.00	₹3.00	₹1,900.00	₹76,000.00
Refined Oil (15 lit)	weekly	40	₹1,705.00	₹12.00	₹3.00	₹1,720.00	₹68,800.00
Wheat flour (50 Kg)	weekly	50	₹1,185.00	₹15.00	₹5.00	₹1,205.00	₹60,250.00
Rice (26 Kg)	weekly	15	₹1,505.00	₹12.00	₹3.00	₹1,520.00	₹22,800.00
							₹892,974.00

4 Descriptive Statistics

1. Product wise Descriptive Statistics

For this I used google colab to know the Statistics in detail about the Sales data. Through this I got the Descriptive Statistics of each product (column) that were sold for 111 days.

	Sugar (50 Kg)	Mustard Oil (15 lit)	Refined Oil (15 lit)	Wheat flour (50 Kg)	Rice (26 Kg)
count	111.000000	111.000000	111.000000	111.000000	111.000000
mean	11.837838	5.837838	4.117117	6.981982	2.099099
std	10.061213	2.436617	1.900903	2.343199	1.167398
min	1.000000	1.000000	0.000000	1.000000	0.000000
25%	6.000000	5.000000	3.000000	6.000000	1.000000
50%	10.000000	5.000000	3.000000	6.000000	2.000000
75%	12.000000	7.000000	5.500000	8.000000	3.000000
max	62.000000	14.000000	9.000000	15.000000	6.000000

2. Day wise Descriptive Statistics

For this I used google colab to know the Statistics in detail about the Sales data. Through this I got the Descriptive Statistics of each day (column) were all products were sold combined

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	3/15/2024	3/16/2024	3/17/2024	3/18/2024	3/19/2024	3/20/2024	3/21/2024	3/22/2024	3/23/2024	3/24/2024	...	6/
count	5.000000	5.000000	5.000000	5.000000	5.000000	5.000000	5.000000	5.000000	5.000000	5.000000	...	
mean	4.800000	5.000000	5.600000	6.000000	2.600000	4.400000	4.400000	3.600000	6.200000	6.400000	...	
std	4.207137	2.915476	3.507136	3.937004	2.302173	3.286335	2.408319	2.607681	4.147288	3.577709	...	
min	2.000000	1.000000	2.000000	2.000000	1.000000	1.000000	1.000000	0.000000	0.000000	1.000000	...	
25%	2.000000	4.000000	3.000000	3.000000	1.000000	1.000000	3.000000	2.000000	4.000000	5.000000	...	
50%	3.000000	5.000000	6.000000	6.000000	1.000000	5.000000	5.000000	4.000000	8.000000	7.000000	...	
75%	5.000000	6.000000	6.000000	7.000000	4.000000	7.000000	6.000000	6.000000	9.000000	9.000000	...	
max	12.000000	9.000000	11.000000	12.000000	6.000000	8.000000	7.000000	6.000000	10.000000	10.000000	...	

8 rows × 111 columns

- Count - Number of not null Integers.
- Mean - Mean value of sales quantity of all products on that date.
- Sid - Standard Deviation of the Sales quantity of all products in the respective date.
- MIn - Minimum quantity of the any product Sold on that date
- 25% - 25th percentile of the product quantity sold on that date.
- 50% - It is the median number of quantities sold on that date.
- 75% - It is the 75th percentile of the quantity of products sold on that date.
- Max - Maximum quantity of any products sold on that particular date.

5   Analysis Process and Method

I have used Google Sheets to analyze the data.

I have collected and updated 111 days of sales data on G-Sheets and done the analysis.

before that, i have cleaned the data by using some process like:-

- updating all null or empty cells with zero.

After that, I run the exploratory data analysis, to take brief details of statistics and visualization of the data.

After EDA, to know the % contribution of the total revenue of each product, Firstly I took join of the sales and Revenue table where column **Date** is foreign key, then I took the product(*) of sales and revenue of each product. In this way I got the total revenue of each product sold each day. Then I have done Revenue pareto analysis, In the new table by taking the summation of 111 days revenue of each product in column 2nd aligned with products name in column 1st, then take the cumulative revenue in 3rd column as we move from product 1 to product 5. Then for % distribution in column 4 I took the division of cumulative revenue of each product by total cumulative revenue. Through this I got to know the contribution of the product in total revenue.

Revenue Pareto
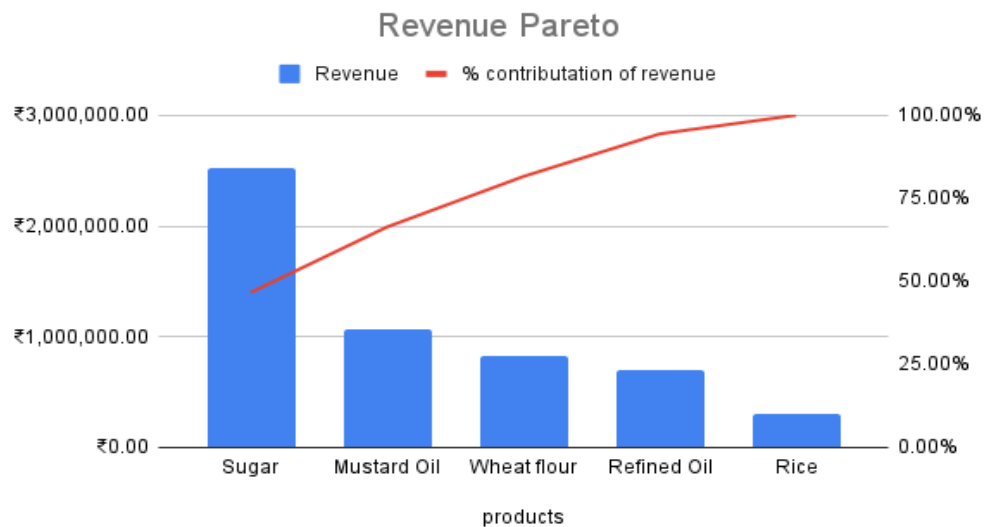
I have also done Sales Volume Pareto to know about the % distribution of sales volume, to analyze which products have high sales potential and demand in the market. For this process I took the summation of 111 days of sales quantity of each product, then took the cumulative sales and divided it to total cumulative sales.
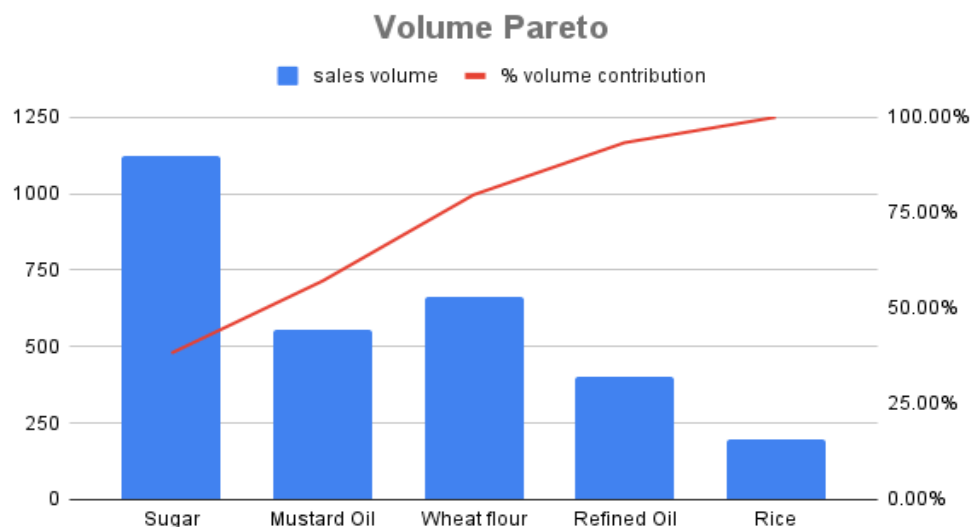

Volume Pareto

After analyzing the Revenue and sales Pareto, i have calculated the profit margins of all products to know, which product having high or low revenue and high or low sales volume making good profit margins or not, does it worth to invest the capital into them or not, does it doing justice to invested capital or not, to run the business sustainable over a long period of time. For profit margins calculation, I took the monthly capital invested in each product from the Stock up data table, then took the monthly total revenue previously calculated, of each product, put it all in the new table and made a subtraction between revenue and capital which results into profit.

6 Results and Finding

- After analyzing, I found sugar contributes **46.68%** of the total revenue followed by mustard oil **19.72%**, wheat flour **15.20%**, Refined Oil **12.83%** and the rest from Rice **5.61%** .
- The case is not as it seems. As per Stock up data the stock up cycle of the products are different, which is not giving us a clear stats of revenue, like sugar stock up cycle period is monthly and rest of the product is weekly.
- Sugar holds **73%** of the total capital, followed by mustard oil **08.87%**, wheat flour **07.94**%, Refined Oil **06.96%** and lastly Rice holds **02.63%** .
- Sugar has **38.32%** of total sales volume where wheat flour has **22.54%** followed by Mustard Oil **18.85%**, Refined Oil **13.64%** and the rest goes with Rice **6.65%** .

Here is the profit chart from which we can see which product is more profitable and investable
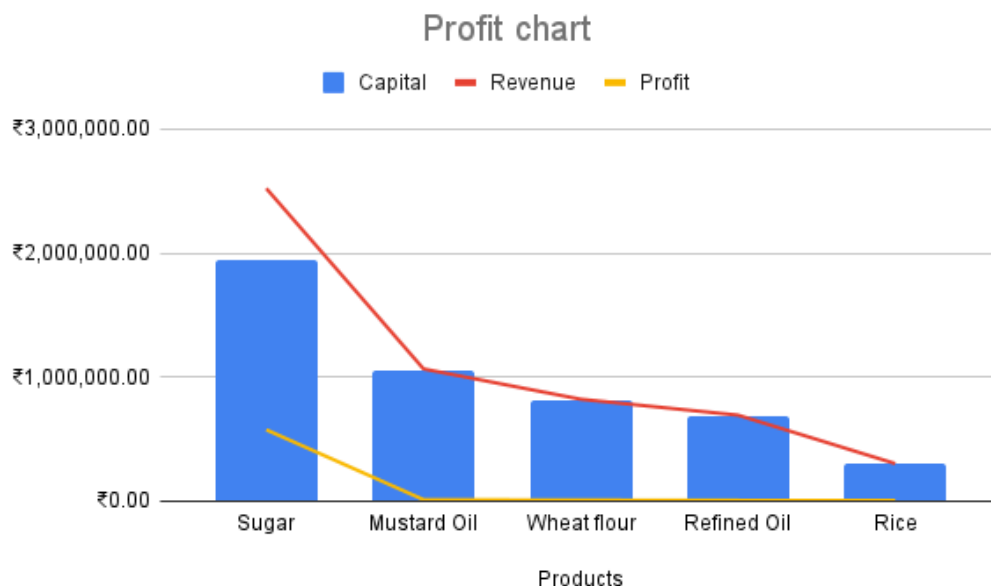
- From this chat, it shows Sugar has a good profit as compared to other products. Products like Mustard Oil, Refined Oil, wheat flour and rice have very low profit while having good sales volume. This is due to low profit margins of the products.

- By analyzing sales and Revenue data Sugar has the highest sales volume **38.32%** and revenue **46.68%** but its profit isn't reliable. Some times of the month its profit is negative and during seasonally & occasionally the profit gets high. That unreliability makes the business unsustainable over a long period of time. Here I plot a line chart, which shows the Economics of Sugar.

Sugar
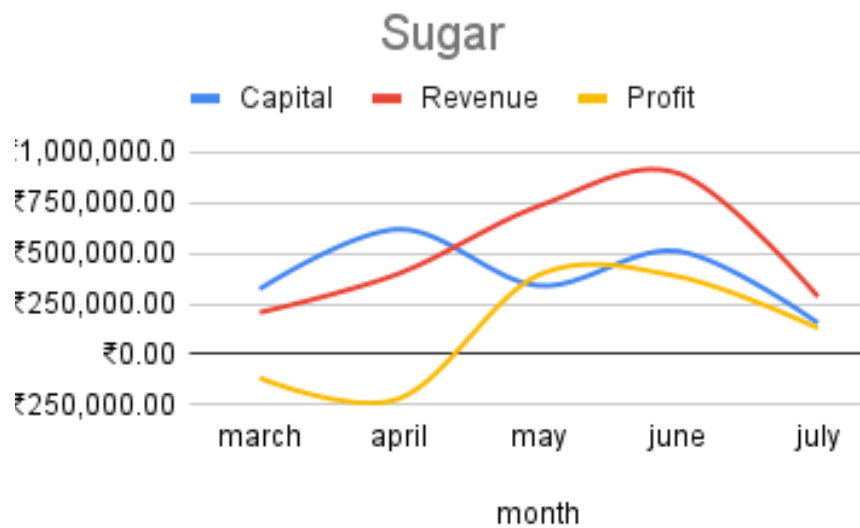
To avoid a situation like that, we have to balance the capital accordingly, like investing more capital in the seasonal sale to recover the losses which occur during different months.

or shift the investment into other products by investing less in sugar, during the non seasonal period of the months.

- During the sales data analysis I found out that products like Wheat flour have a good amount of sales volume considering its Capital and the other products also like Mustard Oil and Refined Oil. During the Research, i got to know there are 3 levels of market. type-1 factory warehouse which manufacture & distributes the product to type-2 where type-2 is big level wholesale which deals over cities & states and only supplies large order and then comes type-3 which can process a small order of products from which the current supply of the products like Mustard Oil, Refined Oil and Wheat flour is going on. As we move from type-1 to type-3 the profit margins are getting lesser. So to increase the profit margins we have to place a large order minimum of 150 units. Which also leads to further reduction in transportation cost. Considering the high volume sale, tuning with a high profit margin is good. And there are no losses in these products unlike sugar. For example, I plot some graphs of current and predicted graph, if we achieve the required profit margin at the same sales volume. In fig-2 the profit margins have increased from ₹12,900 to ₹37,120 **204%** increment in profit which is satisfying, and have scope to increase the business sustainably.
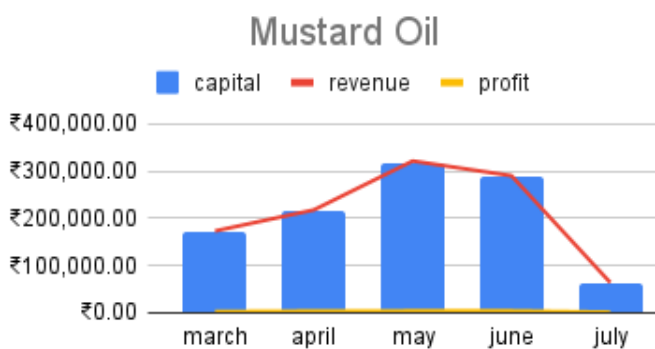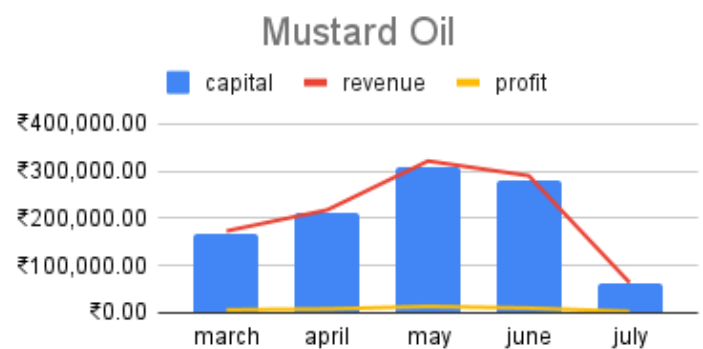

fig-1

fig-2

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