Improving Efficiency and Profitability of Santur Bhabani Sweets by Data Analysis

Final report for the BDM capstone Project

Submitted by

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Contents

Executive Summary:

The executive summary gives us an overview of the analysis done on the sales, productions, wastage, milk supply, and worker data of Santur Bhabani Sweets over 3 months period. The main aim of the analysis is to identify trends, challenges, and opportunities to increase the shop's profitability and efficiency.

At first, we gather raw data from the owner and do some preprocessing and store that data on an Excel sheet to make sure accuracy and consistency. Then we do some analysis on that data to find the valuable insides.

Key Findings:

- Sales for Santur Bhabani Sweets is rising steadily with peak demands on weekends specially for Rasogolla, Golapjam, Kalojam.
- By analyzing product wise profit margin, we can see that there is a room for improvement by optimizing pricing strategy and product offering.
- The wastage data analysis shows that, wastage is increasing over time. So, they need to plan their production in better way.
- Some products like Talsas, Kshir Chamcham, and Jalvara are showing strong growth rate.
- The shop has reliable milk suppliers, but by negotiating better rates and diversifying sources can ensure a consistent supply of quality milk to the shop.
- From the data we can see that Age and performance are inversely related but there is contradiction also. So, Santur Bhabani Sweets should consider using older employees experience with younger workers effort to maintain high performance.

Recommendations:

Based on these findings the recommendations are—

- They need to Optimize production and reduce wastage.
- They can enhance profitability through pricing adjustments and product development.
- To strengthen milk supply they can negotiate better rates and diversify sources which can improve their quality of products.
- By recruiting efficient as well as experienced worker and providing performance base bonus they can improve the efficiency and productivity of workers.
- They can gather customer feedback for their improvement.

By implementing these recommendations, Santur Bhabani Sweets can enhance its profitability, efficiency, and customer satisfaction, which can ensure their sustainable growth and success in the competitive market.

Detailed Explanation of Analysis Process/Methods:

Through this analysis process we examine Daily and Weekly Sales and Production Data, Worker Data, Daily Milk Data using various analytical techniques to find various trends and results which will help Santur Bhabani Sweets to grow in future and solve their business problem. In this whole period, I have used various tools like MS Excel for storing the data, doing various calculation and plotting graphs, Google Colab for finding various statistical solution and doing mathematical work, Python, Pandas, NumPy for finding various parameter and doing in depth calculation, Matplotlib, Seaborn for plotting various graphs to finding trends.

Data Collection, Storing and Preprocessing:

- At first, I collect raw data about Sales, Production, Wastage, Milk, Worker from the owner.
- After that I store all these collected Data in a Excel Sheet.
- I got Daily Sales, Production, Wastage Data from the owner. I used that daily data for my analysis and I converted that Daily data in Weekly Sales, Production, Wastage data to find the trends in detail.

Weekly Sales and Wastage trends Analysis:

Here we analyze our weekly Sales and Wastage Data to understand the weekly trends about sales and wastage of each product.

Sales trends analysis:

- Here I store the selling amount of each item column wise in weekly basis and keep the name of each product in the left most column. Then I calculate the sales trends from week-2 up to week-13.
- To calculate the sales trends I use the below formula:

  Sales trend= ((Current week sale-Previous week sale)/Previous week sale)*100

Wastage trends analysis:

- Similarly, I store the wastage weekly data and calculate wastage trends from week-2 up to week-13, through the below formula – ((Current week wastage -Previous week wastage)/Previous week wastage)*100
- If wastage of any item in previous week came as 0 then by using above formula we will get error since 0 came in the denominator. Where ever I got error I entered the value as 1000.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
ITEMS	WEEK-2		WEEK-3		WEEK-4		WEEK-5		WEEK-6		WEEK-7		WEEK-8		WEEK-9		WEEK-10		WEEK-11		WEEK-12		WEEK-13	
	Sale	Wastage	Sale	Wastage	Sale	Wastage	Sale	Wastage	Sale	Wastage	Sale	Wastage	Sale	Wastage	Sale	Wastage	Sale	Wastage	Sale	Wastage	Sale	Wastage	Sale	Wastage
RASOGOLLA	-2.745	-54.839	-0.212	-35.714	-3.112	77.778	-3.504	-6.250	2.194	86.667	4.848	-46.429	0.600	-33.333	-4.842	190.000	-10.472	-86.207	15.815	400.000	-2.098	20.000	0.472	-29.167
GOLAPJAM	-1.096	-38.462	-3.104	-31.250	-1.007	-9.091	-1.711	50.000	5.691	6.667	0.712	0.000	0.663	-37.500	-2.107	-10.000	-10.045	66.667	13.908	6.667	1.094	-43.750	-3.680	-44.444
LANCHA	12.143	60.000	-3.694	-62.500	2.050	600.000	0.972	-95.238	-4.878	100.000	5.331	100.000	-7.111	50.000	-1.724	183.333	-11.789	0.000	0.716	11.765	8.689	47.368	5.451	-71.429
KALOJAM	-1.111	-68.421	-2.388	83.333	-15.683	-81.818	2.218	-100.000	3.756	1000.000	-2.655	-28.571	-0.992	-100.000	-4.508	1000.000	1.399	-40.000	15.086	-100.000	-11.985	1000.000	-3.660	6.667
KAJU BARFI	-8.868	1000.000	-20.704	37.500	32.637	-81.818	1.181	50.000	-4.280	-66.667	7.317	1100.000	-0.758	116.667	9.733	-100.000	18.957	1000.000	-13.596	0.000	-0.338	0.000	7.131	-10.000
JALVARA	-21.008	68.182	-32.624	-67.568	53.158	8.333	-46.048	-46.154	40.127	414.286	23.182	-22.222	-27.675	-21.429	-23.980	-90.909	81.208	300.000	-24.444	75.000	21.569	-100.000	33.065	1000.000
KALAKAND	2.679	-21.429	-1.913	45.455	-2.128	-56.250	7.065	-100.000	-1.015	1000.000	-4.274	-11.111	0.893	25.000	4.071	30.000	12.415	-38.462	-2.118	-37.500	-5.873	140.000	-1.642	0.000
BAKED RASOGOLLA	-17.484	-60.000	15.248	116.667	1.031	0.000	2.551	-76.923	-3.483	133.333	-9.794	57.143	6.286	-45.455	-1.971	66.667	2.559	-30.000	15.330	200.000	-15.301	-42.857	-1.460	50.000
KSHIRPAK SANDESH	-1.087	-11.765	5.495	-100.000	0.417	1000.000	0.415	400.000	1.860	20.000	8.519	350.000	-2.804	-85.185	1.731	-50.000	10.586	650.000	7.179	60.000	-10.207	-75.000	1.599	33.333
KSHIR CHAMCHAM	21.502	100.000	-14.326	-64.286	17.377	-60.000	-5.587	-100.000	7.692	1000.000	-5.220	-100.000	1.739	1000.000	28.490	100.000	47.672	16.667	-11.411	-100.000	3.051	1000.000	-3.289	650.000
NIMKI	1.239	0.000	3.147	-7.692	3.390	-16.667	-7.869	-90.000	2.491	600.000	-1.389	42.857	0.880	60.000	-4.188	6.250	8.379	-41.176	3.193	10.000	-2.932	90.909	-0.336	-14.286
TALSAS	25.806	-11.538	-39.601	17.391	25.000	-37.037	-86.792	194.118	471.429	-100.000	11.500	1000.000	15.247	-52.632	-15.564	88.889	-1.382	-35.294	62.617	-27.273	-14.943	112.500	8.784	-82.353
CHANA VAJA	-12.069	-71.429	12.353	350.000	-7.679	-38.889	1.890	-45.455	0.557	116.667	3.137	-76.923	2.862	0.000	-3.130	133.333	2.873	185.714	-5.410	-100.000	12.177	1000.000	-9.704	666.667
KHASTA GAJA	38.528	-41.379	-18.125	76.471	22.901	-60.000	-18.012	141.667	-0.758	-34.483	-9.160	-42.105	4.202	-18.182	-17.339	-44.444	-2.439	200.000	61.500	0.000	-26.316	26.667	50.420	0.000
KSHIR KADAMBA	5.217	200.000	-1.818	-100.000	-11.448	1000.000	8.935	55.556	-2.967	-85.714	5.216	400.000	-5.128	10.000	4.505	-9.091	-1.724	-60.000	5.614	450.000	-3.821	-36.364	0.518	-7.143
MISHTI DOI(250 gm)	4.615	0.000	-11.765	-100.000	16.667	1000.000	-4.286	1000.000	8.955	1000.000	-13.699	1000.000	-1.587	1000.000	12.903	1000.000	27.143	1000.000	-22.472	1000.000	18.841	-100.000	-6.098	1000.000
MISHTI DOI(500 gm)	1.980	-100.000	-3.883	1000.000	-3.030	1000.000	-4.167	0.000	6.522	-100.000	0.000	1000.000	-10.204	-100.000	10.227	1000.000	0.000	-100.000	0.000	1000.000	6.186	1000.000	0.000	1000.000
NIKUTI	-36.228	-41.176	4.695	20.000	8.969	-37.500	-0.412	46.667	-5.785	-31.818	-11.404	20.000	37.624	-50.000	-50.000	33.333	56.115	-16.667	-9.677	0.000	19.898	80.000	27.234	-16.667
OVERALL TRENDS	-0.700	-18.996	-3.331	-10.619	0.200	-19.802	-3.607	6.173	2.844	2.326	1.715	15.341	-0.311	-22.660	-2.758	7.006	0.541	1.786	7.496	14.620	-2.022	8.163	1.495	7.075

Fig.1-Weekly Sales and Wastage trends analysis table

Weekly Profit and Revenue Analysis:

After analyzing weekly sales and production data we came to know about weekly generated Revenue and Profit. From this analysis we can understand about the flow of the business of Santur Bhabani Sweets. By these key financial metric we can understand the financial health of this business.

- From the Cumulative profit table, we can track total profit accumulation over 13 weeks.
- Similarly, from Cumulative revenue table we can track total revenue accumulation over 13 weeks.
- From this analysis we can understand the revenue generation trends of the shop.

WEEK NAME	REVENUE	CUMULATIVE REVENUE	PROFIT	CUMULATIVE PROFIT
WEEK-1	138135	138135	26704	26704
WEEK-2	136837	274972	25227.25	51931.25
WEEK-3	131884	406856	22902.5	74833.75
WEEK-4	134400	541256	26038.1	100871.85
WEEK-5	129791.8	671047.8	26344.1	127215.95
WEEK-6	135852	806899.8	29184	156399.95
WEEK-7	137747	944646.8	29483	185882.95
WEEK-8	136642	1081288.8	26801.85	212684.8
WEEK-9	133989	1215277.8	25473.92	238158.72
WEEK-10	135317	1350594.8	25656.5	263815.22
WEEK-11	144293	1494887.8	26938.25	290753.47
WEEK-12	142232	1637119.8	26159	316912.47
WEEK-13	144250	1781369.8	26648	343560.47

Fig.2-Weekly Profit and Revenue Analysis Table

Day wise Sales and Revenue Analysis:

I analyze the whole data to know the day wise sales trends, day wise product performance and day wise revenue generation.

- This table was constructed to know the high selling days across the week. This will help us to plan production accordingly.
- We also can track about day wise demand of each product.
- This will help us to understand the day wise revenue accumulation over the time period of Santur Bhabani Sweets.
- To calculate day wise revenue of each product I use the below formula—
  Revenue=Avg. Sell Price*Sell

ITEMS	AVG. SELLING PRICE	MONDAY		TUESDAY		WEDNESDAY		THURSDAY	FRIDAY		SATURDAY		SUNDAY	
		SELL	REVENUE	SELL	REVENUE	SELL	REVENUE	SELL	SELL	REVENUE	SELL	REVENUE	SELL	REVENUE
RASOGOLLA	10	6148	61480	5465	54650	5575	55750		6702	67020	6160	61600	6708	67080
GOLAPJAM	10	4867	48670	4531	45310	4422	44220		5438	54380	5130	51300	5215	52150
LANCHA	10	3195	31950	3094	30940	2888	28880		3435	34350	3272	32720	3436	34360
KALOJAM	7.3	2729	19921.7	2553	18636.9	2571	18768.3		3177	23192.1	2795	20403.5	2781	20301.3
KAJU BARFI	10	1185	11850	1158	11580	1143	11430	WEEKLY HOLIDAY	1243	12430	1301	13010	1294	12940
JALVARA	12	552	6624	536	6432	512	6144		556	6672	538	6456	589	7068
KALAKAND	10	1308	13080	1286	12860	1208	12080		1356	13560	1366	13660	1328	13280
BAKED RASOGOLLA	15	1177	17655	1196	17940	1259	18885		1392	20880	1305	19575	1267	19005
KSHIRPAK SANDESH	10	1175	11750	1066	10660	1160	11600		1258	12580	1150	11500	1154	11540
KSHIR CHAMCHAM	10	965	9650	907	9070	983	9830		1019	10190	953	9530	970	9700
NIMKI	6	1263	7578	1233	7398	1189	7134		1353	8118	1309	7854	1407	8442
TALSAS	12	533	6396	490	5880	532	6384		649	7788	544	6528	603	7236
CHANA VAJA	8	1223	9784	1151	9208	1164	9312		1372	10976	1244	9952	1275	10200
KHASTA GAJA	8	536	4288	521	4168	566	4528		699	5592	638	5104	618	4944
KSHIR KADAMBA	10	1266	12660	1178	11780	1209	12090		1377	13770	1285	12850	1354	13540
MISHTI DOI(250 gm)	38.8125	148	5744.25	138	5356.125	149	5783.0625		172	6675.75	156	6054.75	188	7296.75
MISHTI DOI(500 gm)	77.625	214	16611.75	190	14748.75	202	15680.25		232	18009	219	16999.875	250	19406.3
NIKUTI	10	426	4260	533	5330	526	5260		533	5330	478	4780	660	6600
TOTAL		28910	299952.7	27226	281947.8	27258	283758.613		31963	331512.9	29843	309877.13	31097	325089

Fig.3-Day wise Sales and Revenue Analysis Table

Product wise Profit Margin Analysis:

I calculate product wise profit margin to understand the profitability of each product of the shop. This analysis help us to understand how much percentage of profit we are getting in each product. This analysis helped us to take decision in product development, pricing strategy and production management.

To calculate the above, I use the below formula—

Product wise Profit Formula= (Profit/Revenue)*100

ITEMS	AVG. SELL PRICE	AVG. COST PRICE	TOTAL SELL	TOTAL PRODUCTION COST	TOTAL REVENUE	TOTAL PROFIT	PRODUCT WISE PROFIT MARGIN(IN PARCENTAGE)
RASOGOLLA	10	8.06	35816	288677	358160	69483	19.4
GOLAPJAM	10	8.4	28853	242365	288530	46165	16
LANCHA	10	8.22	18851	154955	188510	33555	17.8
KALOJAM	7.28	5.48	16221	88891	118089	29198	24.72527473
MISHTI DOI(500 gm)	77.56	57.88	1272	73623	98656.3	25033	25.37390407
KALAKAND	10	8	7656	61248	76560	15312	20
BAKED RASOGOLLA	15	13.01	7398	96248	110970	14722	13.26666667
CHANA VAJA	8	6.09	7236	44067	57888	13821	23.875
KSHIR KADAMBA	10	8.26	7482	61801	74820	13019	17.4
KSHIRPAK SANDESH	10	8.22	6785	55773	67850	12077	17.8
NIMKI	6	4.5	7564	34038	45384	11346	25
KAJU BARFI	10	8.5	7132	60622	71320	10698	15
TALSAS	12	9	3219	28971	38628	9657	25
NIKUTI	10	7	3039	21273	30390	9117	30
MISHTI DOI(250 gm)	38.78	29	921	26709	35716.4	9007	25.21918515
KSHIR CHAMCHAM	10	8.43	5613	47318	56130	8812	15.7
KHASTA GAJA	8	6	3471	20826	27768	6942	25
JALVARA	12	10	3165	31650	37980	6330	16.66666667
Total					1783350	344294	19.3060258

Fig.4-Product wise Profit margin Analysis Table

Analysis of Milk Data:

By analyzing daily Milk Data, we can identify the seller who served best quality of milk as well as low quality of milk. We also can identify the seller who served on an average maximum quantity of milk per day. With this analysis we also can understand the quantity-quality relationship for each seller which can help us to negotiate the better rates with supplier. After knowing the average quantity and quality supplied by each seller we can plan our production accordingly.

- I calculate Avg. Quantity of Milk by adding the amount of milk supplied by each seller in each day and divide that by total number of days supplied.
- From the data I calculate for how many times each seller gave A, B, C quality milk.
  (Lactometer Reading--- 3.9-4.5—A quality (Rs. 45/lit.)
  3.3-3.8—B quality (Rs. 38/lit.)
  2.8-3.2—C quality (Rs. 33/lit.))
- I calculate Avg. Rate/ lit. with respect to the quality of milk given by the supplier.

NAME OF SELLER	AVG. QUANTITY OF MILK	A QUALITY MILK	B QUALITY MILK	C QUALITY MILK	AVG. RATE / LIT.
DEBU SAHOO	110.2875	27	30	23	38.925
RATAN MANNA	99.225	25	34	21	38.875
SUNIL KAMILYA	101.125	27	29	24	38.8625
SANJOY GIRI	96.9125	26	35	19	39.0875
BACHU DAS	93.5	34	28	18	39.85

Fig.5-Milk Data Analysis Table

Worker Data Analysis:

From this analysis we came to know about the strength and weakness of each employee of Santur Bhabani Sweets. It helps us to improve performance and optimize roles and responsibility of each worker. Ultimately it will enhance business productivity and customer satisfaction. It helps us to take strategic decision for business profitability.

					AS PER RATED BY THE OWNER(OUT OF 5)					
NAME	AGE	SALARY	WORKING HOURS	POSITION	CREATIVITY	TIME MANAGEMENT	CUSTOMER SERVICE	TEAM WORK		AVERAGE RATING OF EACH EMPLOYEE(OUT OF 5)
SANTANU MAITY	46	15,500	8	HELPER	2	2	3	3		2.5
SAGAR PANDA	37	18,000	8	MANAGER CUM CASHIER	4	3	2	3		3
SUKUMAR JANA	51	30,000	7	MOYRA	3	3	2	4		3
CHANDAN PANDA	48	28,500	7	MOYRA	2	3	2	3		2.5
NANTU DAS	32	16,000	8	HELPER	2	4	3	3		3
BIKASH DAS	28	12,000	8	SALES BOY	2	3	3	3		2.75
AVERAGE OF EACH FEATURES	40.33333	20000	7.6666667		2.5	3	2.5	3.166666667		

Fig.6- Worker Data Analysis Table

Statistical Analysis:

- I calculate some descriptive statistics like Average, Median, Standard Deviation for Revenue, Cumulative Revenue, Profit, Cumulative Profit to see the central tendency and spread of these component.
- I also calculate correlation coefficient between the above component to see the relationship between these variable.

	AVERAGE	MEDIAN	STANDARD DEVIATION
REVENUE	137028.4	136642	4408.540366
CUMULATIVE REVENUE	949565.6	944646.8	530995.9333
PROFIT	26427.73	26344.1	1659.847103
CUMULATIVE PROFIT	183825	185883	103942.7366

CORRELATION COEFFICIENT BETWEEN REVENUE AND CUML. REVENUE	0.61505671
CORRELATION COEFFICIENT BETWEEN REVENUE AND PROFIT	0.31008326
CORRELATION COEFFICIENT BETWEEN REVENUE AND CUML. PROFIT	0.6152556
CORRELATION COEFFICIENT BETWEEN CUML. REVENUE AND PROFIT	0.19253837
CORRELATION COEFFICIENT BETWEEN CUML. REVENUE AND CUML. PROFIT	0.9997595
CORRELATION COEFFICIENT BETWEEN PROFIT AND CUML. PROFIT	0.20199052

Fig.7-Statistical Analysis Table

Visualization by Plotting:

- To present the findings from complex data I used various graphical representation such as Tables, Charts, Graphs etc. and it also helps me to interpret the data.
- It helps me to visualize the trends, pattern and relation in the data which will help the shop owner to take decision in future.

Limitation and Drawbacks:

- The analysis can not be done smoothly with this unstructured data.
- With out proper analysis proper knowledge about market trends, customer demands it is tough to formulate effective strategies for Santur Bhabani Sweets.
- Without proper customer feedback data, it is hard to match the satisfaction level of customers.

Results and Findings (Graphs and Other Pictorial Representation):

Analyzing the collated data, I get some remarkable results and insights. I mentioned them below one by one—

Weekly Revenue Analysis:

From our plotted line graph, we can notice that revenue trends of Santur Bhabani Sweets fluctuating over the period of 13 weeks.

1. The shop is generating weekly revenue of 137028.4 on an average. There revenue is fluctuating between 129791.8(week-5) and 144293(week-11). Starting from week-1 the revenue gradually decreases till week-5 which shows the downward trends in the first five weeks.
2. After week-5 there is a constant recovery in revenue which indicates improved sales in the later weeks. So, there is not any stability in revenue generation in Santur Bhabani Sweets.

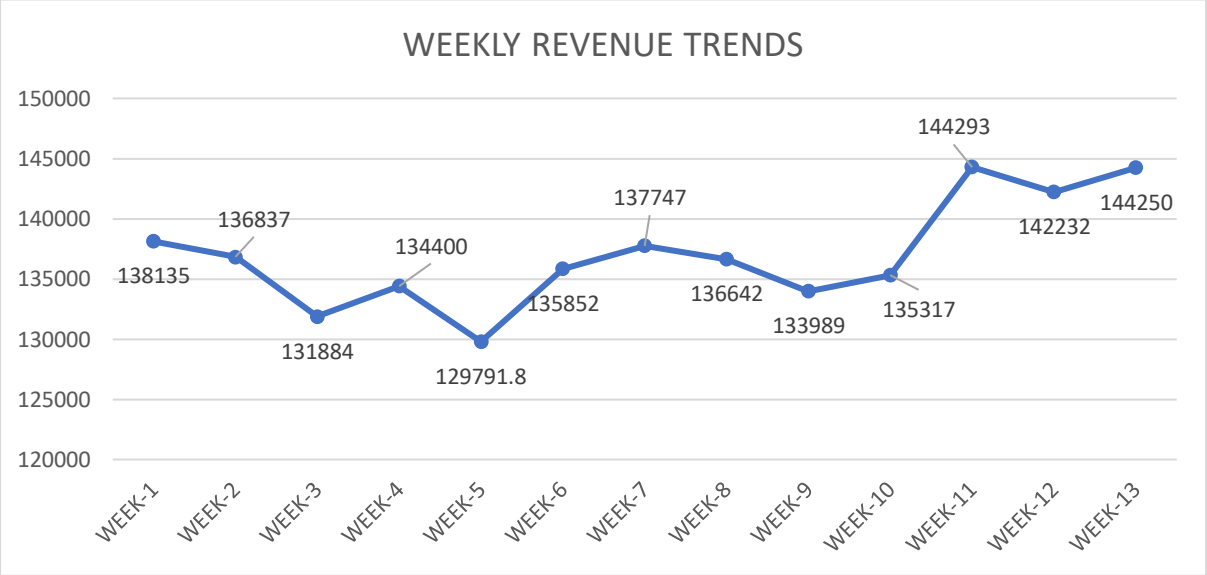

Fig.8-Weekly Revenue Trends

Cumulative Revenue Accumulation:

1. Cumulative revenue increases constantly across all 13 weeks. This steady rise indicates that the business is constantly generating revenue with out any loss.
2. Since there is not any drastic jump in our analysis so, this shows that there is a consistent pace of accumulation. This suggests constant sells growth and overall profitability for Santur Bhabani Sweets.

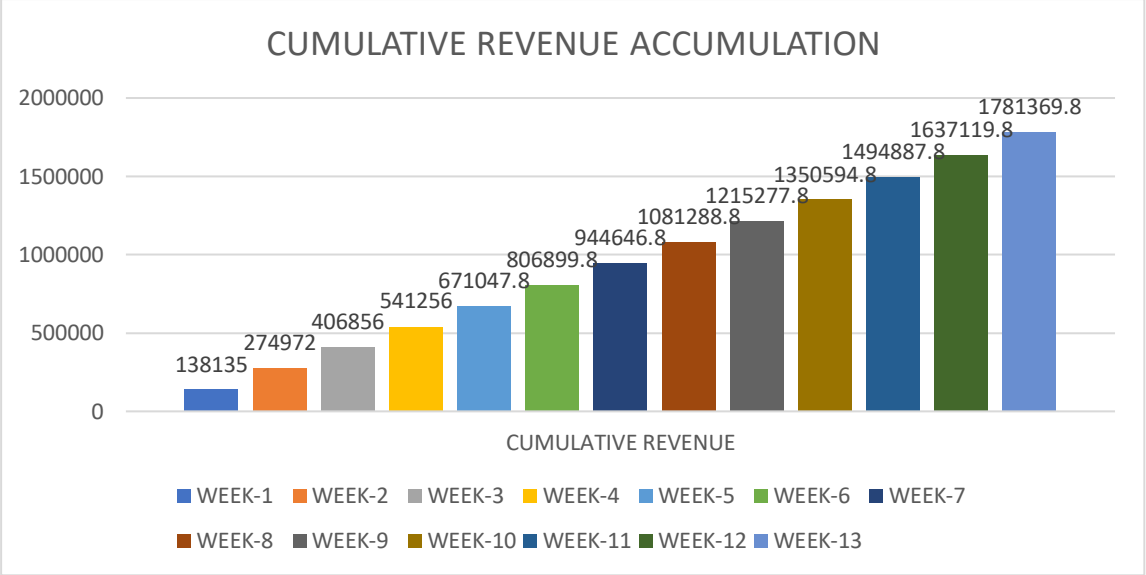

Fig.9-Cumulative Revenue Accumulation

Day wise trends Analysis:

- **Day wise Revenue Generation Analysis:**

I plot this bar chart to analyze the day wise revenue trends of the shop which will help to understand day wise sales trends. This will help them to plan their production accordingly.

1. From the below bar chart, we can see that the shop generates most revenue is on Friday which is about Rs. 331512. In Sunday they also generate almost similar amount of revenue which is Rs. 325089.
2. From this charts it is very much clear that there is a spike in sales towards the weekend.
3. The generation of revenue in the beginning days of week are not that much good with respect to the weekend days.

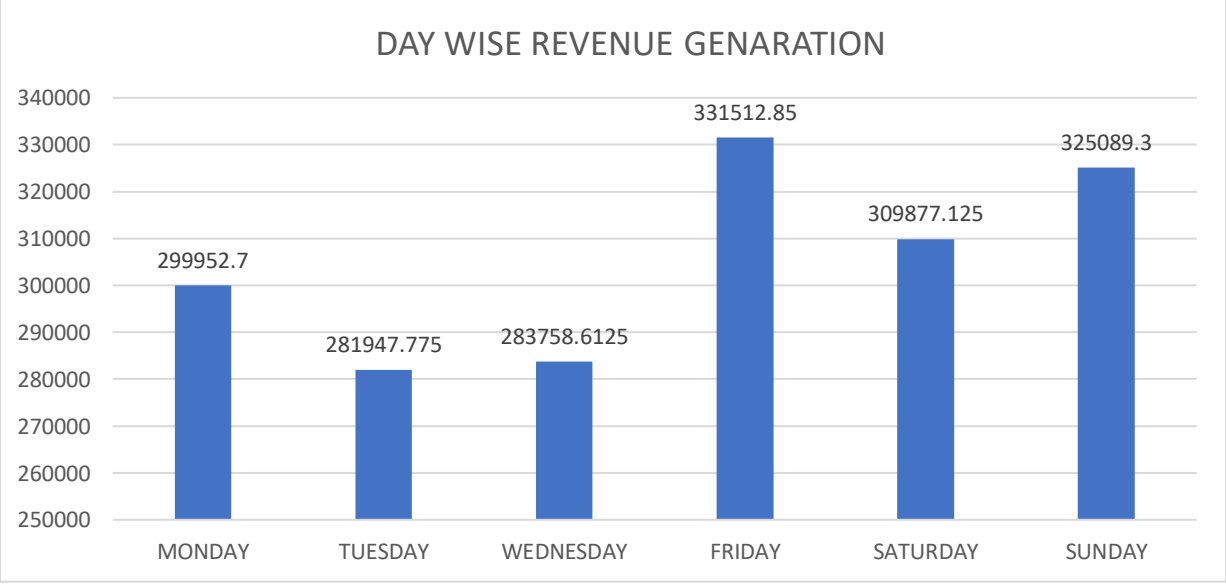

Fig.10- Day wise revenue generation Chart

- **Day wise Product Sell Trends:**
  Here I plotted a product wise bar graph with respect to week days to observe the sales tendency of each product on each day of a week. This will help to understand their product wise sells trend.
  1. From the below bar graph, we can see that the selling trends of Rasogolla, Golapjam is much more higher in weekend days with respect to the other days.
  2. The selling trends of Lancha, Kalojam, Nimki, Kshir Kadamba is also on a higher side in weekend days.
  3. But for Jalvara, Kaju Barfi, Kshirpak Sandesh, Chana Vaja, Mishti Doi the selling trends is almost similar over each day of week.

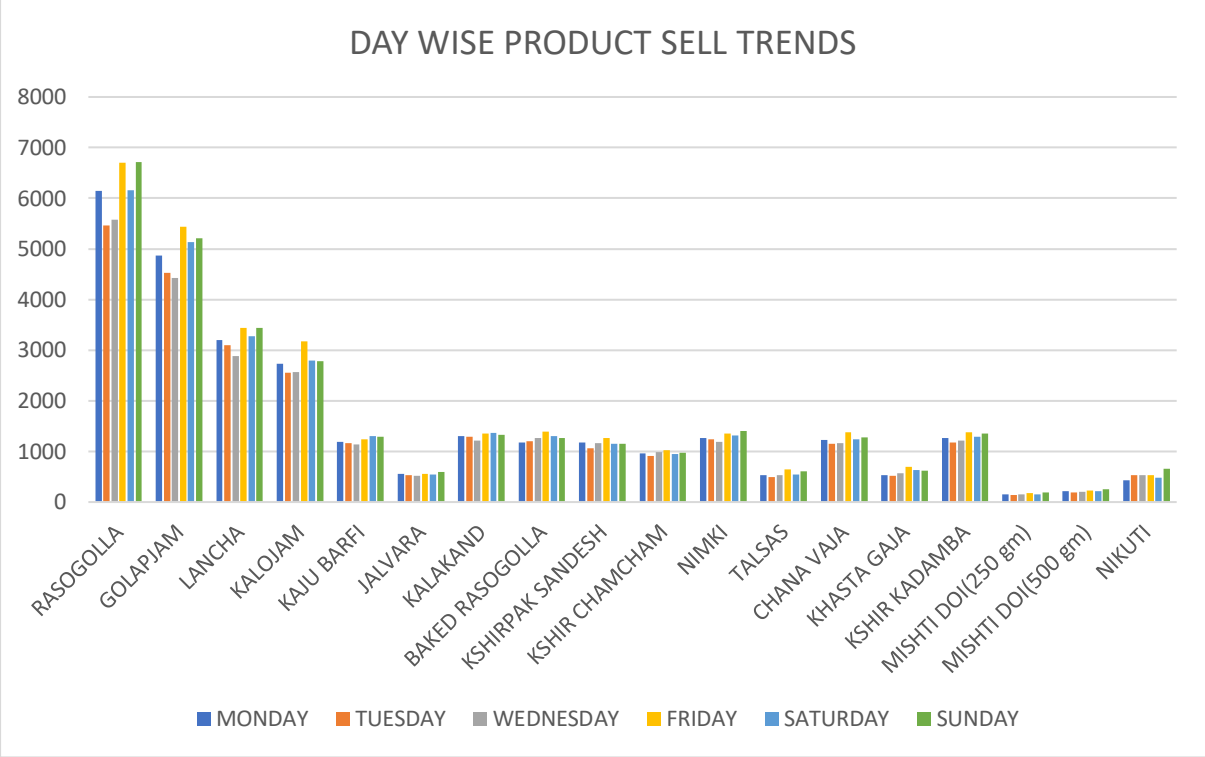

Fig.11-Day wise Product Sell Trends

Weekly Wastage Analysis:

1. In this line chart I plotted weekly wastage trends to observe the wastage tendency of Santur Bhabani Sweets. It shows that the weekly wastage is fluctuating over the period of 13 weeks.
2. In the earlier weeks like week-2,3,4 there are negative wastage trends which indicates better management of resources, productions.
3. But in the latter weeks except week-8 we can see the positive wastage trends which indicates higher wastage percentages.
4. This inconsistency indicates that there are lack in production management they are not able to predict the actual demands.

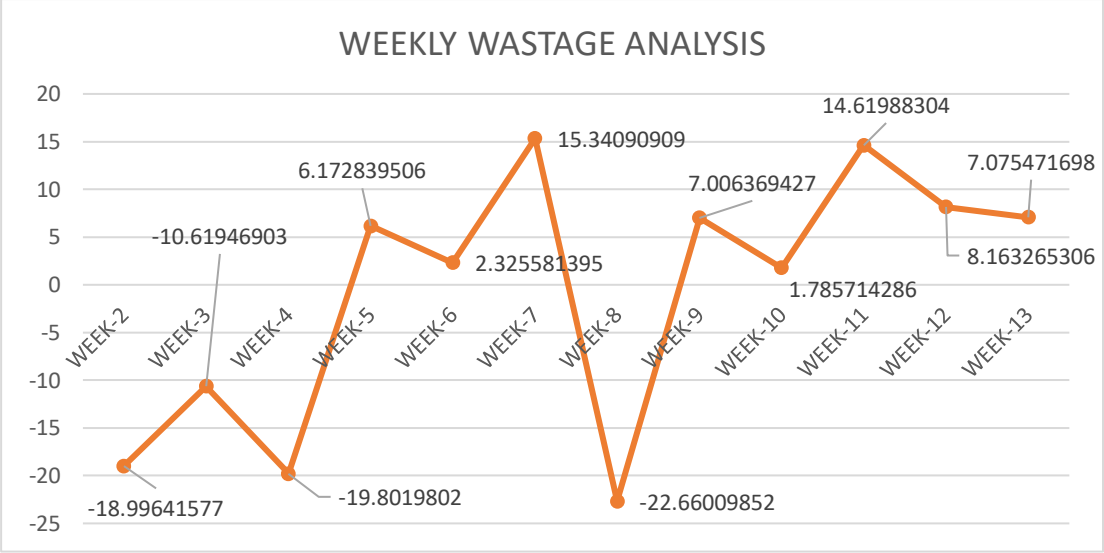

Fig.12-Weekly Wastage Analysis

Weekly Profit Trends:

1. Here we can see some fluctuation in week wise profit. The amount of weekly profit ranges between Rs. 22902 to Rs. 29483.
2. So, I can say there is not very much up and down in weekly profit which shows the business performance is relatively stable but there is not any such growth in their business.
3. From week 3 to 7 there is upward trends in business profit but from week-8 we can observe a little decline in profit generation.

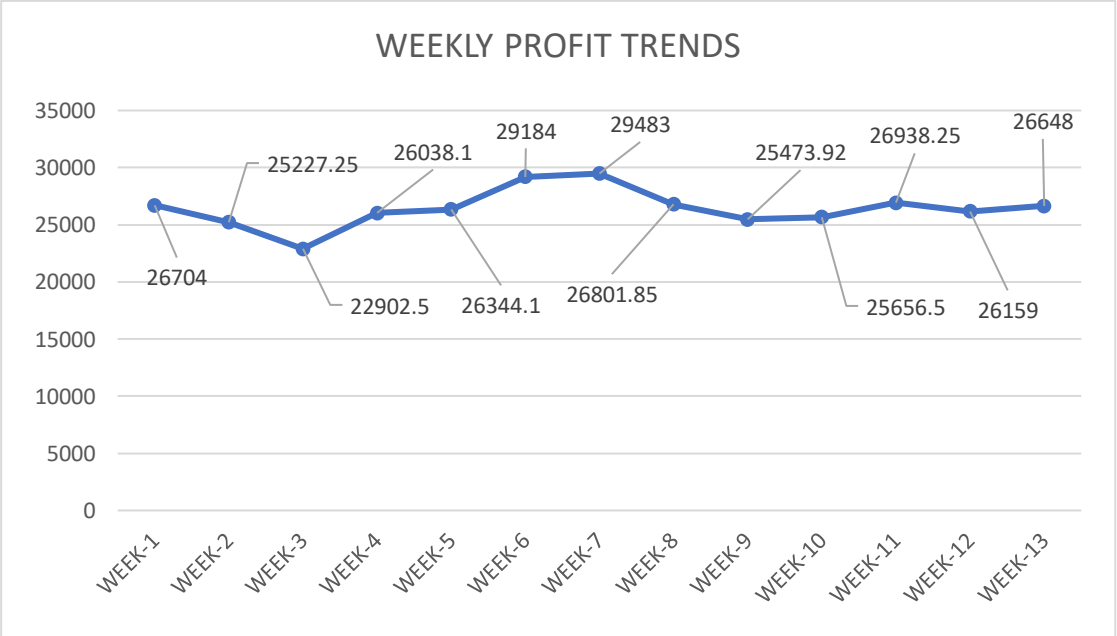

Fig.13-Weekly Profit Trends

Product wise Profit Margin (in percentage) and Revenue Generation Analysis:

1. Here I plotted a combination of line and column chart to analyze the product wise profit margin (in percentage) and revenue generation. To see the product wise value of revenue generation we need to look at the right column of the graph and to see the product wise value of profit margin we need to see at the left column of the graph.
2. From this graph I can see that the minimum amount of profit margin is 13.26% which is for Baked Rasogolla. The maximum amount of profit margin is 30% which is for Nikuti.
3. For most of the product the profit margin vary between 15% to 25%.
4. Noticeably, if the profit margin is more than 20% then the amount of revenue generation for those product is on lower side like Khasta Gaja, Mishti Doi(250 gm), Nikuti, Talsal, Nimki etc.

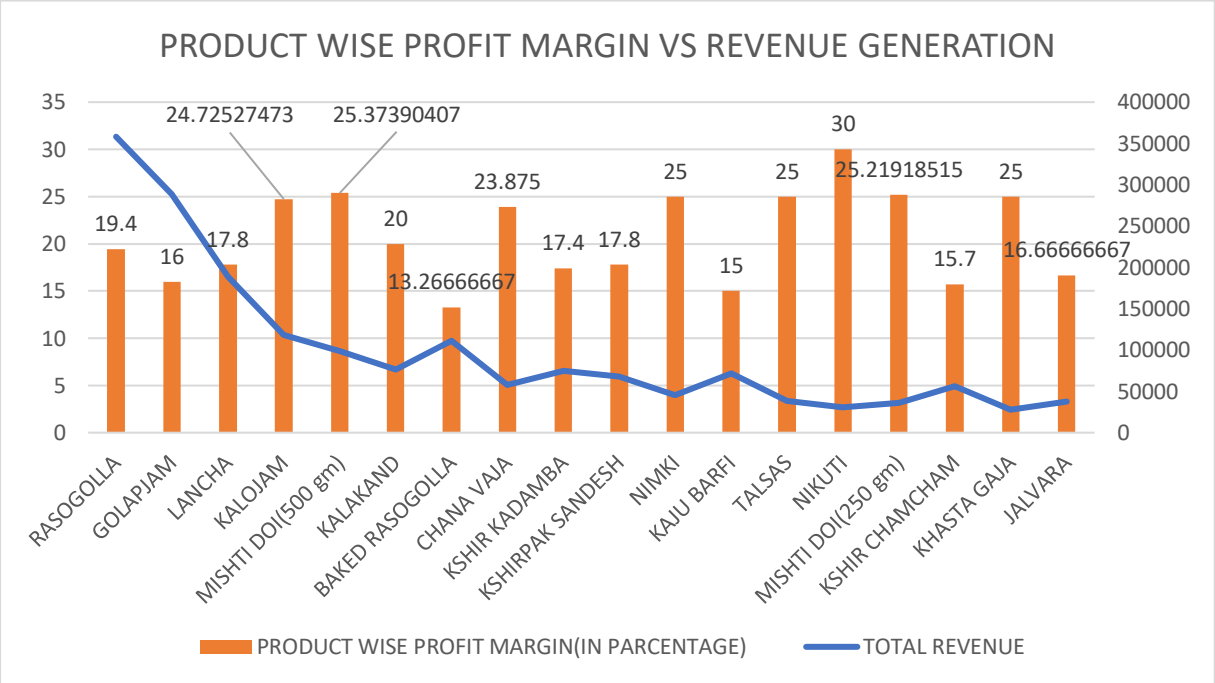

Fig.14- Product wise Profit Margin vs Revenue Generation

Correlation Analysis:

Heatmap of correlation matrix is a powerful tool for identifying relationship between variable. Here the variables are Revenue (Weekly), Cumulative Revenue (Weekly), Profit (Weekly), Cumulative Profit (Weekly). By understanding the relationship between the variables from the heatmap we can take strategic decision such as pricing strategies which will help to increase the revenue generation. So, this will ultimately maximize the profitability of the business.

- **Explanation of Correlation Coefficient:**
    1. A correlation coefficient close to +1 means a strong positive correlation that means if one variable increase then the other variable will also increase.

2. A correlation coefficient close to -1 means a strong negative correlation that indicates if one variable increase then the other variable decrease and vice versa.
3. The value of correlation coefficient equal to 0 indicates there is no linear relationship between the variables

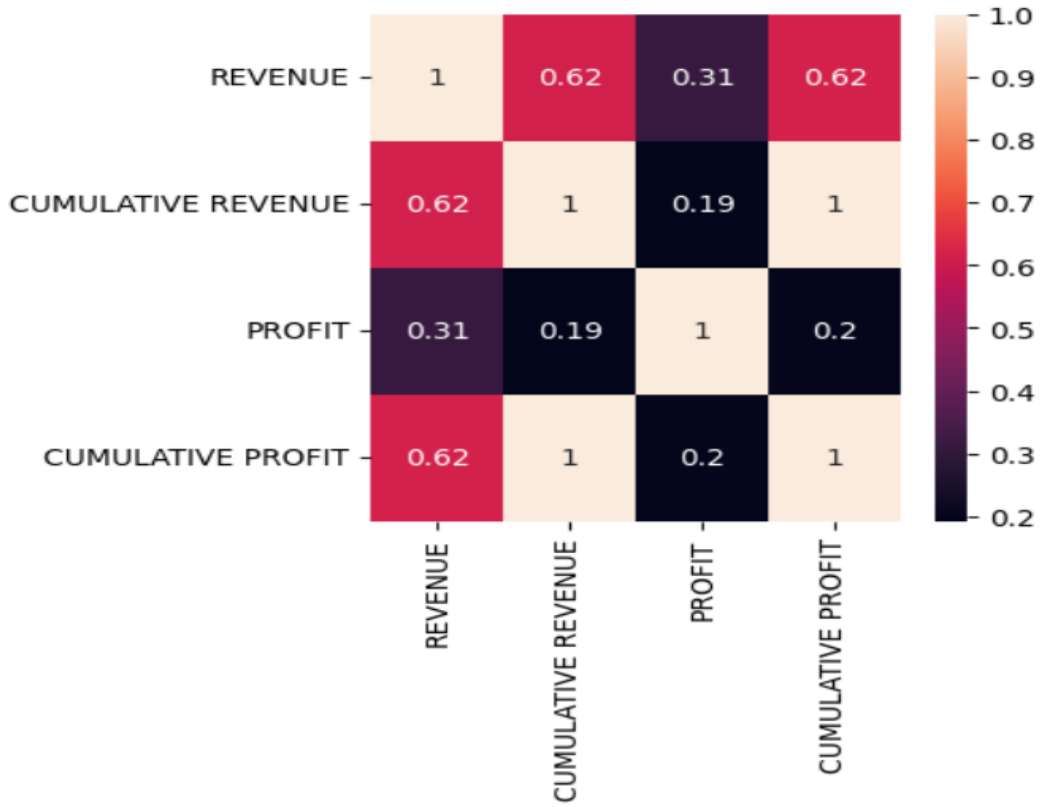

Fig.15- Correlation Heatmap of Revenue (Weekly), Cumulative Revenue (Weekly), Profit (Weekly), Cumulative Profit (Weekly)

- **Explanation of Colour Code of Correlation Coefficient Heatmap:**
  1. The colour codes of heat map make it easy to understand the relationship between the variables.
  2. The darker colour means low correlation coefficient between variables and the lighter colour means strong correlation coefficient between the variables.
- **Important Findings from the Heatmap:**
  1. **Revenue and Profit:**
     The correlation coefficient of 0.31 between Revenue and Profit indicates that there is a weak positive relationship between them that means as revenue increase the profit tends to increase but not very strongly.
  2. **Cumulative Revenue and Cumulative Profit:**
     A correlation coefficient of .99 between cumulative revenue and cumulative profit indicates a very strong positive linear relationship. So, as cumulative revenue increases the cumulative profit increases in a proportional manner. This suggest that cumulative revenue is highly depends on cumulative profit means the more revenue generated the more profit accumulated.

Product wise Average Growth rate Analysis:

After analysing product wise growth rate, we can identify which products are contributing most towards the business growth. Understanding this will help us to take decision on which product to focus on. Product with declining growth can be identified for possible improvement. Here we plotted a clustered bar chart to understand the growth rate of each product.

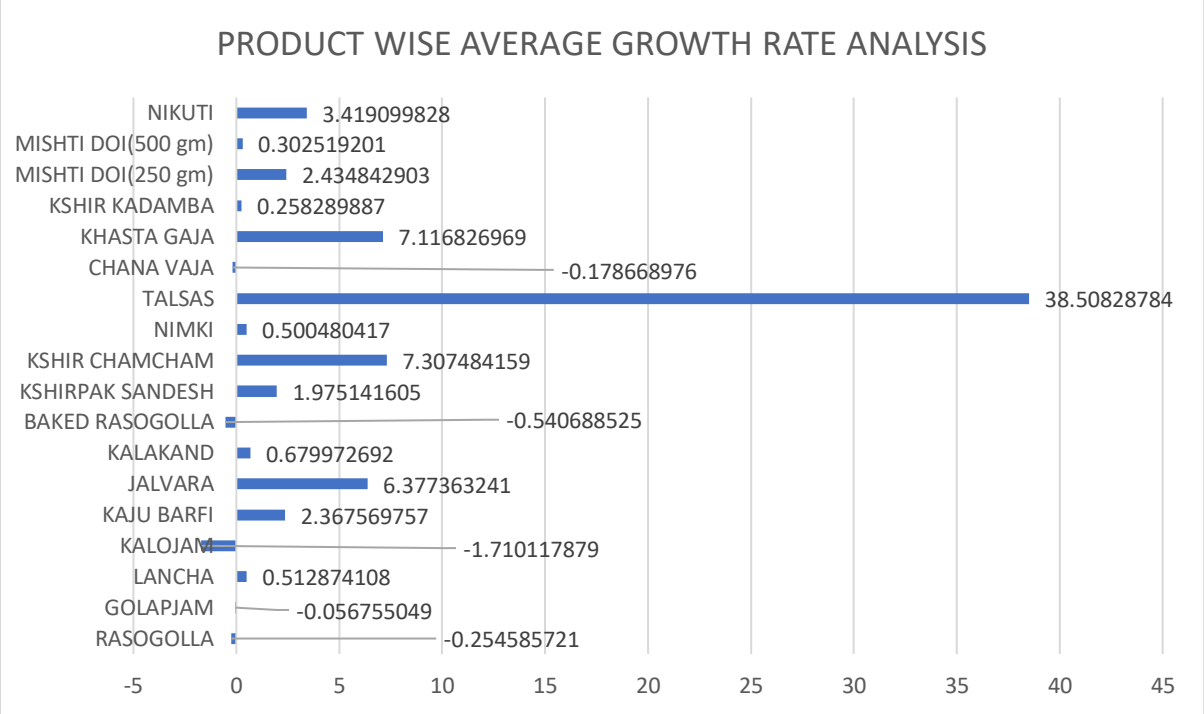

Fig.16- Product wise Average Growth Rate Analysis

- **Findings from the plot:**
  1. From the plot I can see that the demand of some product increase significantly such as Talsas, Kshir Chamcham, Jalvara, Khasta Gaja, Nikuti. This growth rate for these products indicates strong market demand and potential profitability.
  2. With a full understanding of average growth rate for each product we can use work force, marketing efforts more effectively.
  3. In the above analysis we can see that there is not very high decline in growth rate for any of the product. So, we can say that the business is in a stable position.
  4. Some of the most selling product like Rasogolla, Golapjam, Kalojam are facing a little decline in their growth rate which need an attention for the sustainable growth of Santur Bhabani Sweets.
  5. With these understanding we will be able to take some strategic decision like pricing strategy, production management. This also helps in staying competitive by fine tuning offering in response to market changes.

Milk Data Analysis:

1. In the below scatter plot, I plot the average quantity of milk given by each seller with total number of times A and B quality milk given by the seller in 3 months period. In the y-axis I take the total number of times A and B quality milk served by the seller in between A, B, C quality of milk. In the X axis I take Average quantity of milk served by the seller in each day.
   (According to the lactometer riding C is the low quality of milk that's why I consider A and B only for my analysis.)
2. Here we can see that Bachu Das, Sanjoy Giri, Ratan Manna, Sunil Kamilya, Debu Sahoo gave the shop on an average of 93.5, 96.91, 99.22, 101.12, 110.28 lit of milk daily respectively and they gave 62, 61, 59, 56, 57 times A and B quality milk respectively.
3. From this analysis we can see that Debu Sahoo gave maximum quantity of milk daily and Bachu Das served minimum quantity of milk daily. But quality of milk given by Bach Das is the best among all.
4. Sanjoy Giri and Ratan Manna served similar quantity and quality of milk.
5. Sunil Kamilya gave 101.12 lit of milk daily but his milk quality is not satisfactory.

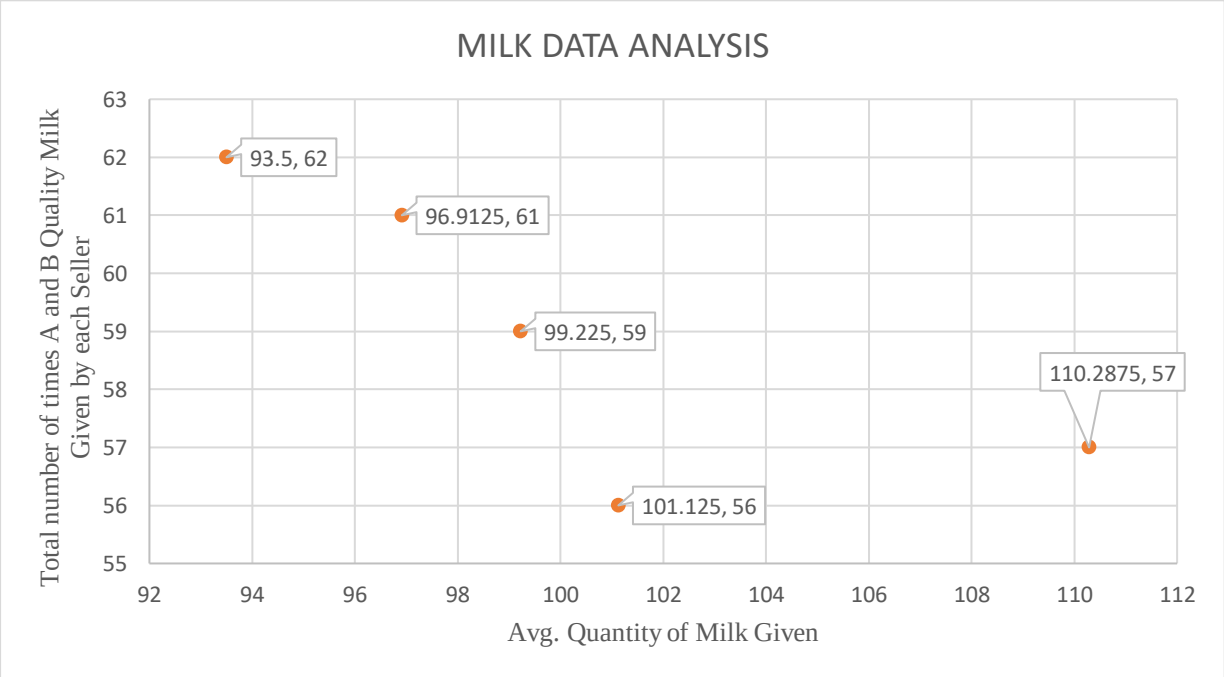

Fig.17-Milk Data Analysis

Worker Data Analysis:

1. Here I create a scatter plot between age and average rating of each employee to analyse the relation between their age and average rating.
2. This will help us to understand the trends in performance rating regarding their age that means how consistent employees are across various age group.
3. From the below scatter plot, we can observe that 2.5 is the lowest and 3 is the highest rating for any employee of Santur Bhabani Sweets.
4. Santanu Maity and Chandan Panda got 2.5 rating. Nantu Das, Sagar Panda and Sukumar Jana got 3 rating.
5. Interestingly Santanu Maity and Chandan Panda are more than 45 years old and Nantu Das and Sagar Panda are around 35 years old. It shows that higher the age, lower the performance for employees.
6. But Sukumar Jana who is 51 years old got rating of 3. So, except him the trends between age and rating follows inversely proportional relationship.

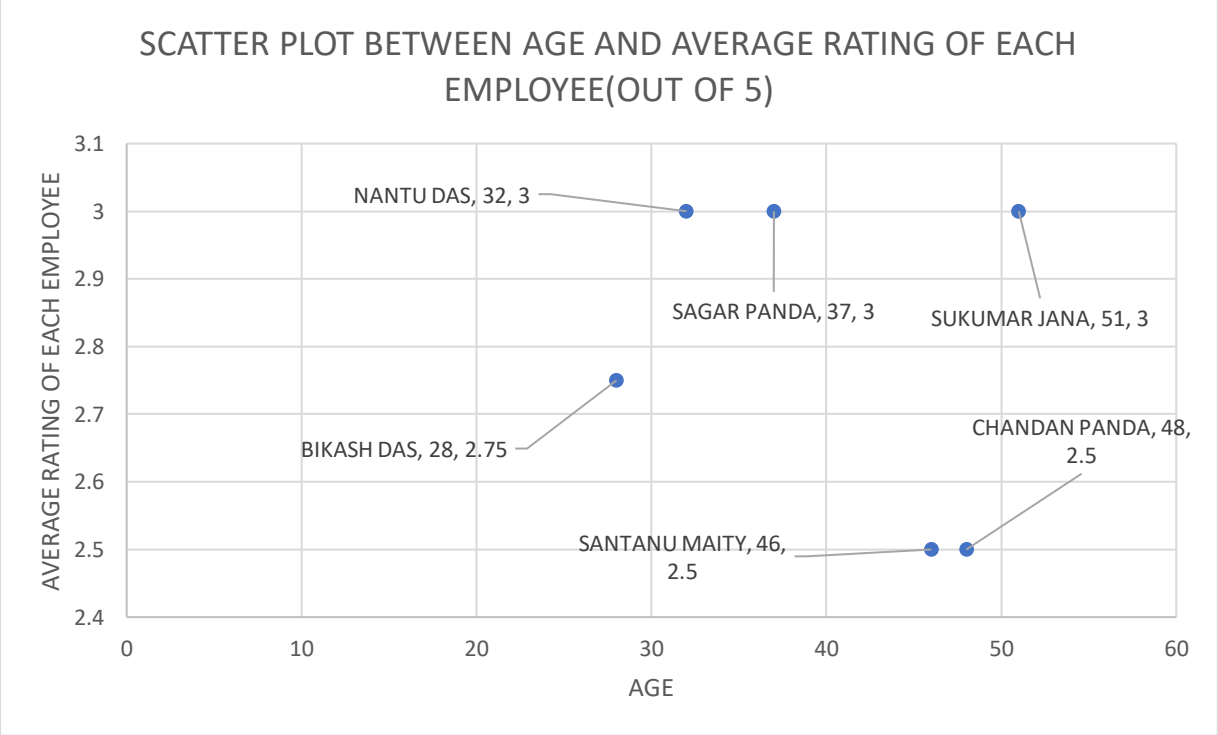

Fig.18-Worker data Analysis

Interpretation of Results:

After the detailed analysis of various operational data of Santur Bhabani Sweets we get some important and crucial insights which are useful for overall improvement of the business. The results are stated below—

- **Revenue and Sales Trends:**
  The revenue and sales data for Santur Bhabani Sweets shows several important patterns. We can see the fluctuation in weekly revenue. The shop is generating on an average ₹137,028.4 as weekly revenue. There is a downward trend observed for the first five weeks but there is a recovery after that. In spite of these fluctuations, cumulative revenue shows steady growth, indicating that the shop is consistently generating income, though at a variable pace. There is a spike in sales on Friday and Sunday. It indicates weekends as peak selling periods. Products like Rasogolla, Golapjam, and Kalojam sell more on weekends, while items such as Kaju Barfi and Mishti Doi maintain steady sales throughout the week. To optimize sales we need to adjust production based on these day-wise and product-specific trends.
- **Profit Trends:**
  The profit trends for Santur Bhabani Sweets indicates weekly fluctuations, with profits ranging between ₹22,902 and ₹29,483. The business is profitable but there is no significant growth in profit which highlighting the need for strategies to enhance profitability. Analyzing product-wise profit margins reveals that items like Nikuti offer the highest margins (30%) but generate relatively low revenue, whereas high-revenue products like Rasogolla and Golapjam have lower profit margins. To drive higher overall profitability, the shop could focus on increasing the sales volume of high-margin products while maintaining the demand for popular high-revenue items.
- **Wastage Trends:**
  In case of wastage there is positive and negative trends observed over the weeks. In the early weeks (Week 2 to Week 4) we can see negative wastage trends. That suggest effective production management happened initially, but increasing wastage in later weeks points to inefficiencies in production management and demand forecasting. Addressing these issues by refining production planning could save production costs and improve profitability.
- **Correlation Analysis:**
  The correlation heatmap reveals that there is a strong positive relationship (0.99) between cumulative revenue and cumulative profit. The correlation between weekly revenue and weekly profit is weaker (0.31). This suggests that while long-term growth is proportional, the shop may not be maximizing profit on a week-to-week basis.
- **Product Growth Rate Analysis:**
  Products like Talsas, Kshir Chamcham, and Jalvara are showing strong growth which reflecting increase in demand for these sweets. However, traditional bestsellers like Rasogolla and Golapjam are experiencing a slowdown in growth. This indicates that the shop may need to focus on refreshing or promoting these older products to keep up their sales momentum.
- **Milk Supplier Analysis:**
  The analysis of milk suppliers shows that suppliers, like Debu Sahoo, provide high quantities of milk and suppliers like Bachu Das, deliver higher quality of milk consistently. We know quality milk supply is vital for product quality. So, the owner

can use this result of analysis to negotiate better rates with reliable suppliers to ensure consistency in production quality.

- **Worker Performance Analysis:**
  The analysis of worker performance reveals an inverse relationship between age and performance ratings. Which shows older employees generally showing lower ratings. This trend suggests that Santur Bhabani Sweets may need to focus on retraining or redistributing responsibilities among the workforce to improve overall productivity. Sukumar Jana, who is 51 years old but has a higher rating, shows that experience can be valuable, and individual performance should be closely monitored.

Recommendation:

Based on the detailed analysis of data the following recommendations are made to improve the profitability, efficiency, and growth of Santur Bhabani Sweets—

- **Peak days production adjustment:**
  Since there are peak in sells on weekends (Friday, Saturday, Sunday), the shop can increase the productions on those days to avoid the stockout of products and fulfill the customer demands. The sells in weekday are lower than weekends, so the shop need to manage this according to the demands.
- **Pricing Strategy:**
  We can observe that product like Rasogolla, Golapjam, Kalojam are high revenue generating products but their profit margin are lower than the low revenue generating products like Nikuti, Khasta Gaja, Talsas etc. So, the shop can reduce the profit margin on low revenue generating products to improve their sells. Slight price adjustments for these items can improve their sales.
- **Marketing Strategy:**
  Since there is a clear spike in sales on weekends, the shop can introduce marketing strategies like “Weekend Specials” or “Special Deals” to boost sales further during these peak times. Since the sales on weekdays are lower, so they can give “Special Discount” on these days to improve the sell. By using advertisement strategy they can improve their growth.
- **Minimizing Production Costs with Proper Production Planning:**
  To minimize production costs at Santur Bhabani Sweets, the shop can align their production with sales trends by increasing output during high-demand periods and reducing it during low-demand times. They can regularly monitor wastage to address inefficiencies. Santur Bhabani Sweets need to maintain flexible production systems to adjust output as needed and optimize their production to prevent overstock. They can collaborate with suppliers to ensure a steady flow of materials which can reduce storage and production costs.
- **Product Development and Diversification:**
  Since growth rates for products like Rasogolla and Golapjam have slowed, Santur Bhabani Sweets can introduce variations of these popular sweets or entirely new products, which can refresh customer interest and drive sales. Products like Kshir

Chamcham, Jalvara, and Talsas have shown increasing demand, so they can invest in marketing, quality enhancement, and better promotion of these products to capitalize on their growing popularity.

- **Supplier Negotiation and Diversification for Quality Milk Supply:**
  By the negotiation with the milk supplier the shop can improve their milk supply which is the main ingredient for a sweet shop. For this reason, they can negotiate better rates with reliable suppliers like Debu Sahoo, who provides large quantities, and Bachu Das, who is known for his high-quality milk. Beside this they can add more suppliers to ensure a steady supply of quality milk to fulfill their target. They also can encourage the unreliable supplier to provide high quality and quantity of milk.
- **Workeforce Management:**
  Older workers tend to have lower performance ratings but Sukumar Jana who is 51 years old has higher rating. So, they can recruit the worker like Sukumar Jana who is efficient as well as experienced. They also can encourage younger employees by providing performance-based bonuses or recognition to keep them motivated and productive. By assigning more critical role to high performing workers they can improve the productivity more. This approach can help them to improve overall efficiency and morale in the workplace.
- **Customer Feedback:**
  By using suggestion box, the shop can collect the customer feedback about quality, pricing, and satisfaction level about the products. By analysing the feedback, they can identify the improvement area. In this way they can also come to know about the customer wanting.
- **Long-term Growth Strategy:**
  By monitoring product growth rates regularly and adjust strategies as needed they can improve their business. Improvement of products with declining growth and support high-growth products can increase their overall profitability. If profitability remains steady, they can consider further expansion options, such as new locations or an online delivery service.

The analysis conducted on Santur Bhabani Sweets reveals significant opportunities for improvement in efficiency, profitability, and overall business performance. By addressing these limitations and implementing the recommended strategies, Santur Bhabani Sweets can enhance customer satisfaction, increase sales, and ensure sustainable growth in a competitive market.