Endeavoring to Improve the Profit Margin of a Jaggery Manufacturing Company

A Mid-term report for the BDM capstone Project

Submitted by

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1 Executive Summary and Title

The Business Data Management Capstone Project focuses on enhancing the operational efficiency of Ponnar Sankar, a small traditional jaggery powder manufacturing company located in Selur Sellapampalayam, Paramathi Velur, Namakkal, Tamil Nadu, [Google-Map]. Established in the early 2000's by Mr. Mani, the company operates in the B2B sector, producing high-quality jaggery powder sold at the Pilikalpalayam Vivasaigal Vellam Sakarai Virpanai Santhai, [Google-Map].

This project involved a thorough analysis of production data from June 2023 to June 2024, using open-source tools such as LibreOffice Calc and Python. The dataset, provided by the mill owner, encompasses production volume, yield consistency, and cost metrics. Analytical methods, including regression analysis and time-series trend analysis, were applied to uncover patterns and provide insights into production efficiency. Descriptive statistics helped illustrate seasonal impacts on yields, while regression models offered predictions on optimal production adjustments.

The findings offer actionable recommendations for Ponnar Sankar to optimize its operations. By refining production schedules around high-demand periods and improving resource allocation, the company can stabilize yields and increase profits. This data-driven approach will empower Ponnar Sankar to address current operational challenges, align production with market demands, and establish a stronger foundation for long-term success in a competitive market.

2 Proof of Originality of Data

Verification of Data Authenticity:

- Photographs: Attached are photographs of the production logs and sales records used in this report.
- Letters on Official Letterhead: We received official letters from Mr. Mani, the owner of Ponnar Sankar, and key personnel, confirming the accuracy and authenticity of the data provided.
- Video Documentation: Recorded video interviews and walkthroughs of the production process to ensure data integrity.

Google Drive Link – Click here to view the folder.

3 Metadata

3.1 Contents of the Data

The collected data includes the following fields, with formulas where applicable:

3.1.1 Contents of the Data of the Production and Sales Dataset of PONNAR SANKAR

- **Date**: The date on which the production data was recorded.
- **Today's Sugarcane (tons)**: The quantity of sugarcane purchased on that day (in tons).
- **Total Sugarcane (tons)**: The cumulative sugarcane available for production, including carry-over from previous days.
- **Full Batches**: The number of full production batches based on the amount of sugarcane available.
- **Carry-over Sugarcane (tons)**: Any remaining sugarcane carried over to the next day's production.
- **Jaggery Yield per Ton (kg)**: The yield of jaggery (in kilograms) per ton of sugarcane.
- **Total Jaggery Production (kg)**: The total amount of jaggery produced that day (in kilograms).
- **Sugarcane Price (₹/ton)**: The price of sugarcane per ton for that day.
- **Labor Charges (₹)**: The labor costs for the day, based on the number of batches processed.
- **Bags (30 kg each)**: The number of 30 kg bags of jaggery powder produced.
- **Carry-over Jaggery (kg)**: Any jaggery carried over to the next production day.
- **Market Price (₹/30kg)**: The market price per 30 Kg Bag of jaggery powder.
- **Total Production Cost (₹)**: The sum of sugarcane costs and labor charges and price of a bag.
- **Total Sales (₹)**: The total jaggery production (kg) multiplied by the market price(₹/kg).
- **Gross Profit (₹)**: The difference between total sales and total production costs.

3.1.2 Contents of the Data of the Jaggery Market Data

- **Date**: The date on which the Jaggery Market data was recorded.
- **Powder Min Price (₹)**: The minimum market price of jaggery powder(Nattu Sakkarai in Tamil).
- **Powder Max Price (₹)**: The maximum market price of jaggery powder(Nattu Sakkarai in Tamil).
- **Rounded Min Price (₹)**: The minimum market price of rounded jaggery(Urundai Vellam in Tamil).
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- **Rounded Max Price (₹)**: The maximum market price of rounded jaggery(Urundai Vellam in Tamil).
- **Squared Min Price (₹)**: The minimum market price of squared jaggery(Achu Vellam in Tamil).
- **Squared Max Price (₹)**: The maximum market price of squared jaggery(Achu Vellam in Tamil).

3.2 Data Fields and their Types

Columns	Data Type
Date	Date
Today's Sugarcane (tons)	Numeric
Total Sugarcane (tons)	Numeric
Full Batches	Numeric
Carry-over Sugarcane (tons)	Numeric
Jaggery Yield per Ton (kg)	Numeric
Total Jaggery Production (kg)	Numeric
Sugarcane Price (₹/ton)	Numeric
Labor Charges (₹)	Numeric
Bags (30 kg each)	Numeric
Market Price (₹)	Numeric
Total Production Cost (₹)	Numeric
Total Sales (₹)	Numeric
Gross Profit (₹)	Numeric

Table 1: Data Feilds and their types of Production and Sales of PONNAR SANKAR.

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Columns	Data Type
Date	Date
Powder Min Price	Numeric
Powder Max Price	Numeric
Rounded Min Price	Numeric
Rounded Max Price	Numeric
Squared Min Price	Numeric
Squared Max price	Numeric

Table 2: Data Feilds and their types of Jaggery Market Data.

4 Descriptive Statistics

This section presents the statistical summary of the daily production data collected from Ponnar Sankar, a traditional jaggery manufacturing unit, over the period from June 2023 to May 2024. The dataset contains key variables such as daily sugarcane procurement, jaggery yield per ton, labor charges, market price, total production cost, total sales, and gross profit. Calculated using Python. These statistics will help identify patterns and deviations that occur seasonally.

Statistic	Today's Sugarcane (tons	Total Sugarcane (ton	Full Batches	Carry-over Sugarcane (ton	Jaggery Yield per Ton (k	Total Jaggery Production (k
Mean	6.86767371601208	7.36356495468278	6.8670694864	0.496495468277946	103.199395770393	709.145317220544
variance	1.3239193618167	1.4280863847537	1.48686120061	0.0796191381969862	117.893776069952	20729.5771433284
Median	6.82	7.36	7	0.49	99	687.96
Mode	6	6.46	6	0.36	92	666
Standard D	1.15061694834411	1.19502568372136	1.21936918143	0.282168634325267	10.8578900376616	143.97769668712
Skewness	0.162747953254186	0.0542201126257586	0.11220510335	-0.0115317499384746	0.089379034339251	0.133231439605733
Kurtosis	-1.09375490799101	-0.930419987881513	-0.93851404591	-1.19129300289031	-1.67388522751233	0.793840233171399
Range	3.99	4.79	4	0.99	32	598.35
Minimum	5	5.06	5	0	88	456.57
Maximum	8.99	9.85	9	0.99	120	1054.92
Sum	2273.2	2437.34	2273	164.34	34159	234727.1
Count	331	331	331	331	331	331

Figure 1: Descriptive Statistics for Daily Jaggery Production Data (June 2023 - May 2024) (First Half)

Sugarcane Price (₹/to	Labor Charges (₹	Bags (30kg each)	Carry-over (kg)	Market Price(₹)	Total Sales Amount(₹)	Total Production Cost(	Gross Profit(₹)
3828.096676737163	433.83685800604	23.631419939577	14.755287009063	1312.2658610272	31034.9186807654	29976.0392749245	1058.87940584089
154965.8637653913	30979.8404541765	25.235749947517878	8.547366307354	1408.4610399686	41153020.4377256	33739184.2975511	10565725.9344884
4000	3410	23	15	1320	30270.24	29700	1578.88
4150	3000	19	27	1350	-	27185	-
393.657038252069	575.308474172053	5.023519677230083	3.862695205599	437.529468953991	6415.06199796429	5808.54407726679	3250.49625972533
-0.28474353618664	-0.37939778191614	###	0.013001189129	91.2673096102262	0.145520220675975	-0.089026820955651	90.381181129174629
-1.587074182961021	1.714350454115566	0.376914950408851	1.248728820507	12.0095898237776	0.696360398340236	0.718370872034858	0.505065649006042
1100	1995	21	29	220	26739.3333333333	24221	4953.65
3200	2500	15	0	1140	20132.6666666667	18993	-7411.71
4300	4495	36	29	1360	46872	43214	12365.36
1267100	1136600	7822	4884	434360	10272558.0833333	9922069	350489.083333333
331	331	331	331	331	331	331	331

Figure 2: Descriptive Statistics for Daily Jaggery Production Data (June 2023 - May 2024) (Second Half)

Statistics	Powder Min Price (₹)	Powder Max Price (₹)	Rounded Min Price (₹)	Rounded Max Price (₹)	Squared Min Price (₹)	Squared Max Price (₹)
Mean	1248.65384615385	1353.07692307692	1207.59615384615	1353.65384615385	1209.23076923077	1357.21153846154
Median	1280	1350	1200	1350	1200	1350
Mode	1280	1350	1200	1350	1200	1350
variance	1811.64940828402	725.147928994082	750.952292899406	596.264792899409	951.331360946749	1125.87832840236
Standard Deviation	42.7695947781909	27.0589763322518	27.5362141889475	24.5367840490812	30.9930248241771	33.7166010439912
Standard Error	4.19390381466253	2.65335092953841	2.70014795153681	2.40602962821303	3.0391161223797	3.30618474337181
Kurtosis	-0.53582824194529	35.9758220452602	12.1269443415721	52.145144258567	10.0226858943322	23.4045853751203
Skewness	-0.719299597615235	5.14076532168822	3.60974615109062	7.18164188087187	3.30925647337696	4.85608626546932
Minimum	1100	1270	1200	1350	1200	1350
Maximum	1300	1550	1350	1550	1350	1550
Range	200	280	150	200	150	200
Sum	129860	140720	125590	140780	125760	141150
Count	104	104	104	104	104	104

Figure 3: Descriptive Statistics for Jaggery Market Data(June 2023 - June 2024)

5 Analysis Process and Methods

5.1 Data Collection

For this project, daily production data from Ponnar Sankar, a traditional jaggery manufacturing company, has been manually collected and recorded in a LibreOffice Calc sheet. The data spans the period from June 2023 to May 2024, providing a comprehensive view of the company's operations. This dataset is crucial for analyzing various aspects of the business, including jaggery production, labor costs, sugarcane procurement, and market sales.Additionally, jaggery market price data has been gathered, including minimum and maximum prices for jaggery powder(Nattu Sakkarai), rounded jaggery(Urundai Vellam) and squared jaggery(Achu Vellam), reflecting real-time market trends.

Additional metrics, such as Total Sales, Gross Profit, and Total Production Cost, have been calculated using predefined formulas within the sheet. The manually collected data has been supplemented with these calculations to better assess profitability and resource allocation. The dataset is structured to enable in-depth analysis, with the goal of improving production efficiency and aligning output with fluctuating market demand.

5.2 Dataset Period

The dataset covers production data from June 1, 2023, to May 31, 2024, providing a detailed view of seasonal fluctuations in jaggery production, and market demand.

Google Drive Link for the dataset : click here to veiw dataset

5.3 Purpose of the Dataset

The primary objective of this dataset is to analyze daily production trends, assess the impact of seasonal variations, and evaluate profitability. The additional columns included for Total Sales, Gross Profit, and Total Production Cost provide deeper insights into the financial performance of the production process. These insights will help optimize production schedules, align them with market demand, and improve resource allocation

5.4 Analysis Process with Justification

In our analysis of powder jaggery production and pricing, we conducted a detailed examination of production and market price fluctuations to understand their impact on profitability. First, we collected and cleaned production data over a specified period, categorizing it by seasonality and festivel periods known to affect demand. Data cleaning was essential to ensure reliability, as missing values or outliers could distort seasonal trends and affect the analysis outcome. This was followed by preprocessing to align data on production quantity, market price, and date, allowing for accurate trend tracking.

We utilized time-series analysis to monitor daily production levels and market prices over the year. This method was chosen because it reveals recurring seasonal trends, such as increased prices during festivals, allowing us to anticipate periods of high demand. The resulting "Powder Jaggery Production vs. Market Price" graph enabled us to visualize and interpret variations in production relative to pricing, highlighting peak periods where production and profitability intersected.

Additionally, a scatter plot analysis was used to identify "High-Price vs. Low-Price Days of Powder Jaggery," allowing us to spot outliers and days with extreme price variations. This analysis was essential for understanding price volatility, as it revealed the relationship between high and low price points and their impact on potential revenue. It offered valuable insight into maximizing profitability by adjusting production to match high-price periods.

Overall, this combination of time-series analysis, scatter plots provided a robust framework for understanding jaggery production economics. The insights gained are intended to aid decision-making by aligning production schedules with market demand, thus maximizing revenue. While this analysis offers a clear snapshot of profitability drivers, future work could incorporate more dynamic cost factors, such as fluctuating labor rates or sudden raw material price hikes, to enhance accuracy.

6 Result and Findings

1. Production and Market Price Relationship: The line chart reveals a pattern where lower production days often correlate with higher market prices. For instance, on June 10, 2023, a production dip was associated with increased market prices, illustrating how fluctuations in production volumes impact pricing. This relationship was similarly observed on October 14, 2023, and January 13, 2024, where production drops coincided with price spikes. These insights suggest that stabilizing production during these periods could help maintain consistent market pricing

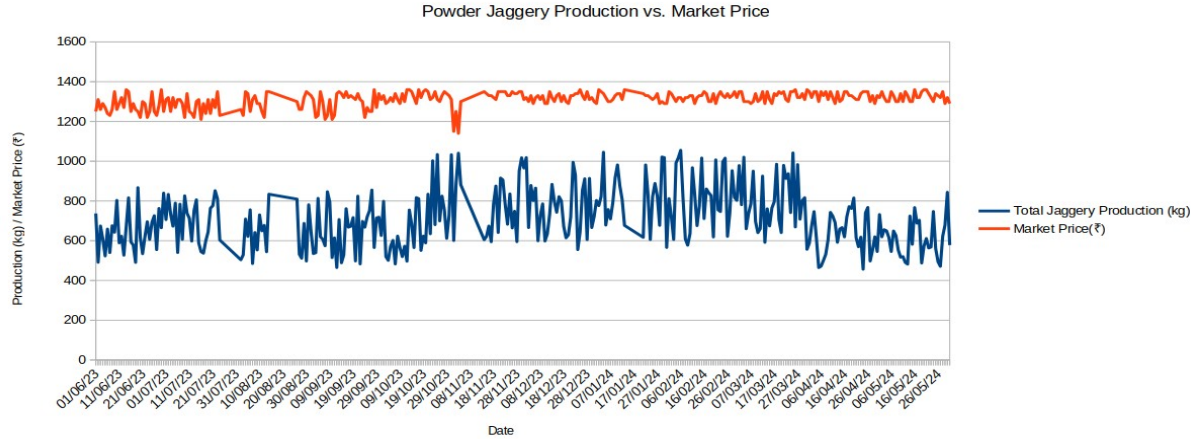

Figure 4: Line chart showing relationship between the jaggery production and market sales price. (Note : calculated from the jaggery production and sales dataset).

2. Monthly Price Variability: The box plot highlights increased price variability around specific times. In particular, dates like October 21, 2023 and January 13, 2024, show wider price ranges, indicating spikes in demand that drive prices upward. These findings emphasize the importance of aligning production schedules with these peak periods to capitalize on higher prices.

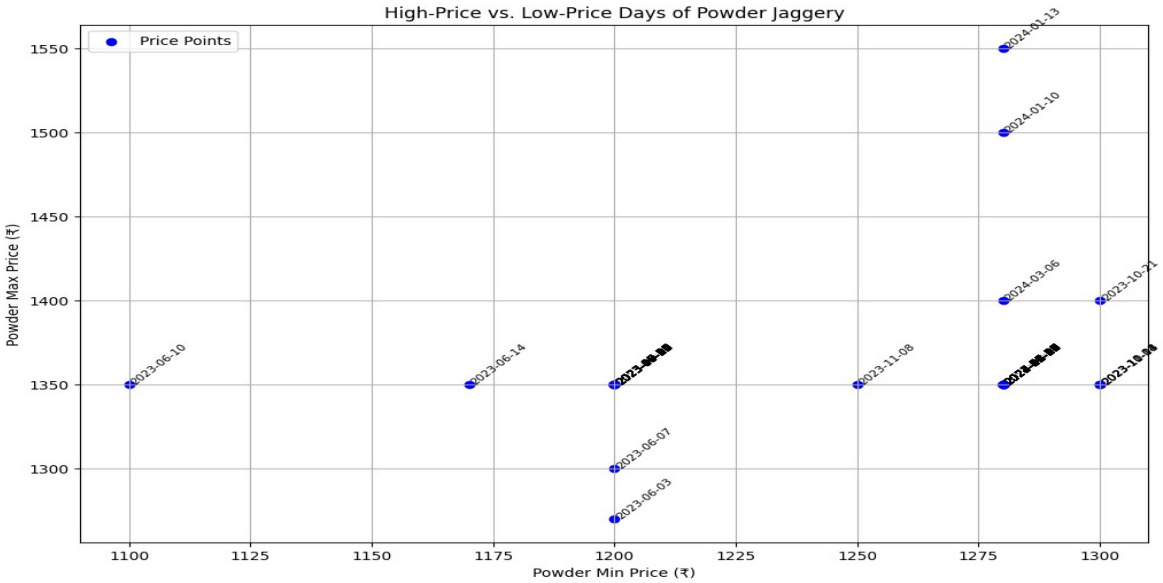

Figure 5: Box plot showing price variability of price of the powderd jaggery. (Note : calculated from the jaggery market dataset).

In summary, the charts highlight how production consistency and strategic timing can significantly influence market prices and profitability. This analysis underscores the importance of production planning and demand forecasting to optimize revenue and enhance profitability. While these initial findings provide valuable insights, further detailed analysis will be conducted in the final report to explore seasonal trends, pricing variations, and yield optimization. By examining these factors in greater depth, we aim to develop more precise recommendations for aligning production with demand fluctuations. This comprehensive approach will equip Ponnar Sankar with actionable strategies to manage variability in both production and market conditions, ultimately positioning the company for sustainable growth.