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Research Paper

Economic Analysis of Sugar Production Costs and Profitability: Evidence from Coromandel Sugars Limited, Karnataka

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ABSTRACT:
The sugar industry is one of India's most important agro-based industries, contributing significantly to agricultural development, rural employment, and industrial growth. However, the profitability of sugar manufacturing is greatly influenced by fluctuations in sugarcane prices, production costs, sugar recovery, and market prices. The present study evaluates the economic performance of sugar production during the period 2009–10 to 2018–19. The study aims to analyze the production cost structure, assess the profitability of sugar manufacturing, and examine operational efficiency based on sugar recovery and processing losses. The findings reveal that the factory processed an average of 6.92 lakh tonnes of sugarcane annually and produced 66,766 tonnes of sugar. The average production cost was Rs. 24,651.33 per tonne, while the average ex-mill sugar price was Rs. 29,244.90 per tonne, resulting in an average profit of Rs. 4,593.57 per tonne and a 15.53% profit margin. The study also found that sugarcane procurement cost constituted the largest share of production cost, whereas lower sugar recovery and higher processing losses adversely affected profitability. The average sugar recovery was 9.62%, with total processing losses averaging 2.03%. The study concludes that improving sugar recovery, reducing processing losses, adopting advanced processing technologies, and efficiently utilizing by-products are essential for enhancing the long-term profitability and sustainability of sugar manufacturing in Karnataka.

KEY WORDS: *Sugar production; Cost–profit analysis; Sugarcane; Production cost; Profitability; Sugar recovery; Coromandel Sugars Limited; Karnataka.*

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I. INTRODUCTION:

The sugar industry occupies a pivotal position in the Indian economy, serving as one of the largest agro-based industries after textiles. It plays a significant role in agricultural development, rural employment generation, industrial growth, and national income. India is the world's second-largest producer of sugar after Brazil and has emerged as one of the leading consumers of sugar globally. The industry supports nearly 50 million sugarcane farmers and their families, besides providing direct and indirect employment to millions of workers engaged in cultivation, harvesting, transportation, processing, and marketing activities. Sugar production contributes substantially to rural industrialization by creating forward and backward linkages with agriculture, transport, trade, power generation, ethanol production, and several allied industries.

Sugarcane (Saccharum officinarum L.) is one of the most important commercial cash crops cultivated in tropical and subtropical regions of India. The crop is characterized by its high biomass production and multiple industrial uses. Apart from sugar, sugarcane serves as the raw material for manufacturing ethanol, industrial alcohol, jaggery, khandsari sugar, bio-compost, paper, particle boards, chemicals, and renewable energy through bagasse-based cogeneration. Consequently, the sugar industry has evolved from being merely a sugar-producing sector to an integrated bio-energy and bio-refinery industry. The increasing emphasis on renewable energy, ethanol blending programmes, and sustainable utilization of by-products has further enhanced the economic importance of sugar factories in recent years.

India cultivates sugarcane on approximately five million hectares with annual production exceeding 400 million tonnes in favourable years. Major sugar-producing states include Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, Gujarat, Andhra Pradesh, Telangana, Haryana, Punjab, and Bihar. Among these,

Karnataka occupies a prominent position owing to its favourable climatic conditions, extensive irrigation facilities, and adoption of high-yielding sugarcane varieties. The state contributes significantly to national sugar production and hosts several cooperative as well as private sugar mills that play a crucial role in regional economic development. Sugar factories in Karnataka have increasingly diversified into cogeneration of electricity and ethanol production, thereby strengthening their financial sustainability.

Within Karnataka, Mandya district has historically been recognized as one of the major sugarcane-growing regions because of assured irrigation from the Krishna Raja Sagara (KRS) reservoir and an extensive canal irrigation network. Fertile alluvial soils, favourable agro-climatic conditions, and long-standing experience in sugarcane cultivation have enabled the district to sustain a vibrant sugar economy for several decades. Coromandel Sugars Limited, K.R. Pete, is one of the important sugar manufacturing units operating in this region. The factory procures sugarcane from thousands of farmers across its command area and significantly contributes to rural employment, farmers' income, and industrial development. The economic performance of such sugar mills directly affects the livelihood of sugarcane growers, transport operators, factory employees, and numerous ancillary industries associated with sugar production.

Despite its considerable economic significance, the sugar industry faces numerous challenges arising from rising production costs, fluctuating sugar prices, climatic variability, delayed cane payments, changing government policies, and increasing competition from alternative sweeteners. The profitability of sugar factories largely depends upon the delicate balance between sugarcane procurement prices and the realization from sugar sales. In India, sugarcane prices are generally determined through the Fair and Remunerative Price (FRP) announced by the Government of India, while some states prescribe higher State Advised Prices (SAP). In contrast, sugar prices are largely influenced by market demand and supply conditions, export-import policies, domestic consumption, and international market trends. This mismatch between administered input prices and market-determined output prices often creates financial stress for sugar mills.

The cost of manufacturing sugar is predominantly influenced by the price paid for sugarcane, which generally accounts for nearly 70–75 percent of the total production cost. Other cost components include labour wages, fuel, electricity, chemicals, maintenance, transportation, depreciation, administrative expenses, and interest charges. Although technological improvements have reduced processing costs in many modern sugar factories, rising sugarcane procurement costs continue to exert upward pressure on the overall cost of production. Consequently, even small increases in cane prices significantly affect the profitability of sugar mills.

Another critical determinant of economic performance is sugar recovery percentage, which measures the amount of sugar extracted from a given quantity of sugarcane. Recovery is influenced by several agronomic and technological factors, including sugarcane variety, maturity, climatic conditions, harvesting practices, transportation time, milling efficiency, and factory operational management. Higher recovery percentages increase sugar output without requiring additional sugarcane, thereby reducing the production cost per tonne of sugar. Conversely, lower recovery leads to higher raw material consumption and reduced profitability. Therefore, improving recovery efficiency has become one of the primary objectives of modern sugar factories.

The efficient utilization of sugar industry by-products also plays an increasingly important role in improving economic viability. Bagasse, molasses, and press mud, once considered waste materials, have become valuable commercial products. Bagasse is widely utilized for cogeneration of electricity and manufacture of paper and fibre boards. Molasses serves as the principal raw material for ethanol, industrial alcohol, potable spirits, and several chemical industries. Press mud is increasingly used in the production of organic manure, bio-fertilizers, and compost. Revenue generated from these by-products provides an important supplementary income source that can partially offset fluctuations in sugar prices and improve the overall profitability of sugar factories.

Economic evaluation of sugar manufacturing requires a comprehensive assessment of production costs, revenue generation, profitability, and operational efficiency. Cost–profit analysis enables researchers and policymakers to understand the financial performance of sugar factories under varying production and market conditions. Such analysis identifies major cost components, evaluates production efficiency, estimates profit margins, and highlights opportunities for improving competitiveness. Furthermore, it provides valuable information for factory management, investors, policymakers, and farmers regarding resource allocation, pricing policies, technological modernization, and long-term planning.

Several studies have examined different dimensions of the sugar industry, including production economics, sugarcane cultivation, productivity analysis, efficiency measurement, sugar price fluctuations, and utilization of by-products. However, relatively fewer studies have undertaken a detailed factory-level cost–profit analysis integrating production costs, profitability indicators, and recovery performance over an extended period. Such micro-level studies are particularly important because they capture the actual operational conditions experienced by individual sugar factories and provide practical recommendations for improving financial performance.

The present study has been undertaken to evaluate the economic performance of sugar manufacturing during the period **2009–10 to 2018–19**. The study analyses trends in sugarcane crushing, sugar production, production cost, ex-mill sugar price, revenue, profit, profit margins, and sugar recovery. It also examines the distribution of sugar losses through molasses, bagasse, press mud, and other processing stages to assess factory efficiency. By integrating cost analysis with operational performance indicators, the study provides a comprehensive understanding of the factors influencing the profitability of sugar production.

The findings of this study are expected to contribute to the existing literature on sugar industry economics by providing empirical evidence from one of Karnataka's important sugar-producing regions. The results will be useful for sugar factory managers in identifying opportunities for cost reduction and operational improvement, for policymakers in formulating appropriate pricing and support policies, and for sugarcane farmers in understanding the economic factors affecting factory performance and cane procurement. Furthermore, the study highlights the importance of technological modernization, improved sugar recovery, efficient utilization of by-products, and effective cost management for ensuring the long-term sustainability and competitiveness of the sugar industry in Karnataka and India.

II. OBJECTIVES

1. **To analyze the production cost structure of sugar** at Coromandel Sugars Limited, K.R. Pete, by examining trends in sugarcane procurement cost, conversion cost, and total production cost during the period 2009–10 to 2018–19.
2. **To evaluate the profitability of sugar production** by assessing production cost, ex-mill sugar prices, gross revenue, profit/loss, and profit margins over the study period.
3. **To examine the operational efficiency of sugar production** by analyzing sugar recovery percentage, processing losses (molasses, bagasse, press mud, and undetermined losses), and their impact on the cost and profitability of sugar production.

III. METHODOLOGY

The study is based on secondary data collected from the annual reports and production records of the selected sugar factory for the period **2009–10 to 2018–19**.The present study is based on a case study approach to evaluate the cost and profitability of sugar production a**t** Coromandel Sugars Limited, K.R. Pete, Karnataka**.** Information relating to sugarcane crushed, sugar production, sugarcane procurement price, cane cost, conversion cost, production cost, ex-mill sugar price, gross revenue, profit/loss, sugar recovery percentage, and sugar losses was compiled from the factory's official records and published reports. Additional information on the sugar industry was obtained from reports of the Government of India, the Directorate of Sugar, and relevant research publications.

The collected data were organized into suitable tables and analyzed using descriptive statistical techniques. Statistical measures such as mean, standard deviation (SD), coefficient of variation (CV), and compound annual growth rate (CAGR) were employed to examine trends, variability, and growth in production cost, profitability, and operational efficiency. Cost analysis was carried out by estimating cane cost, conversion cost, total production cost, gross revenue, profit/loss, and profit margin per tonne of sugar. Operational efficiency was assessed using sugar recovery percentage and the distribution of sugar losses through molasses, bagasse, press mud, and undetermined losses. The analyzed results were presented in tabular form and interpreted to assess the economic performance and profitability of sugar production at Coromandel Sugars Limited.

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IV. RESULT AND DISCUSSION

4.1 Brief Profile of India Cements Limited Sugar Division (Coromandel Sugars Limited), K.R. Pete

Coromandel Sugars Limited (CSL), originally established as ICL Sugars Limited in 1996, is an associate company of The India Cements Limited, one of India's prominent industrial conglomerates. The company commenced commercial sugar production in August 1999 and has since emerged as a significant agro-based enterprise in Karnataka's sugar industry. The manufacturing unit is located at Makavalli Village, about 10 kilometres from K.R. Pete in Mandya District, Karnataka. The factory serves a command area comprising nearly 150 villages in and around K.R. Pete Taluk, where sugarcane cultivation forms the primary source of raw material.

The plant began operations with an installed crushing capacity of 2,500 tonnes of cane per day (TCD), which was subsequently increased to 3,500 TCD to accommodate the growing availability of sugarcane in the region. The factory has since undergone substantial modernization and currently operates with a crushing capacity of 4,800 TCD. In addition, it has established a 30 MW multi-fuel cogeneration power plant, which utilizes bagasse and other fuels for electricity generation. After meeting the factory's internal energy

requirements, surplus power is supplied to the Karnataka Power Transmission Corporation Limited (KPTCL), thereby contributing to renewable energy generation and improving overall operational efficiency.

4.2. Economic Analysis of Sugar Production Costs and Profitability

The cost–profit analysis of sugar production at Coromandel Sugars Limited, K.R. Pete, during the period 2009–10 to 2018–19 provides a comprehensive understanding of the economic performance of sugar manufacturing under changing market and production conditions. The production of sugar is highly sensitive to fluctuations in sugarcane availability, procurement prices, recovery percentage, manufacturing efficiency, and ex-mill sugar prices. The results presented in Tables 1, 2, and 3 collectively illustrate the relationship between production cost, profitability, and process efficiency. The findings indicate that while the factory maintained consistent production throughout the study period, increasing sugarcane prices, declining recovery rates in certain years, and fluctuations in sugar prices significantly influenced overall profitability.

4.2.1. Production Cost of Sugar

Table 1 presents the annual production cost of sugar based on sugarcane crushed, procurement price, sugar produced, cane cost, conversion cost, and total production cost. During the study period, the quantity of sugarcane crushed varied substantially from 5.30 lakh tonnes in 2016–17 to 8.86 lakh tonnes in 2011–12, with an overall average of 6.92 lakh tonnes. This variation reflects differences in cane availability resulting from climatic conditions, irrigation facilities, varietal adoption, farmers' cropping decisions, and government policies affecting sugarcane cultivation. Higher cane availability generally enabled greater sugar production and improved capacity utilization of the factory.

Table 1.: Details of Production Cost of Sugar in Coromandel Sugars Limited, K R Pete during 2009-10 to 2018-19

Year	Quantity of Cane Crushed (Tonnes)	Price Per Tonne of cane (Rs.)	Total Cane cost (Lakhs)	Quantity of Sugar Produced (Tonne)	Cane Cost Per Tonne of Sugar (Rs)	Conversion Cost per Tonne of Sugar (Rs)	Production Cost Per Tonne of Sugar (Rs)	Total Production Cost (Lakhs)
	1	2	3=(1x2)/10^5	4	5=(3/ 4)	6	7=(5+6)	(8=7x4)
2009-10	6,32,300.00	1,950.00	12,329.85	63,735.00	19,345.49	520	19,865.49	12661.27
2010-11	7,59,300.00	1,900.00	14,426.70	76,520.00	18,853.50	500	19,353.50	14809.30
2011-12	8,86,325.00	2,000.00	17,726.50	85,450.00	20,744.88	515	21,259.88	18166.57
2012-13	6,85,900.00	2,400.00	16,461.60	65,455.00	25,149.49	590	25,739.49	16847.78
2013-14	6,73,500.00	2,650.00	17,847.75	66,000.00	27,042.05	594	27,636.05	18239.79
2014-15	7,54,200.00	2,200.00	16,592.40	72,150.00	22,997.09	590	23,587.09	17018.09
2015-16	6,99,300.00	2,300.00	16,083.90	67,350.00	23,881.07	590	24,471.07	16481.27
2016-17	5,30,000.00	2,520.00	13,356.00	47,950.00	27,854.01	600	28,454.01	13643.70
2017-18	5,63,400.00	2,550.00	14,366.70	51,400.00	27,950.78	620	28,570.78	14685.38
2018-19	7,38,600.00	2,613.00	19,299.62	71,650.00	26,935.96	640	27,575.96	19758.18
Total	**69,22,825.00**	**23,083.00**	**1,58,491.02**	**6,67,660.00**	**2,40,754.33**	**5,759.00**	**2,46,513.33**	**1,62,311.32**
Mean	**6,92,282.50**	**2,308.30**	**15,849.10**	**66,766.00**	**24,075.43**	**575.90**	**24,651.33**	**16,231.13**
S D	**1,02,799.64**	**283.47**	**2,191.64**	**11,050.70**	**3,485.96**	**47.32**	**3,529.35**	**2,239.36**

Source: Compiled from the data collected at the sugar factory during field visit

The average procurement price of sugarcane during the study period was Rs. 2,308.30 per tonne, increasing steadily from around Rs. 1,900–1,950 per tonne in the initial years to Rs. 2,613 per tonne by 2018–

19. This continuous increase reflects periodic revisions in Fair and Remunerative Price (FRP), State Advised Price (SAP), rising labour costs, and increased cultivation expenses. Since sugarcane accounts for nearly three-fourths of the total manufacturing cost, any increase in cane price immediately raises the cost of sugar production. Consequently, sugar factories have limited flexibility to reduce production costs unless they improve operational efficiency or enhance sugar recovery.

The average cane cost per tonne of sugar produced was Rs. 24,075.43, whereas the average conversion cost amounted to only Rs. 575.90 per tonne. This clearly indicates that raw material cost dominates the total cost structure of sugar manufacturing, while processing expenses such as labour, fuel, chemicals, maintenance, electricity, and administrative overheads contribute only a relatively small proportion. The low conversion cost also suggests that the factory maintained satisfactory operational efficiency in terms of processing expenditure.

The total production cost per tonne of sugar averaged Rs. 24,651.33 over the study period. The lowest production cost (Rs. 19,353.50 per tonne) was recorded during 2010–11, primarily because of relatively lower cane prices and efficient sugar recovery. In contrast, the highest production cost (Rs. 28,570.78 per tonne) occurred during 2017–18, despite only a moderate increase in conversion cost. The increase was mainly driven by higher sugarcane procurement prices and comparatively lower sugar recovery, which required more cane to produce one tonne of sugar. Similar increases were also observed during 2016–17 and 2018–19, where production costs exceeded Rs. 27,500 per tonne.

The annual total production cost increased from Rs. 12,661.27 lakh in 2009–10 to Rs. 19,758.18 lakh in 2018–19, with an average annual expenditure of Rs. 16,231.13 lakh. The standard deviation of Rs. 2,239.36 lakh indicates moderate variability in annual production expenditure, whereas the standard deviation of Rs. 3,529.35 for production cost per tonne demonstrates considerable year-to-year fluctuations in manufacturing cost. These results confirm that production cost remained highly sensitive to fluctuations in sugarcane procurement prices and recovery performance.

4.2.2. Profitability of Sugar Production

The profitability analysis presented in Table 2 reveals considerable variation in financial performance across the study period. The average ex-mill price of sugar was Rs. 29,244.90 per tonne, while the average production cost remained Rs. 24,651.33 per tonne, resulting in an average net profit of Rs. 4,593.57 per tonne. Thus, the sugar factory earned a positive margin on average; however, annual profits fluctuated widely because sugar prices are largely market-driven whereas cane prices are determined by government policy and remain relatively rigid.

Table 3.: Details of Cost-profit of Sugar Production in Coromandel Sugar Ltd, K. R. Pete during 2009-10 to 2018-19

Year	Quantity of Sugar Produced (Tonnes)	Product Cost per Tonne of Sugar (Rs)	Ex-mill Price per Tonne of Sugar (Rs)	Profit per Tonne of Sugar (Rs)	Total Production Cost of Sugar (Lakhs)	Total Gross Revenue of Sugar (Lakhs)	Total Profit/Loss of Sugar (Lakhs)	Profit/ Loss Margin (%)
	1	**2**	**3**	**4=(3-2)**	**5=(1x2)/10^5**	**6=(1x3)/10^5**	**7=(6-5)**	**8=(7/6) x100**
2009-10	63,735.00	19,865.49	28,745.00	8,879.51	12,661.27	18,320.63	5,659.35	30.89
2010-11	76,520.00	19,353.50	25,134.00	5,780.50	14,809.30	19,232.54	4,423.24	23.00
2011-12	85,450.00	21,259.88	26,196.00	4,936.12	18,166.57	22,384.48	4,217.91	18.84
2012-13	65,455.00	25,739.49	30,774.00	5,034.51	16,847.78	20,143.12	3,295.34	16.36
2013-14	66,000.00	27,636.05	27,572.00	-64.05	18,239.79	18,197.52	-42.27	-0.23
2014-15	72,150.00	23,587.09	27,714.00	4,126.91	17,018.09	19,995.65	2,977.57	14.89
2015-16	67,350.00	24,471.07	25,610.00	1,138.93	16,481.27	17,248.34	767.07	4.45
2016-17	47,950.00	28,454.01	34,597.00	6,142.99	13,643.70	16,589.26	2,945.56	17.76
2017-18	51,400.00	28,570.78	35,541.00	6,970.22	14,685.38	18,268.07	3,582.69	19.61
2018-19	71,650.00	27,575.96	30,566.00	2,990.04	19,758.18	21,900.54	2,142.36	9.78
Total	**6,67,660.00**	**2,46,513.33**	**2,92,449.00**	**45,935.67**	**1,62,311.32**	**1,92,280.15**	**29,968.82**	**155.35**

Mean	**66,766.00**	**24,651.33**	**29,244.90**	**4,593.57**	**16,231.13**	**19,228.01**	**2,996.88**	**15.53**
S D	**11,050.70**	**3,529.35**	**3,608.16**	**2,678.22**	**2,239.36**	**1,892.13**	**1,699.29**	**9.00**
C V (%)	**16.55**	**14.32**	**12.34**	**58.30**	**13.80**	**9.84**	**56.70**	**57.96**
CAGR (%)	**1.31**	**3.71**	**0.68**	**-11.39**	**5.07**	**2.00**	**-10.23**	**-11.99**

Source: Compiled from the data collected at the sugar factory during field visit

The highest profit per tonne of sugar (Rs. 8,879.51) was achieved during 2009–10, when production costs were relatively low while sugar prices remained favourable at Rs. 28,745 per tonne. This year also recorded the highest annual profit margin of 30.89 percent, indicating an exceptionally profitable season for the factory. Similarly, 2016–17 and 2017–18 recorded profits of Rs. 6,142.99 and Rs. 6,970.22 per tonne, respectively, due to a sharp increase in ex-mill sugar prices to Rs. 34,597 and Rs. 35,541 per tonne. Although production costs were high during these years, the substantial rise in market prices more than compensated for increased manufacturing expenses.

In contrast, profitability declined considerably during 2011–12, 2012–13, and 2015–16, mainly because production costs increased faster than selling prices. The most critical year was 2013–14, when the ex-mill sugar price (Rs. 27,572 per tonne) fell marginally below the production cost (Rs. 27,636.05 per tonne). Consequently, the factory incurred a loss of Rs. 64.05 per tonne, resulting in an overall annual loss of Rs. 42.27 lakh and a negative profit margin of –0.23 percent. This result clearly demonstrates the vulnerability of sugar factories when procurement prices remain high but sugar market prices stagnate or decline.

The total gross revenue generated from sugar sales averaged Rs. 19,228.01 lakh annually, while the average annual profit amounted to Rs. 2,996.88 lakh. The average profit margin of 15.53 percent indicates that sugar production remained economically viable during most years. However, the coefficient of variation for profit (58.30 percent) and profit margin (57.96 percent) indicates extremely high variability in financial returns. Such variability reflects the cyclical nature of the sugar industry, where profitability depends not only on production efficiency but also on market demand, export opportunities, international sugar prices, government trade policies, and inventory levels.

The Compound Annual Growth Rate (CAGR) analysis provides additional evidence regarding long-term trends. Production cost increased annually by 5.07 percent, whereas gross revenue increased by only 2.00 percent. Consequently, total profit declined at –10.23 percent per annum, and profit margin decreased by –11.99 percent annually. These results indicate that production costs increased at a much faster rate than revenue, thereby reducing the long-term profitability of sugar manufacturing. Unless productivity improves or market prices increase proportionately, the financial sustainability of sugar mills may become increasingly difficult.

4.2.3. Sugar Recovery and Manufacturing Efficiency

Sugar recovery is one of the most important indicators of factory efficiency because it determines the quantity of sugar produced from a given quantity of sugarcane. Table 3 shows that the average sugar recovery during the study period was 9.62 percent, indicating that approximately 9.62 kg of sugar was extracted from every 100 kg of sugarcane. Recovery remained above 10 percent during the first two years but gradually declined thereafter, reaching the lowest level of 9.05 percent in 2016–17 before recovering to 9.70 percent during 2018–19.

Table 3.: Sugar losses in different by-products in Coromandel Sugars Limited, K R Pete Taluk during 2009-10 to 2018-19

Year	Recovery of Sugar (%)	Percent of Sugar losses (%)					Sugar Content in the Cane (%)
		Molasses	Bagasse	Press mud	Un-determined	Total Sugar Loss (%)	
	1	2	3	4	5	6= (2+3+4+5)	7=(1+6)
2009-10	10.08	1.10	0.40	0.04	0.23	1.77	11.85
2010-11	10.08	1.14	0.40	0.04	0.21	1.79	11.87
2011-12	9.64	1.24	0.50	0.08	0.24	2.05	11.69

2012-13	9.54	1.27	0.48	0.09	0.21	2.05	11.59
2013-14	9.80	1.25	0.49	0.09	0.20	2.03	11.82
2014-15	9.57	1.27	0.50	0.04	0.23	2.04	11.61
2015-16	9.63	1.36	0.52	0.04	0.20	2.12	11.75
2016-17	9.05	1.36	0.54	0.06	0.23	2.19	11.24
2017-18	9.12	1.32	0.50	0.05	0.21	2.08	11.20
2018-19	9.70	1.36	0.52	0.05	0.21	2.14	11.84
Mean	**9.62**	**1.27**	**0.49**	**0.06**	**0.22**	**2.03**	**11.65**

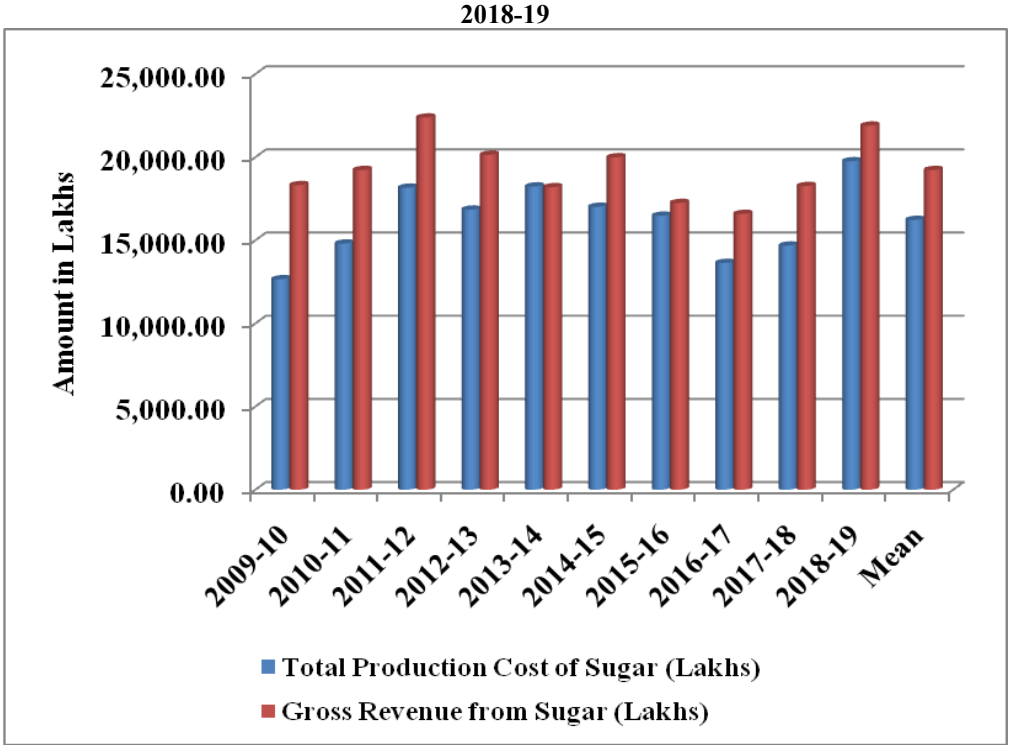
Source: Chief chemist, Coromandel Sugar Factory

The reduction in sugar recovery during certain years may be attributed to several factors including lower sucrose content in cane, delayed harvesting, prolonged transportation time between field and factory, varietal differences, climatic stress, and operational inefficiencies during crushing. Lower recovery directly increases production cost because more sugarcane is required to produce one tonne of sugar. This relationship is evident in Table 1, where years with relatively lower recovery also exhibited higher cane cost per tonne of sugar and higher production cost.

The average sugar content in sugarcane was 11.65 percent, indicating that nearly 2.03 percent of recoverable sugar was lost during processing. Among various by-products, molasses accounted for the largest sugar loss (1.27 percent), followed by bagasse (0.49 percent), undetermined losses (0.22 percent), and press mud (0.06 percent). Since molasses retained the highest proportion of unrecovered sugar, improving crystallization efficiency and optimizing boiling house operations could substantially enhance sugar recovery. Similarly, reducing losses through bagasse by improving milling efficiency and juice extraction would increase overall factory performance.

Total sugar losses increased gradually from 1.77 percent in 2009–10 to 2.14 percent in 2018–19, indicating a slight deterioration in extraction efficiency over the study period. Although the increase appears small, even a marginal improvement of 0.10–0.20 percent in sugar recovery can generate significant additional revenue for a large sugar factory processing several lakh tonnes of cane annually. Therefore, continuous monitoring of process losses is essential for maintaining competitiveness in the sugar industry.

Fig 1.: Total Production Cost of Sugar v/s Gross Revenue from Sugar in CSL Factory during 2009-10 to 2018-19



From **fig. 1,** it was clear that the gross revenue from sugar was higher than the production cost of sugar throughout the ten years of study except in the year 2013-14. The loss during the year 2013-14 was due to the huge increase in the price of sugarcane to 2650 rupees. Since cane makes major portion of production cost its FRP greatly affect the profit/loss of sugar production.

4.2.4. Integrated Economic Interpretation

The combined analysis of production cost, profitability, and sugar recovery demonstrates that the economic performance of Coromandel Sugars Limited was primarily governed by three interrelated factors: (i) sugarcane procurement price, (ii) sugar recovery percentage, and (iii) ex-mill sugar price. Among these, sugarcane cost emerged as the single largest determinant of production expenditure. While the factory had limited control over cane prices due to government regulations, it could improve profitability by increasing recovery percentage, reducing processing losses, enhancing operational efficiency, and maximizing the utilization of by-products such as bagasse, molasses, and press mud.

The study also reveals that years characterized by higher recovery and favourable sugar prices generated substantially greater profits even when production costs were relatively high. Conversely, unfavourable market prices combined with rising cane costs quickly eroded profitability, as observed during 2013–14. This finding highlights the importance of integrating technological improvements with effective marketing strategies and policy support.

From a managerial perspective, the results suggest that investment in modern milling equipment, automation, improved clarification systems, efficient crystallization technology, and better cane quality management can significantly reduce production cost per tonne of sugar. Strengthening farmer extension services to encourage high-sucrose varieties, timely harvesting, and rapid cane transportation can further improve recovery. Additionally, diversification into value-added products such as ethanol, cogenerated power, industrial alcohol, bio-fertilizers, and specialty chemicals derived from molasses and bagasse would provide additional income streams and reduce dependence on fluctuating sugar prices.

Overall, the findings demonstrate that although Coromandel Sugars Limited maintained positive profitability during most of the study period, the long-term trend indicates increasing production costs and declining profit growth. Sustainable profitability therefore requires continuous improvements in sugar recovery, efficient cost management, technological modernization, and effective utilization of by-products, together with supportive government pricing policies and stable market conditions. These measures will enhance the economic resilience and long-term competitiveness of the sugar industry in Karnataka and India as a whole.

V. CONCLUSION:

The findings demonstrate that the profitability of Coromandel Sugars Limited was primarily influenced by three interrelated factors: the cost of sugarcane procurement, the ex-mill price of sugar, and sugar recovery efficiency. Rising sugarcane prices continuously increased production costs, while fluctuations in sugar prices created uncertainty in revenue generation. Although improvements in market prices during some years offset the higher production costs, the long-term decline in profit growth suggests increasing financial pressure on the sugar industry.

Furthermore, the results emphasize the importance of enhancing factory efficiency through better cane quality management, improved recovery rates, reduction in processing losses, modernization of milling operations, and effective utilization of by-products such as bagasse, molasses, and press mud. These measures would help reduce production costs, improve operational efficiency, and stabilize profitability. Overall, the study concludes that sustainable profitability in the sugar industry depends not only on favourable market prices but also on efficient resource utilization, technological advancement, and effective cost management throughout the production process.

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