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A Study on Operational Performance and Growth Trends in Private and Co-Operative Sugar Factories in Belagavi District

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Abstract:
Sugar factories in Belagavi district hold a vital position in Karnataka's agro-based economy, supporting a large number of sugarcane farmers, generating rural employment, and contributing significantly to industrial and regional development. The operational efficiency of these factories has a direct impact on farm incomes, cane cultivation decisions, and the sustainability of the sugar sector in the region. This study examines the operational performance and growth trends of private and co-operative sugar factories in Belagavi district over the period 2021–22 to 2024–25. The analysis focuses on key operational indicators such as crushing capacity, cane crushed, sugar production, and sugar recovery. A descriptive and comparative research design is adopted using secondary data from factory records, annual reports, and industry sources. Mean analysis, Compound Annual Growth Rate (CAGR), and independent sample t-test are employed. The findings reveal that private sugar factories outperform co-operative factories in volume-related indicators, while sugar recovery levels remain nearly similar. CAGR results indicate a declining trend in cane crushed and sugar production due to cane supply constraints.

1. INTRODUCTION:

The sugar industry is one of the most important agro-based industries in India, playing a vital role in rural employment generation, agricultural development, and industrial growth. In Karnataka, the sugar sector contributes significantly to the state's economy by supporting millions of sugarcane farmers and allied activities such as transport, labour services, and by-product industries. Among the major sugar-producing regions of the state, Belagavi district holds a prominent position due to its favourable agro-climatic conditions, extensive sugarcane cultivation, and the presence of both private and co-operative sugar factories. The performance of these factories has a direct bearing on farmers' income stability, rural livelihoods, and the overall sustainability of the sugar industry. Sugar factories in Belagavi district operate under two dominant institutional structures—private and co-operative. Co-operative sugar factories were established to protect farmers' interests through collective ownership and assured cane procurement, whereas private sugar factories focus on efficiency, capacity expansion, and commercial viability. Over the years, both types of factories have faced several challenges, such as fluctuating cane availability, rising input costs, climatic uncertainties, policy changes, and market volatility. These challenges have significantly influenced operational performance indicators such as crushing capacity utilization, cane crushed, sugar production, and sugar recovery. Despite capacity expansion initiatives, especially in private sugar factories, many units have experienced declining production trends due to inadequate cane supply

and external constraints. Co-operative sugar factories, on the other hand, have shown greater vulnerability owing to limited financial flexibility and operational constraints. In this context, a systematic comparison of the operational performance and growth trends of private and co-operative sugar factories becomes essential for understanding their relative efficiency and long-term viability. The present study focuses on analysing the operational performance of selected private and co-operative sugar factories in Belagavi district using key indicators such as crushing capacity, cane crushed, sugar produced, and sugar recovery. Further, the study assesses growth trends through Compound Annual Growth Rate (CAGR) analysis and examines the statistical significance of performance differences using appropriate analytical tools. By providing empirical insights, the study aims to contribute to policy formulation, managerial decision-making, and the development of sustainable strategies for strengthening the sugar industry in Karnataka.

2. LITERATURE REVIEW: -

Lakshmi and Venkatasalam (2025) assessed the activity and operational performance of select sugar mills in Tamil Nadu, with specific reference to K.C.P. Sugar and Industries Corporation Limited during FY 2022–23. Using a descriptive–analytical design and secondary data, the study evaluated performance through key activity and profitability ratios. The findings indicated an increase in sugarcane crushed and sugar bagged, while turnover declined compared to the previous year. The study highlighted modernization, diversification into ethanol and power generation, credit management, and policy support as key determinants of operational efficiency and profitability.

Umamageswari and Maheswari (2024) analysed the production, productivity, and profitability of select co-operative sugar mills in Tamil Nadu from 2006–07 to 2020–21 using secondary data and statistical techniques. The results showed significant relationships between sugar production, sugarcane crushed, recovery rate, and cost productivity components, along with a strong association between return on assets and asset efficiency. The study concluded that improvements in production efficiency, cost control, and asset utilization are crucial for enhancing profitability and sustainable performance of co-operative sugar mills.

Yasmeen et al. (2018) analysed the performance of cooperative sugar factories in north-eastern Karnataka using cost and return analysis, capacity utilization, physical and financial indicators, and ratio analysis. The findings revealed significant inter-factory variations in capacity utilization and operational efficiency, influenced by differences in cane crushed, recovery rates, and crushing duration. The study concluded that effective planning, timely automation, and improved coordination with farmers, particularly for early cane payment settlements, are critical for enhancing cooperative sugar factory performance.

Kale (2018) evaluated the operational efficiency of a cooperative sugar factory under cooperative and private management through a comparative analysis of two operational phases. Using secondary data and VSI-prescribed efficiency parameters, the study assessed performance before and after the transition to private management. The findings indicated superior performance under private management in sugar production, recovery, capacity utilization, reduced mill extraction, and cane price paid, while no significant difference was observed in cane crushing and crushing season. The study concluded that private management improved operational efficiency, though leasing was recommended only as a temporary corrective strategy.

3. OBJECTIVES:

1. To analyse the operational performance of private and co-operative sugar factories based on crushing

capacity, cane crushed, sugar production, and sugar recovery.
2. To assess the growth trends in key operational indicators of private and co-operative sugar factories using Compound Annual Growth Rate (CAGR).

4. HYPOTHESES: -

H_{01}: There is no significant difference in the operational performance of private and co-operative sugar factories in terms of crushing capacity, cane crushed, sugar production, and sugar recovery.

H_{11}: There is a significant difference in the operational performance of private and co-operative sugar factories in terms of crushing capacity, cane crushed, sugar production, and sugar recovery.

5. RESEARCH METHODOLOGY: -

The present study adopts a descriptive and comparative research design to analyse the operational performance of private and co-operative sugar factories. The study is based entirely on secondary data collected from published annual reports, official factory records, industry websites, and authenticated publications for the period 2021–22 to 2024–25. Key operational variables considered include crushing capacity, cane crushed, sugar production, and sugar recovery. Analytical tools such as mean analysis were used to compare average performance, while Compound Annual Growth Rate (CAGR) was employed to assess growth trends over the study period. Further, an independent sample t-test was applied to examine the statistical significance of differences in operational performance between private and co-operative sugar factories at a 5% level of significance. The analysis was supported using SPSS and spreadsheet techniques, ensuring systematic and objective evaluation of operational efficiency and performance trends.

TABLE 1

Year-wise Operational Performance of Co-operative Sugar Factory

(Shri Hiranyakeshi Sahakari Sakkare Karkhane Niyamit)

Year	Crushing Capacity (Tons/Day)	Cane Crushed (Lakh MT)	Sugar Produced (Lakh Qtls)	Sugar Recovery (%)
2021–22	8,000	9.53	11.05	11.59
2022–23	8,000	9.54	8.81	11.35
2023–24	8,000	8.03	7.03	10.90
2024–25	8,000	5.21	4.80	10.82

Source: Secondary data (Aneknt prakshan)

Table 1 presents the year-wise operational performance of the co-operative sugar factory from 2021–22 to 2024–25. The crushing capacity remained constant at 8,000 tons per day throughout the study period, indicating no capacity expansion. However, cane crushed declined steadily from 9.53 lakh MT in 2021–22 to 5.21 lakh MT in 2024–25, reflecting reduced cane availability or operational challenges. A similar declining trend is observed in sugar production, which fell sharply from 11.05 lakh quintals to 4.80 lakh quintals during the same period. Sugar recovery also showed a gradual decline from 11.59% to 10.82%, suggesting reduced efficiency in sugar extraction. Overall, the table indicates a weakening operational performance of the co-operative sugar factory overtime despite stable installed capacity.

TABLE 2

Year-wise Operational Performance of Private Sugar Factory

(The Ugar Sugar Works Ltd.) **

Year	Crushing Capacity (Tons/Day)	Cane Crushed (Lakh MT)	Sugar Produced (Lakh Qtls)	Sugar Recovery (%)
2021–22	10,000	23.09	26.32	11.34
2022–23	10,000	19.58	11.81	11.60
2023–24	15,000	17.07	11.61	11.05
2024–25	15,000	16.28	9.72	10.75

Source: Secondary data (Ugar sugars Website)

Table 2 depicts the operational performance of the private sugar factory over four years. Unlike the co-operative factory, the private factory increased its crushing capacity from 10,000 tons per day to 15,000 tons per day, reflecting expansion-oriented management. Despite this capacity growth, cane crushed declined from 23.09 lakh MT in 2021–22 to 16.28 lakh MT in 2024–25, indicating supply-side constraints. Sugar production also fell significantly from 26.32 lakh quintals to 9.72 lakh quintals. Sugar recovery fluctuated marginally and remained relatively stable around 11%, showing better efficiency control. The table reveals that although the private factory expanded capacity, declining cane availability and external factors adversely affected production levels during the later years.

TABLE 3

Mean Comparison of Operational Performance (4-Year Average) **

Variable	Factory Type	Mean
Crushing Capacity (Tons/Day)	Private	12,500
	Co-operative	8,000
Cane Crushed (Lakh MT)	Private	19.01
	Co-operative	8.08
Sugar Produced (Lakh Qtls)	Private	14.87
	Co-operative	7.92
Sugar Recovery (%)	Private	11.24
	Co-operative	11.17

Source: Computed from secondary data

Table 3 compares the four-year average operational performance of private and co-operative sugar factories. The private factory shows a higher mean crushing capacity (12,500 tons/day) compared to the co-operative factory (8,000 tons/day), indicating superior scale of operations. Similarly, the private factory

recorded substantially higher average cane crushed (19.01 lakh MT) and sugar produced (14.87 lakh quintals) than the co-operative factory. However, the difference in sugar recovery is minimal, with private and co-operative factories recording 11.24% and 11.17% respectively. This suggests that while private factories outperform co-operative factories in volume-related indicators, efficiency in sugar recovery remains almost similar. Overall, the mean comparison highlights the stronger operational performance of private sugar factories.

Fig:3.1

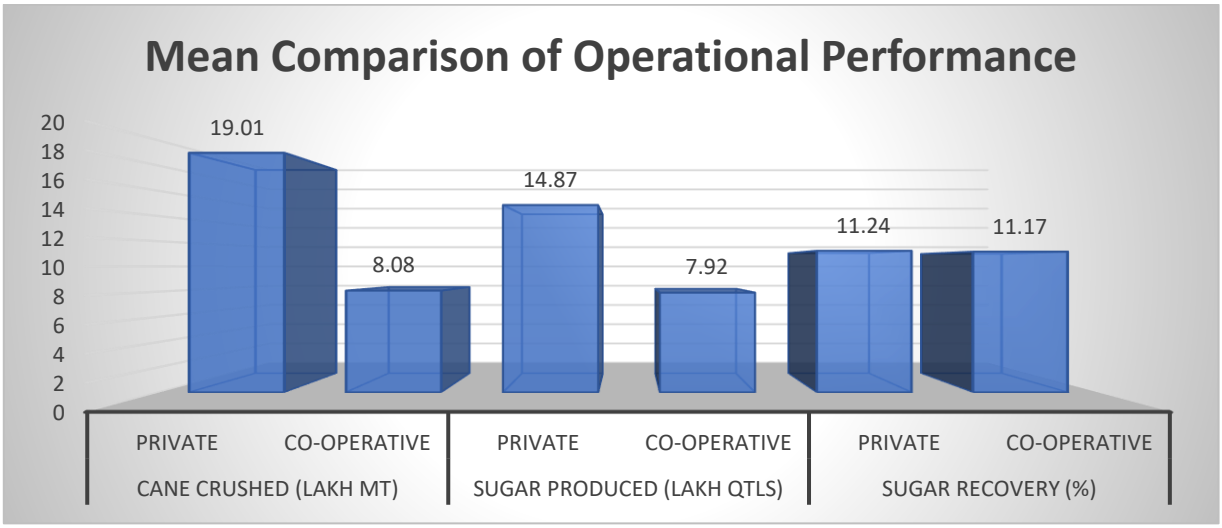

Figure 3.1 shows that private sugar factories consistently crushed more cane than co-operative factories, indicating superior procurement and operational scale. Both factories exhibit a declining trend over time, with a sharper fall in the co-operative factory reflecting higher vulnerability to cane supply constraint

Fig:3.2

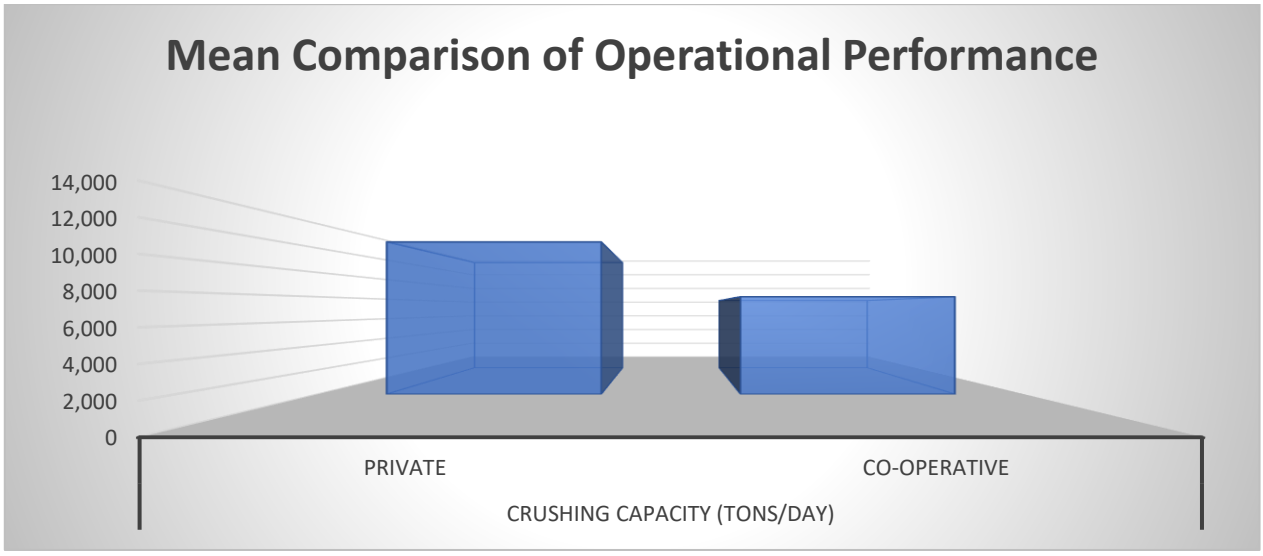

Figure 3.2 indicates that private sugar factories maintained higher sugar production than co-operative factories across all years. However, a continuous decline in production is observed for both, particularly in co-operative factories, due to reduced cane crushing and recovery efficiency.

TABLE 4
CAGR of Operational Performance – Co-operative Sugar Factory**
(Shri Hiranyakeshi Sahakari Sakkare Karkhane Niyamit)

Indicator	2021–22	2024–25	CAGR (%)	Trend
Crushing Capacity (Tons/Day)	8,000	8,000	**0.00**	Stable
Cane Crushed (Lakh MT)	9.53	5.21	**–18.9**	Declining
Sugar Produced (Lakh Qtls)	11.05	4.80	**–24.2**	Sharp decline
Sugar Recovery (%)	11.59	10.82	**–2.3**	Slight decline

Source: Computed from secondary data

Table 4 presents the Compound Annual Growth Rate (CAGR) of operational indicators of the co-operative sugar factory. Crushing capacity recorded a CAGR of 0%, indicating no expansion during the study period. Cane crushed showed a steep negative CAGR of –18.9%, reflecting a substantial decline in raw material processing. Sugar production declined sharply with a CAGR of –24.2%, indicating severe operational stress. Sugar recovery showed a marginal decline of –2.3%, suggesting slight efficiency deterioration. Overall, the table highlights a sustained downward trend in the operational performance of the co-operative sugar factory, primarily driven by declining cane availability and reduced production levels.

TABLE 6
CAGR of Operational Performance – Private Sugar Factory**
(The Ugar Sugar Works Ltd.)

Indicator	2021–22	2024–25	CAGR (%)	Trend
Crushing Capacity (Tons/Day)	10,000	15,000	**+14.5**	Strong growth
Cane Crushed (Lakh MT)	23.09	16.28	**–10.7**	Moderate decline
Sugar Produced (Lakh Qtls)	26.32	9.72	**–28.4**	Sharp decline
Sugar Recovery (%)	11.34	10.75	**–1.8**	Stable

Source: Computed from secondary data

Table 6 shows the CAGR of operational indicators of the private sugar factory. Crushing capacity recorded a strong positive CAGR of +14.5%, indicating significant capacity expansion. However, cane crushed declined at –10.7%, showing that increased capacity was not fully utilized. Sugar production witnessed a sharp decline with a CAGR of –28.4%, reflecting adverse operational conditions despite expansion efforts. Sugar recovery remained relatively stable with a marginal decline of –1.8%. The results indicate that while private factories are proactive in capacity expansion, external factors such as cane shortage significantly constrain production performance**.**

TABLE 7

Comparative CAGR Summary of Sugar Factories**

Indicator	Private Factory CAGR (%)	Co-operative Factory CAGR (%)	Better Performer
Crushing Capacity	**+14.5**	0.0	**Private**
Cane Crushed	–10.7	–18.9	**Private**
Sugar Produced	–28.4	–24.2	Co-operative (slightly)
Sugar Recovery	–1.8	–2.3	**Private**

Source: Author's computation based on secondary data

Table 7 provides a comparative overview of CAGR performance between private and co-operative sugar factories. The private factory outperformed the co-operative factory in crushing capacity growth and cane crushed decline, indicating better resilience and adaptability. The co-operative factory performed slightly better in sugar production decline, although both experienced negative growth. In sugar recovery, the private factory showed relatively better stability. Overall, the table indicates that private sugar factories exhibit stronger operational resilience and growth orientation, while co-operative factories face sharper declines in key performance indicator

TABLE 8

Independent Sample t-Test Results: Private vs Co-operative Sugar Factory**

Variable	Factory Type	Mean	Std. Dev.	t-value	df	Sig. (p)	Result
Crushing Capacity (Tons/Day)	Private	12,500	2,886.75	3.118	3.00	0.053	Marginally Significant
	Co-operative	8,000	0.00				
Cane Crushed (Lakh MT)	Private	19.01	3.07	5.936	6	**0.001**	**Significant**
	Co-operative	8.08	2.04				
Sugar Produced (Lakh Qtls)	Private	14.87	7.69	1.706	6	0.139	Not Significant
	Co-operative	7.92	2.65				
Sugar Recovery (%)	Private	11.24	0.41	0.264	6	0.801	Not Significant
	Co-operative	11.17	0.37				

Source: Computed from secondary data using SPSS

Level of Significance: 5%

Table 8 presents the results of the independent sample t-test comparing operational performance between private and co-operative sugar factories. The difference in crushing capacity is marginally significant ($p = 0.053$), indicating near-significant variation. Cane crushed shows a statistically significant difference ($p = 0.001$), confirming superior performance of private factories. Differences in sugar produced and sugar recovery are not statistically significant, suggesting similar performance levels in these indicators. Overall, the t-test results indicate that private and co-operative sugar factories differ significantly in scale and cane processing, while efficiency-related parameters remain comparable.

6. KEY FINDINGS: -

1. The co-operative sugar factory maintained a constant crushing capacity during the study period but experienced a continuous decline in cane crushed and sugar production, indicating underutilization of installed capacity.
2. The private sugar factory expanded its crushing capacity significantly; however, this capacity growth did not result in proportional increases in cane crushed or sugar production due to declining cane availability.
3. Mean comparison results show that private sugar factories outperform co-operative factories in volume-related indicators such as crushing capacity, cane crushed, and sugar produced, while sugar recovery levels remain nearly similar.
4. Independent sample t-test results reveal a statistically significant difference in cane crushed between private and co-operative sugar factories, leading to the rejection of the null hypothesis for this variable.
5. The t-test results indicate no significant difference in sugar production and sugar recovery between private and co-operative sugar factories, supporting the acceptance of the null hypothesis for efficiency-related indicators.
6. CAGR analysis shows a negative growth trend in cane crushed and sugar production for both factory types, confirming that growth performance is declining and largely influenced by external factors such as cane supply constraints.

7. SUGGESTIONS: -

1. Co-operative sugar factories should strengthen farmer linkage programs and incentive mechanisms to ensure a stable and adequate cane supply.
2. Private sugar factories need to align capacity expansion decisions with long-term cane procurement planning to avoid underutilization.
3. Both factory types should adopt modern agronomic practices and provide technical support to farmers to improve cane yield and quality.
4. Investment in process optimization and technology upgradation is essential to improve sugar recovery and operational efficiency.
5. Policy support from government agencies is required to stabilize cane prices, promote sustainable sugarcane cultivation, and mitigate climatic risks affecting sugar production.

8. CONCLUSION: -

The study highlights a consistent decline in operational performance of both private and co-operative sugar factories during the study period, primarily due to reduced cane availability. While private sugar factories demonstrated a higher scale of operations and proactive capacity expansion, such growth did not translate

into improved production outcomes. Co-operative sugar factories showed greater vulnerability, with sharper declines in cane crushed and sugar produced despite stable capacity. However, sugar recovery levels remained broadly similar across both factory types, indicating comparable operational efficiency. Overall, the findings suggest that sustainable cane procurement and improved farm–factory linkages are crucial for enhancing the long-term viability of the sugar industry.

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