Data-Driven Strategies for Revenue Growth and Utility Efficiency at Katraj Dairy

A Mid-Term Report for the BDM Capstone Project

Submitted by

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Contents

1 Executive Summary

Katraj Dairy, a well-known cooperative in Pune, has been a big name in the dairy industry for years. This report takes a close look at their sales data from FY 2019-24 to find ways to boost revenue and make the business run more smoothly. The main focus is on fine-tuning pricing strategies for their best-selling products and getting better at forecasting demand to keep inventory levels just right.

By diving into the sales data, I've been able to spot some key trends and patterns that can help Katraj Dairy make smarter decisions. I've identified which products are driving most of the sales, so we can focus on adjusting prices for those items to maximize revenue. Plus, by understanding how sales fluctuate throughout the year, the dairy can improve how it forecasts demand, making sure they're ready for busy periods without overstocking.

The goal of this report is to give Katraj Dairy practical insights that will help them increase revenue by optimizing their pricing and improving demand forecasting.

2 Proof of Originality

Details about the Organization

Organization Name: Pune Zilla Dudh Utpadak Sangh Maryadit, popularly known as Katraj Dairy.

Business Owner: Nilesh Hulge

Managing Director: Shri. Manoj Limaye

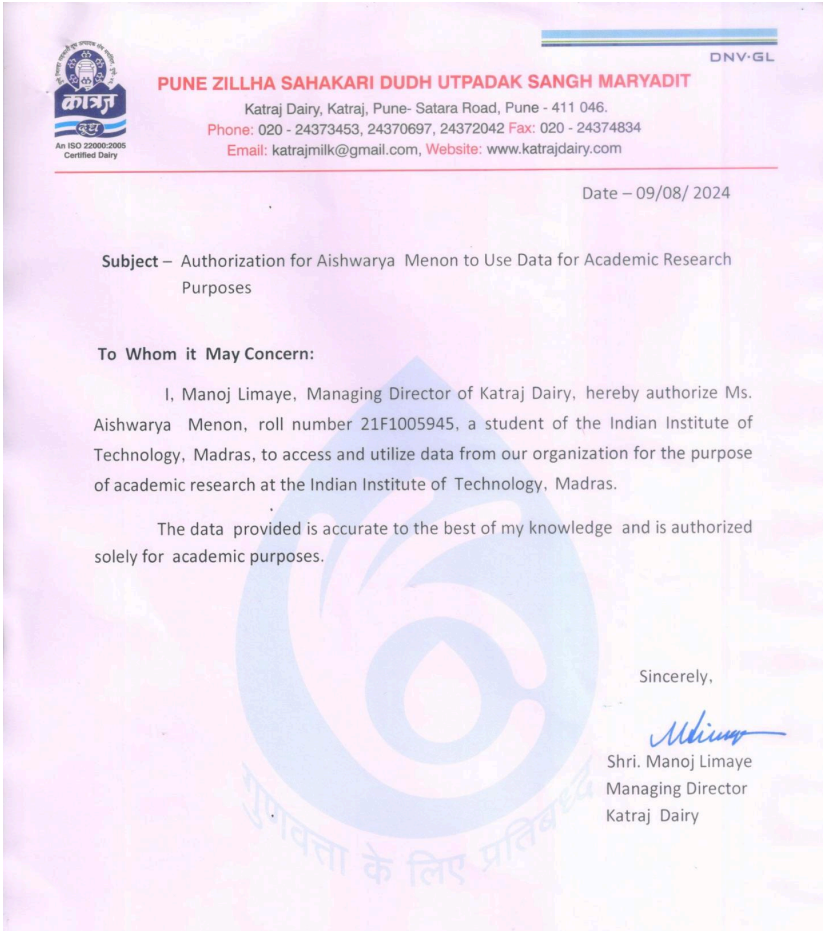
Address: Satara Road, Opp. Rajiv Gandhi Udyan, Katraj, Pune – 411046

Official Website: https://katrajdairy.com

Images and Videos Related to the Organization:

https://drive.google.com/drive/folders/1SlSkYz25QkzKYJc1_2sTL-DJXNg4kNBS?usp=share_link

Letter from the Organization:



DNV·GL

PUNE ZILLHA SAHAKARI DUDH UTPADAK SANGH MARYADIT

Katraj Dairy, Katraj, Pune- Satara Road, Pune - 411 046.
Phone: 020 - 24373453, 24370697, 24372042 Fax: 020 - 24374834
Email: katrajmilk@gmail.com, Website: www.katrajdairy.com

An ISO 22000:2005 Certified Dairy

Date – 09/08/ 2024

Subject – Authorization for Aishwarya Menon to Use Data for Academic Research Purposes

To Whom it May Concern:

I, Manoj Limaye, Managing Director of Katraj Dairy, hereby authorize Ms. Aishwarya Menon, roll number 21F1005945, a student of the Indian Institute of Technology, Madras, to access and utilize data from our organization for the purpose of academic research at the Indian Institute of Technology, Madras.

The data provided is accurate to the best of my knowledge and is authorized solely for academic purposes.

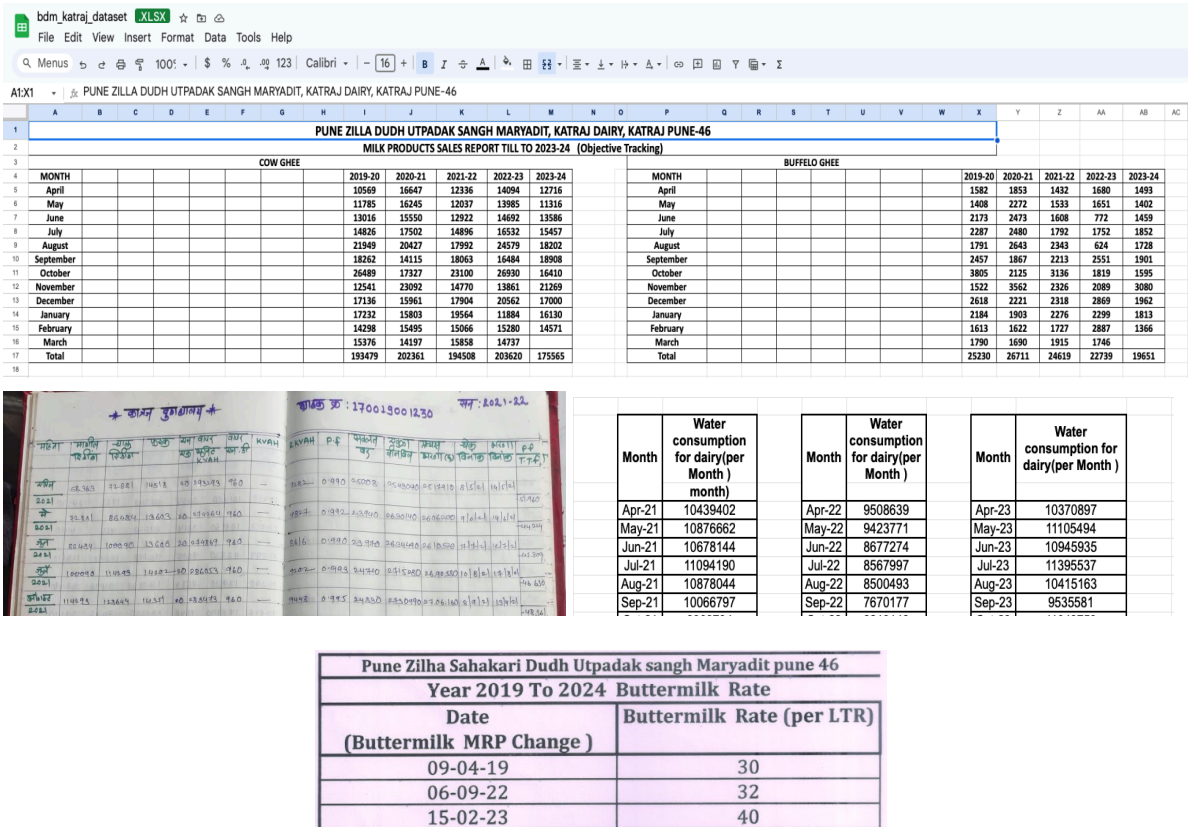
Sincerely,

Shri. Manoj Limaye
Managing Director
Katraj Dairy

Figure 1: Letterhead from the Managing Director of Katraj Dairy

3 Metadata

The Managing Director at Katraj Dairy provided sales data for FY 2019-24 and utility data for FY 2021-24. Initially in registers, the data was later shared in Excel and CSV formats. To meet deadlines, I requested photos of electricity entries and converted them into an Excel sheet. I convinced them to provide cost and sales price data for their top-performing product to analyze optimal pricing for revenue growth, and they shared this pricing data as well.



PUNE ZILLA DUDH UTPADAK SANGH MARYADIT, KATRAJ DAIRY, KATRAJ PUNE-46

MILK PRODUCTS SALES REPORT TILL TO 2023-24 (Objective Tracking)

COW GHEE

MONTH	2019-20	2020-21	2021-22	2022-23	2023-24
April	10569	16647	12336	14094	12716
May	11785	16245	12037	13985	11316
June	13016	15550	12922	14692	13586
July	14826	17502	14896	16532	15457
August	21949	20427	17992	24579	18202
September	18262	14115	18063	16484	18908
October	26489	17327	23100	26930	16410
November	12541	23092	14770	13861	21269
December	17136	15961	17904	20562	17000
January	17232	15803	19564	11884	16130
February	14298	15495	15066	15280	14571
March	15376	14197	15858	14737	
Total	193479	202361	194508	203620	175565

BUFFELO GHEE

MONTH	2019-20	2020-21	2021-22	2022-23	2023-24
April	1582	1853	1432	1680	1493
May	1408	2272	1533	1651	1402
June	2173	2473	1608	772	1459
July	2287	2480	1792	1752	1852
August	1791	2643	2343	624	1728
September	2457	1867	2213	2551	1901
October	3805	2125	3136	1819	1595
November	1522	3562	2326	2089	3080
December	2618	2221	2318	2869	1962
January	2184	1903	2276	2299	1813
February	1613	1622	1727	2887	1366
March	1790	1690	1915	1746	
Total	25230	26711	24619	22739	19651

Month	Water consumption for dairy(per Month) month)
Apr-21	10439402
May-21	10876662
Jun-21	10678144
Jul-21	11094190
Aug-21	10878044
Sep-21	10066797

Month	Water consumption for dairy(per Month)
Apr-22	9508639
May-22	9423771
Jun-22	8677274
Jul-22	8567997
Aug-22	8500493
Sep-22	7670177

Month	Water consumption for dairy(per Month)
Apr-23	10370897
May-23	11105494
Jun-23	10945935
Jul-23	11395537
Aug-23	10415163
Sep-23	9535581

Pune Zilha Sahakari Dudh Utpadak sangh Maryadit pune 46

Year 2019 To 2024 Buttermilk Rate

Date (Buttermilk MRP Change)	Buttermilk Rate (per LTR)
09-04-19	30
06-09-22	32
15-02-23	40

Figure 2: Datasets obtained from Katraj Dairy

So, after cleaning and combining all this, I made the final 3 sheets. One shows month-wise sales and utility consumption, the other one shows product-wise sales (for different purposes) and one more just for BUTTERMILK and DAHI for pricing strategies. Here's the link to the final data that I'm going to make use of:
https://drive.google.com/drive/folders/1Ixz9KdoXBW0-cu34bgMsaGl49cVpot00?usp=share_link

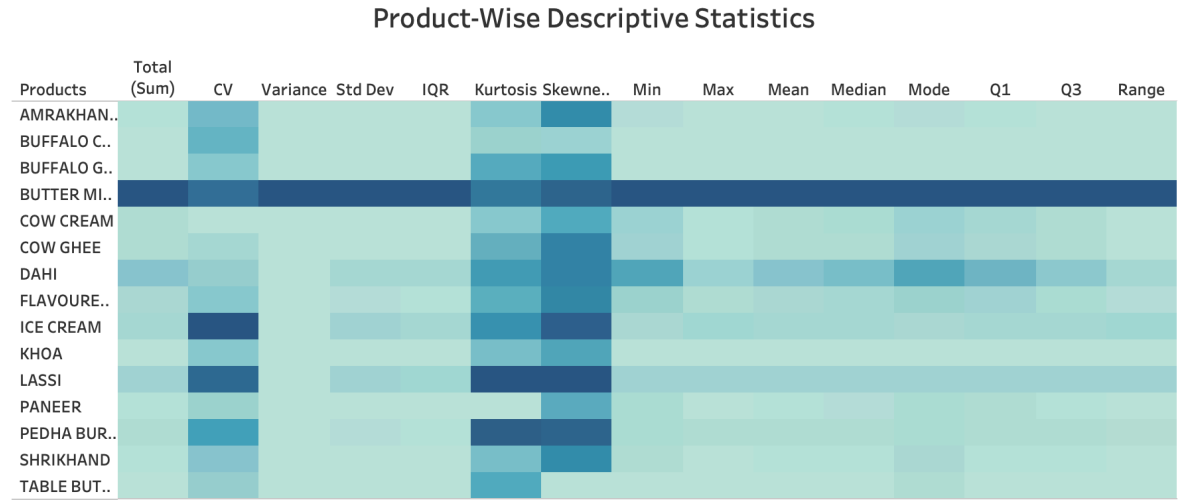
The final data have the following fields:
Financial year, Month, Product name, Sales volume (qty), Selling price (only for the top-performing products i.e., BUTTERMILK and DAHI), Revenue (calculated), Water consumption (in Liters), Electricity consumption (price).

4 Descriptive Statistics

In this analysis, descriptive statistics techniques are applied to two types of data: overall sales and product-wise sales. The overall sales statistics provide a general overview of the data, while the product-wise analysis offers a detailed view of the sales performance for each individual product.

We will perform this analysis using Python in a Colab notebook for efficiency, although it can also be done in Microsoft Excel.

For the product-wise sales analysis, I will create a DataFrame and apply conditional formatting (just like a heatmap) to enhance visual appeal. Details are shown in the screenshots below.



Products	Mean	Median	Mode	Range	Variance	Std Dev	IQR	Skewness
AMRAKHAND	6678.542373	6216	3584	10222	5033085.735	2243.453974	3182.5	0.9134690469
BUFFALO CREAM	2577.135593	2615	47	4732	931636.7054	965.2132953	1145	-0.417336021
BUFFALO GHEE	2016.101695	1867	624	3181	340860.9895	583.8330151	672	0.6882125559
BUTTER MILK	325988.1017	260746	99384	1008339	43927416297	209588.6836	241055.5	1.660993571
COW CREAM	17689.11864	17725	12132	14345	8560149.968	2925.773397	3856.5	0.4191932034
COW GHEE	16432.76271	15803	10569	16361	12836749.6	3582.840995	3792	1.077743994
DAHI	74626.79661	73681	45806	90237	336753316.9	18350.83968	21986	1.077230907
FLAVOURED MILK	25724.74576	24882	12752	35763	52969168.02	7277.992032	7520.5	1.005194008
ICE CREAM	32411.15254	23180	7161	102937	571143215.2	23898.60279	21254.5	1.67116467
KHOA	1645.888889	1619	525	2272	221808.4444	470.9654387	519.5	0.4528929024
LASSI	36042.23729	29221	10781	115809	560793496.4	23681.07887	24840	1.850867644
PANEER	10237.10169	9811	6102	9617	6124065.507	2474.684931	3504	0.3426113727
PEDHA BURFI Sale	15765.32203	14524	6245	38277	52100606.98	7218.075019	6676	1.652073143
SHRIKHAND	7617	7304	7039	10730	5016018.586	2239.646978	2915	0.891270658
TABLE BUTTER	4236.915254	4578	4614	6042	1181511.803	1086.97369	1266.5	-0.7226054046

Products	Kurtosis	Min	Max	Q1	Q3	Count	Total (Sum)	CV
AMRAKHAND	0.4782151273	3584	13806	4920.5	8103	59	394034	0.3359197036
BUFFALO CREAM	0.1418452522	47	4779	2001.5	3146.5	59	152051	0.3745294962
BUFFALO GHEE	1.396237882	624	3805	1636.5	2308.5	59	118950	0.289585102
BUTTER MILK	2.768067125	99384	1107723	177599	418654.5	59	19233298	0.6429335381
COW CREAM	0.4731670575	12132	26477	15805.5	19662	59	1043658	0.1653996141
COW GHEE	1.171567649	10569	26930	14156	17948	59	969533	0.2180303494
DAHI	1.810597817	45806	136043	60985	82971	59	4402981	0.2459014792
FLAVOURED MILK	1.303818021	12752	48515	20801.5	28322	59	1517760	0.2829179382
ICE CREAM	2.124338778	7161	110098	17334	38588.5	59	1912258	0.7373573882
KHOA	0.7608275892	525	2797	1345.75	1865.25	36	59252	0.286146557
LASSI	3.724274605	10781	126590	20824.5	45664.5	59	2126492	0.6570368726
PANEER	-0.3813786253	6102	15719	8474	11978	59	603989	0.2417368709
PEDHA BURFI Sale	3.536652115	6245	44522	11186.5	17862.5	59	930154	0.4578450731
SHRIKHAND	0.7512464866	4209	14939	5906.5	8821.5	59	449403	0.2940326872
TABLE BUTTER	1.431879151	680	6722	3511	4777.5	59	249978	0.2565483671

Measure	Value
Mean	581063.18
Median	490043.5
Mode	301617
Range	1322305
Variance	72828788798
Std Deviation	269868.1
IQR	302444.25
Skewness	1.74
Kurtosis	3.37
Min	301617
Max	1623922
Q1	399125.25
Q2 (Median)	490043.5
Q3	701569.5
Count	60
Sum	34863791
Coefficient of Variation	0.46

Figure 3: Descriptive statistical analysis on (a) product-wise sales (i) heatmap, (ii) values and (b) overall sales

From the descriptive statistics for each product shown above, we conclude the following:

Top Performers: BUTTERMILK (325988.10 avg units/month), DAHI (74626.80 avg units/month), and LASSI (36042.24 avg units/month) are the top performers with high average sales.

High Variability: Products like BUTTER MILK (std_dev 209588.68), ICE CREAM (std_dev 23898.60), and LASSI (std_dev 23681.08) show high variability in sales, suggesting potential inconsistency.

Stable Products: PANEER (std_dev 2474.68), SHRIKHAND (std_dev 2239.65), and KHOA (std_dev 470.97) have relatively lower variability, indicating more consistent sales.

Skewness: Many products show positive skewness, indicating occasional high sales values. Notably, LASSI (skewness 1.85) and ICE CREAM (skewness 1.67) have higher skewness, suggesting peaks in demand.

Low Variability: TABLE BUTTER has the lowest coefficient of variation (0.2565), indicating consistent sales, but it also has lower mean sales (4236.92 units/month).

High & Low Demand Periods: BUTTERMILK, DAHI and LASSI have the peak sales months for these products, indicating periods of exceptionally high demand. Planning for these peaks can optimize inventory and staffing. Whereas, BUFFALO CREAM, SHRIKHAND and ICE-CREAM have the lowest sales months, indicating periods of low demand. Strategies such as promotions or discounts could be employed during these times to boost sales.

Sales Consistency: TABLE BUTTER AND COW GHEE have a small IQR, indicating that their sales are consistent and less variable, making them easier to forecast and manage.

Outliers and Extreme Values: High kurtosis indicates that LASSI and ICE CREAM have more frequent extreme values or outliers, suggesting the presence of occasional very high sales spikes.

5 Detailed Explanation of Analysis Process

5.1 Data Collection and Preparation

The complete data was collected till 20th June ‘24. I received three different datasets from the corresponding department heads:

1. Monthly sales data for five consecutive years (with selling price for 2 of the products).
2. Month-wise water consumption data for the latest three years.
3. Month-wise electricity consumption data for the latest three years.

The sales and water consumption data were provided in Excel sheets. However, due to time constraints, the electricity data was given as photos, which I manually entered into an Excel sheet. All these files were then cleaned and combined into a single collection. The cleaning stage involved maintaining consistency throughout, correcting datatypes, removing or imputing missing values, and verifying outlier values to ensure their accuracy.

5.2 Descriptive Statistical Analysis

Various descriptive statistical techniques were used to summarize the data, including measures of central tendency (mean, median, mode), dispersion (range, variance, standard deviation, IQR), and distribution shape (skewness, kurtosis). Summary statistics covered extreme values, percentiles, total sales, count, and the coefficient of variation to analyze sales performance and variability.

5.3 Data Visualization

In this report, I used several data visualization techniques to uncover key insights about Katraj Dairy's operations:

- A pie chart helped identify which products contribute the most to overall sales.
- The Pareto chart showed that a small number of products make up the bulk of sales.
- To understand long-term growth, I looked at yearly sales trends with a bar chart. A time-series chart was used to track monthly sales fluctuations.
- Lastly, I used a combination chart to explore how sales and water usage relate.

6 Results and Findings

6.1 Graphs

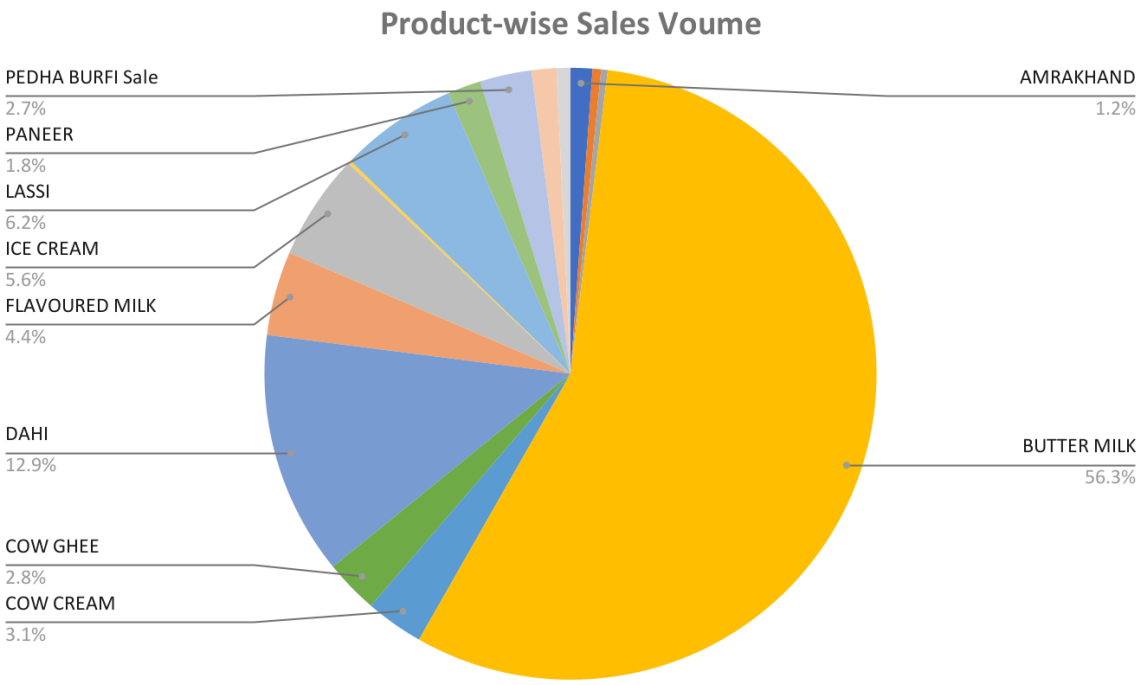


Figure 4: Pie chart showing the contribution of each product in the overall sales

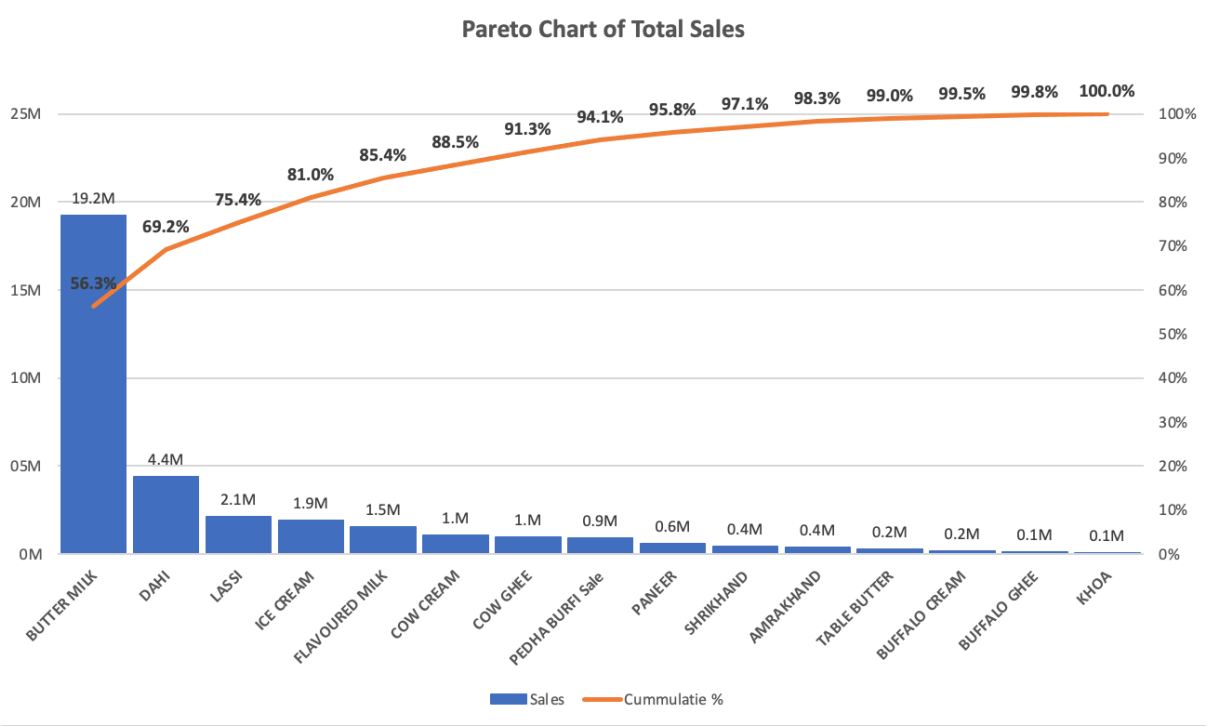


Figure 5: Pareto chart of the total sales (FY 2019-2024), M indicates Million

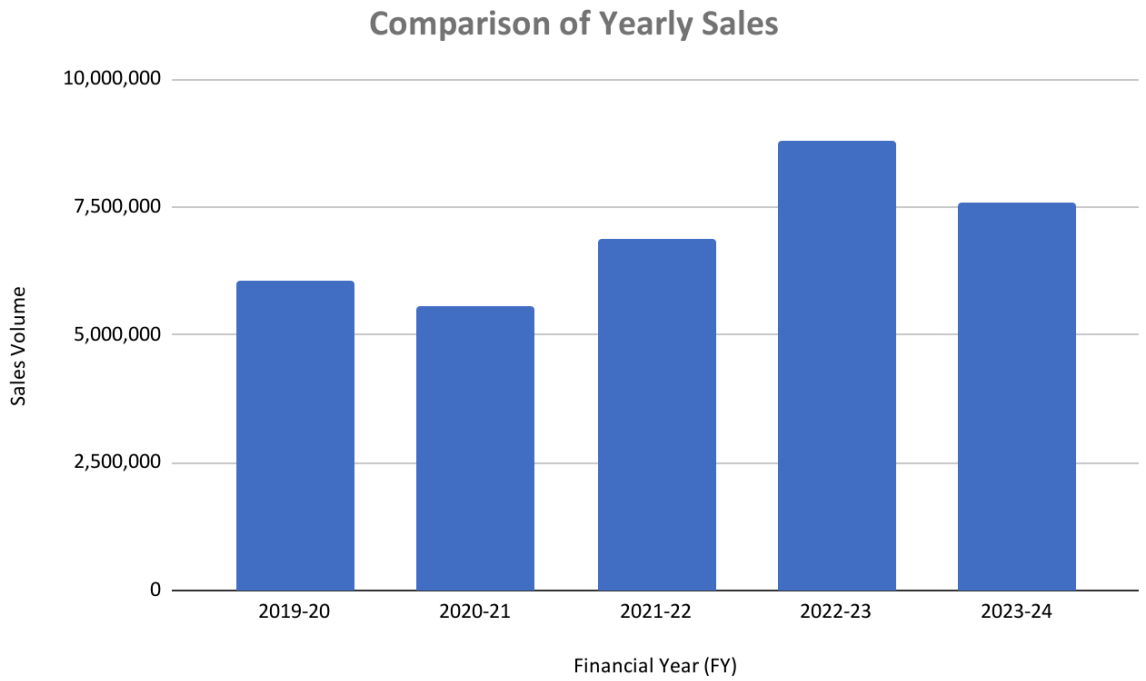


Figure 6: Bar chart for yearly sales

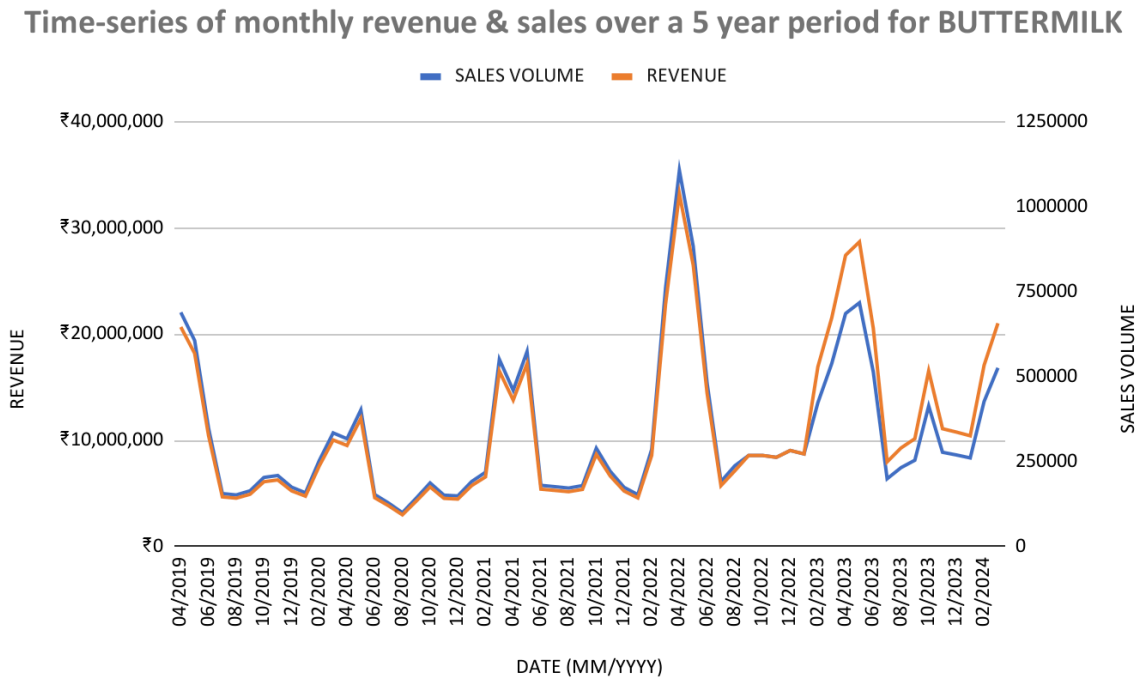


Figure 7: Time-series of monthly sales over a period of 5 financial years

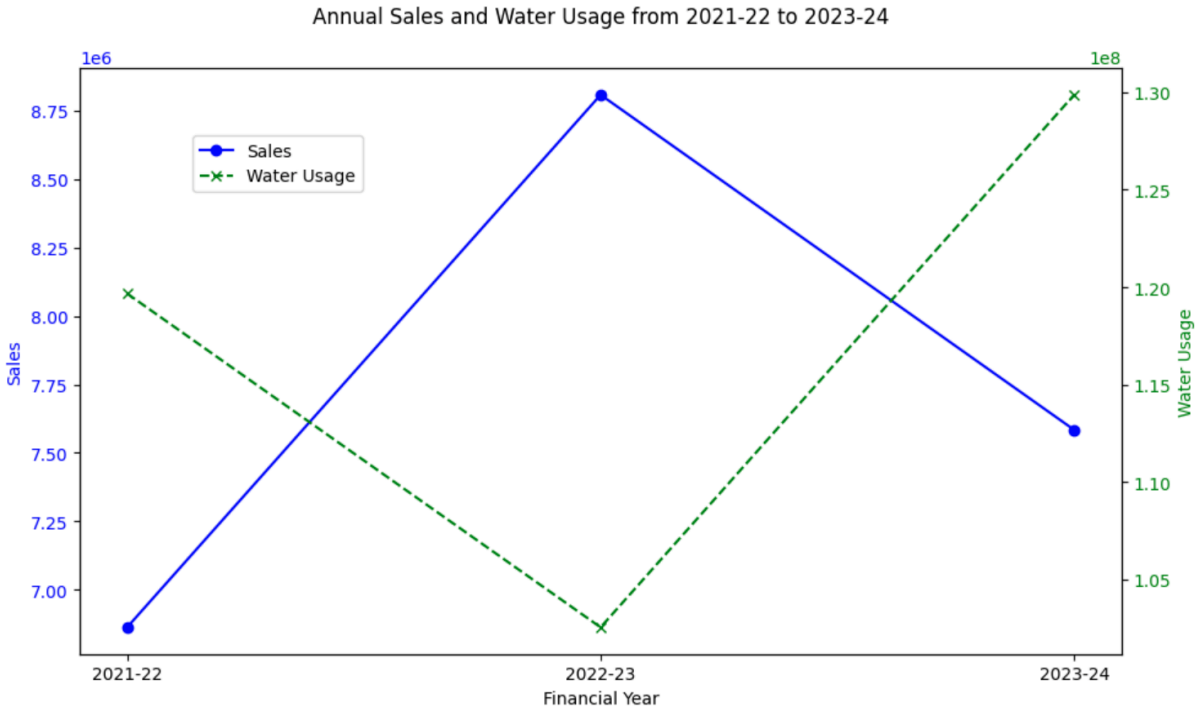


Figure 8: Combination chart comparing overall sales and water usage

6.2 Results

Optimize Utility Consumption to Reduce Costs

1. **Combination Chart of Sales and Water Usage:** Although utility data was limited, we noticed that water usage dropped by about 15% in FY 2022-23, even as sales went up by around 12%. This suggests that some good practices might already be in place, and there could be room to refine these further.

Develop Pricing Strategies Using Elasticity Analysis to Maximize Revenue

2. **Pareto Chart of Total Sales:** The analysis showed that just two products—Butter Milk and Dahi—make up more than 70% of the total sales volume, with Butter Milk alone contributing 56.3% and Dahi 12.9%. Focusing on these key products for pricing strategies could have a big impact on boosting revenue.

Improve Demand Forecasting Through Seasonal Trend Analysis

3. **Time-Series Chart of Monthly Sales:** The time-series chart highlighted seasonal trends, with sales jumping by up to 25% during peak months. Knowing these patterns will help improve demand forecasting, so the dairy can better manage inventory and avoid running out of stock or having too much.
4. **Bar Chart of Yearly Sales:** Sales have been growing steadily over the past five years, with a big 20% increase in FY 2022-23 compared to the year before. This growth is important for planning production and making sure the dairy can keep up with demand.

Enhance Product Contribution Analysis

5. **Pie Chart of Product Contribution to Overall Sales:** The pie chart showed that Butter Milk and Dahi are the biggest contributors to sales, making up 69.2% of the total. This means these products should be the focus of strategic efforts and resources.

6.3 Summary

In this mid-term report, I found that Butter Milk and Dahi are the most important products, making up 69.2% of total sales. I also noticed that sales have seasonal peaks, going up by as much as 25%, which means better demand forecasting is needed. While water usage decreased by 15% as sales grew by 12%, there wasn't enough utility data to fully explore cost savings. In the final report, I'll focus on fine-tuning pricing strategies, improving forecasting, and taking a closer look at electricity data to find more ways to save costs and help Katraj Dairy grow steadily.