

The Sweet Revolution: Transformations in India's Sugar Sector

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Abstract

Over the past five years, the sugar sector in India has seen a revolution because of increased efficiency, sustainability, competitiveness, and technical advancement. The paper examines how sugar business in India has changed over the last five years. This study uses secondary data sources gathered from government websites, publications, journals, and newspapers to review pertinent literature. It explores the significant changes in the sector, including the adoption of contemporary technology, heightened rivalry, governmental initiatives, and progress toward a sustainable future. The impact of these changes on the industry, including increased production efficiency, decreased prices, and higher-quality products, is also examined in the study. The final section of the study explores how government regulations help to promote biofuel production and stabilize the business. Changes in the structure of consumption, as characterized by rising demand from the food industry and a larger role in bioethanol production, are the main drivers impacting the expansion of the sugar market. It examines adjustments to production and exports and highlights significant advancements in the industry.

Keywords: sugar industry, biofuel, sustainable development, ethanol

I. Introduction

India's sugar industry is one of the biggest and most significant in the world. India has surpassed Brazil to become the world's greatest producer and consumer of sugar and second-largest exporter of sugar, according to the Ministry of Consumer Affairs, food, and Public Distribution.

It is categorized as a Kharif crop, one that needs a hot, muggy atmosphere as well as soil that can hold moisture. Three divisional belts - the Sutlej Ganga plain, the black earth belt, as well as the coastal Andhra and Krishna valleys - are used for the cultivation of sugarcane. With the advent of contemporary technology and the appearance of new companies, the industry has seen a significant transition in recent decades. The Food and Agriculture Organization predicted that India will produce around 33.7 million tons of sugar in 2019–20, an increase of about 3.2 percent over the previous year. India produced 35.8 million tons of sugar during the marketing year 2021-2022. It is anticipated to reach 36.5 million tons in the marketing year 2022-2023.

In the 2022 marketing year, Maharashtra overtook Uttar Pradesh as the state with the most sugar output in India. The state with the second-highest number of sugar mills is thought to be Uttar Pradesh. Maharashtra is thought to be the first state with the most sugar mills, and it has 155 of them. 195 mills are present. Most of the sugarcane in the nation is grown in Uttar Pradesh, which Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Gujarat, Bihar, Haryana, and Punjab follow. The significant developments in the Indian sugar business and their effects will be examined in this essay.

Background

The sugar industry in India has a lengthy history dating back to the 16th century. The Portuguese were the ones who initially brought the sugar-making process to India. At that time, most of the nation's southern and western areas were the only ones that produced sugar. In the 18th century, the British colonized India and built enormous sugar refineries throughout the country. Unfounded rumors state that about 1824, the French established the first sugar mill in Odisha. The first complex sugar processing enterprise was created in 1904 with the construction of the first Hoover pan processing facility in Saran, Bihar (Mishra, 2018). There was a lot of room for improvement in the industry's performance at that point.

The Indian government has implemented several policies and initiatives to support the industry, such as the Sugarcane Price Control Order of 1964 and the National Sugar Policy of 2006. These policies have helped to stabilize the industry and promote the growth of the sector. By the 19th century, India's sugar industry had developed into one of the most prominent in the country.

The sugar business is one of India's oldest industries and an important economic driver. It is the largest sugar producer in the world. India is the nation where sugarcane is grown on the largest amount of land. In the nation, there are about 6000 sugar mills, 507 of which are operational, and over 1.2 million people are employed overall. In India, where these kinds of producers dominate the market, most sugar mills are owned by small-scale farmers and cooperatives. As large players, such as multinational firms, have progressively joined the market over time, the dynamics of the sector have changed.

II. Literature Review

In recent years, several studies have been conducted to explore the transformation of the Indian sugar industry. The Literature Review is stated below-

Kumar & Singh (2014) studied the impact of the transformation of the sugar industry on the profitability of the industry. The study found that the introduction of new business models had led to increased competition and better pricing for consumers, resulting in higher profits for the industry.

Eggleston, G. & Lima I. (2015), in their research paper, identified Sustainability Issues and Opportunities in the Sugar and Sugar-Bioproduct Industries: The worldwide shift from a fossil-fuel-based to a biobased economy is expected to entail a significant quantity of biomass from sugar crops. However, most of this transition is still in its early phases. The cost of the facility, the availability of reliable quality feedstocks at reasonable costs, financing possibilities, and the regulatory environment are all essential considerations in the development of commercial biobased operations. At the same time, the sugar industry is increasingly expanding into "sugar and sugar-bioproduct industries" that are extensively involved in increasing the biomass of the sugar crop in various regions of the world.

Malik (2017) studied the impact of technological advancements on the industry and concluded that new technologies have enabled the industry to become more efficient and reduce costs.

Mohan, N. & Kanaujia, A. (2019) Biomass Energy for Economic and Environmental Sustainability in India: The development of sugarcane bio-refineries, such as those for bio-electricity, bioethanol, bio-manure, and chemicals, etc., is crucial for the future of the sugar industry as a whole. By generating value addition, ensuring the country's energy security, and addressing environmental challenges, the sugar sector may be a possible source of delivering renewable, clean, and green bioenergy for the industry's benefit.

Sharma et al. (2019) analyzed the impact of increased competition on the industry and found that it has led to a reduction in prices and improved the quality of products.

Kumar (2020) evaluated the role of government policies in the industry and concluded that these policies have helped to stabilize the industry and promote the growth of the sector.

Solomon, S., & Swapna, M. (2022) Indian Sugar Industry: Towards Self-reliance for Sustainability: Innovative technology interventions for sugarcane development, production, and management have aided the industry's transition to a more diverse and bio-based productive, sustainable, and lucrative model, allowing it to progressively become self-sufficient. With the correct combination of links and partnerships, this self-sufficient sector has been effective in addressing numerous unanticipated obstacles, including those that arose during the COVID-19 epidemic.

Objectives of Study

1. The objective of this paper is to explore the transformation of the Indian Sugar industry in the past 5 years and to analyze the impact of these transformations on the industry.
2. The paper also examines the role of government policies in stabilizing the industry and promoting the growth of the sector towards sustainable development.

III. Research Methodology

This paper will use a qualitative approach for content analysis to analyze the transformation of the Indian sugar industry. The research methodology will involve a review of relevant literature, such as academic articles, newspaper articles, and government reports.

Data Source: Secondary Data is Collected from Government websites, articles, Journals, and Newspapers.

Research Tools: Average, Percentage through MS Excel.

IV. Results And Findings of the Study

Transformation of the Sugar Industry

The sugar industry in India has undergone a significant transformation in the past few years. This transformation has been driven by technological advancements, increased competition, and government policies.

A) Technological Advancements: With the advent of new technology, the sector has grown more efficient. Automation has increased manufacturing productivity, and new technologies have allowed the sector to cut prices. The application of current technology has helped the sector to boost production while decreasing waste.

The following table represents technological changes in the Indian sugar industry in the last five years:

Table 1: Shows technological changes over the year.

Year	Description
2015	Introduction of energy recovery systems to reduce energy consumption.
2016	Automation of sugar production processes and adoption of energy-efficient technologies.
2017	Implementation of advanced energy management systems and adoption of renewable and sustainable energy sources.
2018	Introduction of evaporators with multiple effect concentration (MEC) technology and use of membranes to separate sucrose from other impurities.
2019	Implementation of advanced analytics and optimization techniques to improve production planning and process control.
2020	Use of Artificial Intelligence (AI) and Machine Learning (ML) to improve decision-making and optimize production.
2021	Use of digital technologies such as Blockchain, Internet of Things (IoT), and Cloud Computing to facilitate data exchange and improve traceability.

B) Increased Competition: The rise of new industry competitors has intensified competitiveness. This has resulted in lower pricing and higher product quality. As firms attempt to remain competitive, competition has also helped the sector to become more efficient.

Table 2: Increase in the number of Sugar Mills

Year	Mills Operated
2015	526
2016	493
2017	525
2018	532
2019	461
2020	506
2021	***

Source: IndiaStat

*** Data was not available

The above tables show that the total number of mills operating fluctuated between 461 to 526 from the year 2015 to 2021. From the year 2019 to 2020, there has been a significant increase in mills being operated from 461 mills to 506 mills respectively. This clearly shows that there has been a 9.7% growth in mills being operated in 2020.

C) Government Policies: To assist the sector, the government has developed a variety of programs and initiatives. These regulations have contributed to the industry's stabilization and expansion.

Table 3: Various Government policies implemented till now-

GOVERNMENT POLICIES	DESCRIPTION
Price Support Scheme (PSS)	Providing financial assistance to Sugar mills in the form of loan waivers and subsidized loans.
Sugar Development Fund (SDF), 1982	Providing funds to sugar mills for research and development activities.
Rastriya Krishi Vikas Yojana (RKVY)	Providing financial assistance to farmers in the form of subsidized loans and loan waivers.
National Policy on Biofuels (2018)	It mandates the use of 10% ethanol-blended petrol in India by the year 2022 and 20% by the year 2025.
National Biofuel Coordination Committee (NBCC)	Being responsible for the coordination and monitoring of the implementation of policies and regulations related to the production and use of biofuels.

Changes after the Implementation of the Policy

Government initiatives in India's sugar sector have had a good influence. It has enhanced farmer returns, increased industrial efficiency and output, and reduced reliance on imported petroleum products. These laws have allowed the sector to become more competitive and resilient, while also promoting a sustainable and lucrative environment for farmers and businesses alike. The government has mandated that oil firms mix a certain quantity of ethanol into gasoline. Sugarcane prices have risen because of increasing demand for ethanol, which is generated from sugarcane, and farmers are now earning larger returns. Furthermore, to stimulate the production of ethanol from sugarcane, the government has provided many subsidies, tax rebates, and power discounts. This has contributed to decreased production costs and increased profitability in the sugar sector. Sugarcane MSP has grown by 20%. The government mandates that 10% of ethanol be mixed with gasoline.

Impact of Transformation

The sector has been significantly impacted by the Indian sugar industry's restructuring. The sector has enhanced output and cut expenses, making it more efficient. Prices have decreased and product quality has improved as a result of increasing competition. The government's measures have also assisted in promoting sector growth and stabilizing the industry.

a) Technological Changes:

India's sugar industry has benefited from several technical developments in recent years. These developments have had a substantial effect on the industry's success. The largest changes are the adoption of new production techniques and the installation of new gear and equipment. With the introduction of mechanized harvesting and hauling equipment, cane harvesting has accelerated and increased in output.

To increase yields and reduce costs, new cane cultivars have also been developed. There are around 116 improved sugarcane varieties in India, thanks to the All India Coordinated Research Project's (AICRP) well-organized network. About 60 of these cultivars have received approval for commercial cultivation since 2000. All of them were created by Indian experts, and several variations of them are cultivated over huge territories. The most important technical advancement in the field has been brought about by the adoption of new manufacturing techniques.

The use of Continuous Diffusion and Sugar Syrup Clarification technologies has enabled higher sugar recovery rates, improved productivity, and higher product quality. Accuracy and efficiency have also increased with the development of automated technology for managing sugar production.

Increased yields and lower costs are now possible thanks to the advent of new manufacturing methods and technology.

b) Management Changes:

In India, there have been several changes in the sugar industry's management. The two main changes are the introduction of corporate governance and the reorganization of the industry. The advent of corporate governance has allowed the industry to become more organized and productive.

However, the reorganization of the sector has allowed for more specialization and consolidation, which has increased efficiency and profitability.

Current Scenario

- **Production:** Sugar output in India has expanded from 20 million tonnes in 2000 to 30-32 million tonnes by 2020.
- **Exports:** India's sugar exports have climbed from 2.5 million tonnes in 2000 to 4.5 million tonnes in 2020.
- **Consumption:** Sugar consumption in India has risen from 18 million tonnes in 2000 to 25 million tonnes by 2020.
- Sugar sector is now self-sufficient with no subsidy.
- In the current season, more than 5000 Lakh Metric Tons (LMT) of sugarcane were produced in India, with around 3574 LMT being exported. (Sucrose), of which 36 LMT was used to manufacture ethanol, while sugar mills produced 359 LMT.

- **Prices:** Sugar prices in India have fallen from Rs. 17 per kg in 2000 to Rs. 13.5 per kg in 2020, with the average expected to be in the range of Rs.28 to Rs.35 per kg in 2022.

“Sugar Industry and the “Agenda for Sustainable Development 2030”

All nations and stakeholders may follow the bold blueprint provided by the 2030 Agenda for Sustainable Development Goals (SDG 17) to strive toward a future of sustainable prosperity while also preserving the environment and leaving no one behind. Sustainability's social, economic, and environmental elements are all included. The sugar industry is gradually moving towards sustainability and self-reliance in order to capitalize on new opportunities brought about by changes in global sugar production and trade, as well as new options for renewable energy (ethanol, electricity, CNG), and bio-based products (bio-plastics, bio-chemicals, and wellness products) through the concept of bio-refineries. The industry has adopted the essential sustainability measures for all its major stakeholders, resources, environment, and product development through multiple Government departments, agencies, NGOs, CSR, and so on.

Table 4: India's Ethanol industry has a huge potential to grow in the next decades

PARTICULARS	INDIA
FY21 Ethanol production (bn litres)	3.5bn
FY30E Ethanol production Target (bn litres)	11.5bn
Cane diverted towards ethanol (%)	25%
Flex fuel Car penetration (% of total cars)	---

Source: Industry Reports, Systematix Institutional Research.

Until now, industrial-scale ethanol production in India has come from sugar manufacturers, which have been allowed to redirect it to other customers, such as alcohol producers, who pay considerably higher rates. The National Biofuel Policy was established in May 2018 to encourage the usage of biofuels (such as ethanol) throughout the country. It aims to expand biofuel availability by raising blending rates in gasoline from 2% to 20% by 2025 and diesel from 0.1% to 5.0% by 2030. As a result, sugar will serve as both a bio-energy source and a sweetener.

Table 5: Export- Import Data of Sugar Industries in India (2015-2020)

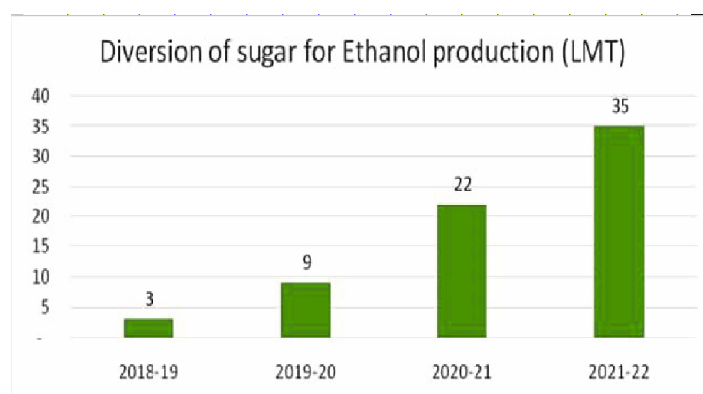
Sugar season/ Financial Year (Apr-Mar)	Export (Quantity in tonnes)	Import (Value in Rs/Crore)	Export (Quantity in tonnes)	Import (Value in Rs/Crore)
2015-16	3128275	9787.95	1600027	4011.03
2016-17	2538230	8621.61	2144429	6849.63
2017-18	1750724	5180.54	2401484	6017.22
2018-19	3977639	9451.57	1487677	3147.5
2019-20	5787322	13910.31	1114828	2441.95
2020-21	7506555	20577.09	1963233	4698.64
2021-22	10431275	34197.63	358431	1227.4
2022-23 (April-July) *	455282	16510.53	1451*	19.75

Source: DGCI&S, Kolkata

*Estimate

The data demonstrates that sugar exports have significantly increased during the past five years. This is most likely a result of rising molasses and sugar demand on the international market, as well as rising sugar industry production capacity in India. Sugar imports have somewhat dropped, most likely because of India's expanded production capability.

Figure 1: Diversion of Sugar for Ethanol production

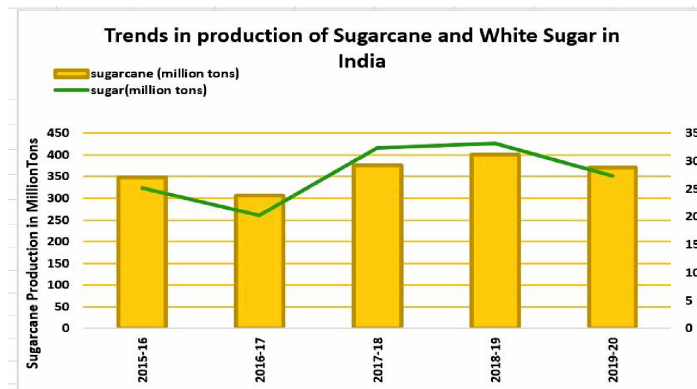


Source: Press Bureau of Information, Government of India.

From 2018 to 2021, the amount of sugar diverted to ethanol increased from 3 LMT to 35 LMT, bringing in money for sugar mills, as seen in

figure 1 above. To better their financial status and enable sugar mills to continue functioning, the government has urged companies to divert sugar to ethanol production and export extra sugar.

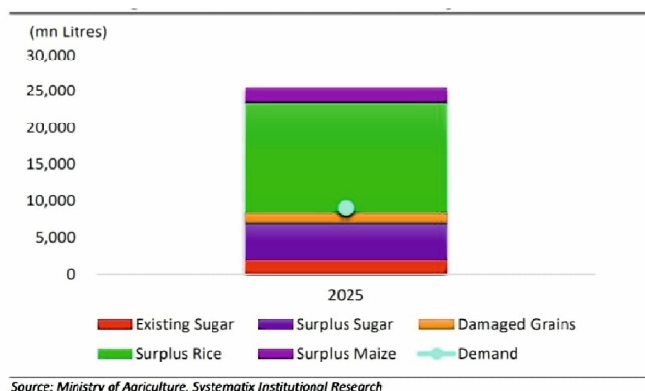
Figure 2: Production of sugarcane and white sugar.



Source: Ministry of Agriculture, Systematix Institutional Research

The information shows that between 2015 and 2019, there was a rise in the global output of white sugar. 2020 will see a modest decline in production as a result of the COVID-19 epidemic, which affected every sector. In terms of the production of white sugar and sugarcane, the sugar sector may be expected to rise on average.

Figure 3: Sufficient feedstock available to meet the 20% Ethanol blended target



Source: Ministry of Agriculture, Systematix Institutional Research

The government’s biofuel program is notably succeeding as it has attained the 10% ethanol production objective before the deadline of 2022, which would alleviate the problem of Surplus Sugar Stock. The sugar

industry has served as the face of Made in India due to the large sugarcane harvest and has the ability to set the standard for ethanol generation. The Indian government and the sugar industry are collaborating to reach their objective of mixing 20% ethanol into gasoline by 2025.

Since the use of sugar in ethanol has improved sugar mills' financial standing through quicker payments, lower working capital needs, and less cash blockage due to less surplus sugar with mills, the growth of ethanol as a biofuel over the past five years has been very beneficial to the sugar industry. The 20% blending goals set by the Ethanol Blending with Petrol (EBP) Program are still being reached, albeit more slowly. The aim of 20% ethanol by 2025 can be reached with the current cane supply.

According to the conclusions of this study, the advent of modern technology, greater competition, and government regulations have all contributed to the sector's development. The Indian Sugar Mills Association (ISMA) and other organizations initiated a GPS-based sugarcane crop area survey, which has made a significant contribution to the sugar business. ISMA has been using GPS to scan and estimate the sugarcane acreage since 2011. This makes physical involvement less necessary and enables a quicker, more precise examination. Before 2011, surveying the sugarcane region required a minimum of 4-5 workers. The portable GPS gadget could work with just one operator. The industry has benefited from this shift because of increased production efficiency, lower prices, and better product quality. The government's measures have also assisted in promoting sector growth and stabilizing the industry. Following India's national biofuel policy, sugarcane juice has just been approved in addition to molasses. The exploitation of excess sugarcane to make ethanol, the future of new energy generation, is made possible using sugarcane as a biofuel. With the government's continuing backing, it is anticipated that the industry will expand in the years to come.

V. Conclusion and Suggestions

Over the past few years, India's sugar business has seen a substantial transition. Government regulations, heightened competition, and technology breakthroughs have all fueled this transition. The government's measures have also assisted in promoting sector growth and stabilizing the industry.

Markets throughout the world are evolving as a result of ongoing efforts to boost productivity while seeking sustainable growth. As a result, the demand for all resources—including food, feed, and energy—has risen. India imports 83 percent of its oil needs, which costs roughly Rs. 120 billion (\$1.74 billion). Utilizing biofuels has advantages such as reducing reliance on imported crude oil, enhancing the environment, increasing farmer income, and creating jobs in rural regions. The effort promotes the Made in India, Swachh Bharat, and increasing farmer income programs of the Indian government. The sugar business is a great illustration of a developing sustainable system with many opportunities for self-sufficiency.

The government should concentrate on assisting cooperatives and small-scale producers to guarantee the sugar industry's sustained expansion in India. The government should also offer incentives to promote the industry's usage of cutting-edge technology like automation. Finally, the government should keep enforcing regulations to aid the sector and encourage its expansion.

VI. Future Scope of Research

This study looked at how the sugar industry in India has changed over the last five years and how those changes have affected the sector. Future studies should concentrate on certain facets of the business, such as how the government supports it, farmer dues, and how technology improvements affect it. Further investigation should be done to assess the effects of government policies on the industry as well as the effects of the epidemic.

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