



Artificial intelligence (AI) revolutionizing Indian food processing industry

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DOI: <https://doi.org/10.66856/ijcmr.2026.12.3.12234>

Abstract

The food processing sector has become a significant driver of India's economy in recent years. The sector has been contributing to poverty reduction in India by creating jobs, increasing the value of agricultural products, reducing food waste, and boosting exports. Since this industry is a labor-intensive one, it has the potential to create a large number of jobs, particularly in rural areas where poverty is high. Moreover, by processing raw agricultural products, the food processing sector is able to increase their value, resulting in higher returns for farmers and rural communities. Additionally, this sector has helped in reducing food waste by preserving surplus food and converting it into more shelf-stable products. AI plays a crucial role in the food processing industry by enhancing efficiency, quality control, and innovation. It optimizes production processes through predictive maintenance, reducing downtime and minimizing waste. The global AI market, valued at \$136.6 billion in 2022, is projected to reach \$1.81 trillion by 2030, growing at a CAGR of 38.1%. In food manufacturing, AI enhances efficiency by improving processing, packaging, and shelf life. It also reduces post-harvest losses, boosting profits for farmers and rural communities. This paper presents a food industries status and AI Influences.

Keywords: AI, food producing industry, gross value added, internet of things (IoT) and robotics

Introduction

India has emerged as the fastest growing major market for packaged food globally. The food processing industry is a cornerstone of the Indian economy, playing a pivotal role in its overall industrial landscape. It ranks as one of the largest and most influential sectors in the country, encompassing a wide array of activities from food manufacturing, packaging, preservation, and distribution to innovation in processing technologies. India's food processing sector is home to numerous leading companies that specialize in diverse product categories, including ready-to-eat meals, snacks, beverages, dairy, and confectionery. These companies are recognized for their substantial market presence, driving advancements in food safety, quality control, and supply chain efficiency, while significantly contributing to the sector's growth and development.

Recent trends in Artificial Intelligence (AI) include the rise of generative AI, increased adoption of AI in health-care, food processing finance, and manufacturing, and advancements in machine learning and natural language processing. AI's growth is driven by improved algorithms, better data access, and cloud computing, enabling more efficient, scalable, and innovative applications across industries. AI helps businesses stay competitive and meet evolving consumer needs more effectively.

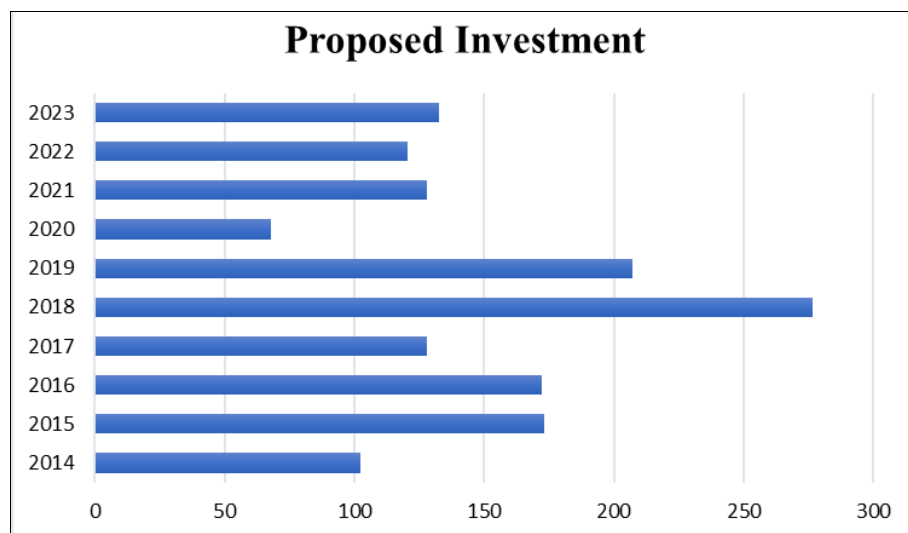
AI plays a crucial role in the food processing industry by enhancing efficiency, quality control, and innovation. It optimizes production processes through predictive maintenance, reducing downtime and minimizing waste. AI-driven technologies enable real-time monitoring for consistency and safety in food products, ensuring compliance with quality standards. Additionally, AI aids in supply chain optimization, demand forecasting, and personalized consumer experiences, fostering growth. Overall, AI's integration enhances productivity, reduces costs, and strengthens the industry's ability to meet consumer needs effectively.

Artificial Intelligence (AI)

In today's world including the food industry, technology advancement has improved very fast. Technology over the year have been changed from production to find our food through applications, robotics, data and processing techniques. The rise of Artificial Intelligence in the global market has been fueled by a growing demand for personalized and efficient solutions. Consumers are increasingly looking for AI-driven products and services. The global AI market was valued at \$136.6 billion in 2022 and is projected to reach \$1.81 trillion by 2030, growing at a compound annual growth rate (CAGR) of 38.1% from 2023 to 2030. According to a recent report from ING, technology helps food manufacturers produce more efficiently for a growing world population. By using tech to improve processing and packaging, it can improve the shelf life and safety of food. Post-harvest losses in agriculture are a key area where AI can greatly help in achieving economic quality assurance for the country's diversified and invalidate food production. Additionally, by processing raw agricultural products, the sector adds value, resulting in greater profits for farmers and rural communities.

Status of Food Processing Industry

The food processing sector has become a key contributor to India's economy in recent years. As one of the largest and fastest growing industries in the country, it holds immense potential to foster economic growth, generate employment, and boost exports. The sector plays a crucial role in poverty reduction by creating job opportunities, enhancing the value of agricultural products, minimizing food waste, and promoting exports. Being labor-intensive, it has the capacity to create numerous jobs, particularly in rural areas with high poverty levels, leading to increased income and improved living standards.



Source: www.statista.com

Fig 1: Proposed Investment Value in Food Processing Industries

Table 1: Gross Value Added (GVA) by Food Processing Industries

Year	Gross Value Added (GVA)					
	Manufacturing		Agriculture, Forestry and Fishery		Food Processing Industry	
	Constant Price (in Rs. Lakh Cr.)	Growth rate (%)	Constant Price (in Rs. Lakh Cr.)	Growth rate (%)	Constant Price (in Rs. Lakh Cr.)	Growth rate (%)
2013-14	15.61	17.22	16.09	17.75	1.3	0
2014-15	16.84	17.34	16.06	16.54	1.34	3.08
2015-16	19.04	18.15	16.16	15.4	1.61	20.15
2016-17	20.55	18.14	17.26	15.24	1.79	11.18
2017-18	22.09	18.36	18.4	15.29	1.93	7.82
2018-19	23.29	18.29	18.79	14.76	2.36	22.28
2019-20	22.60	17.07	19.94	15.07	1.96	-16.89
2020-21	23.29	18.36	20.74	16.35	1.96	0.22
2021-22	25.61	18.46	21.70	15.64	1.90	-3.46
2022-23	25.05	16.92	22.72	15.35	1.92	1.29

Source: Annual Report-2023-24, MOS Food Processing Industry.

Table 2: Employment in Food Processing Industry

Sectors	Employed Women		Employed Men		Total employment	
	Industry (In Lakh)	%	Industry (In Lakh)	%	Industry (In Lakh)	%
Registered	2.10	10.16	18.58	89.84	20.68	100
Un-registered	12.62	24.63	38.49	75.37	51.11	100

Source: Annual Report-2023-24, MOS Food Processing Industry.

The gross value addition in the food processing sector has increased from Rs. 1.34 lakh crore in 2014-15 to Rs 1.98 lakh crore in 2022-23. Food processing sector is the largest employment provider for the organized manufacturing segment providing employment to more than 20 lakh people. Out of which 2.10 lakh are women employed in FPI. Since 2014-15, the sector has attracted about US \$ 6.36 billion worth of Foreign Direct Investment till June 2023. The exports of processed food have increased from US \$ 4.9 billion in 2014-15 to over US \$ 13.01 billion in 2022-23 growing at a CAGR of 13%. India is blessed with various agro-climatic zones and thus we produce large quantities as well as diverse types of foods from cereals, pulses to fruits and vegetables to millets. India is the largest producer of pulses, millets and milk, 2nd largest producer of wheat, rice, ground nuts, fruits & vegetables. There exists a huge potential and immense opportunities for entrepreneurs, MSMEs, global companies to setup infrastructure to meet the increasing consumer demand.

Artificial intelligence in Food processing Industry

AI transforms food Industry significantly by adopting robotics automotive repetitive processes such as packing, sorting and processing. It helps food processing industry to enhance presentation and save operating cost. With the rise of Artificial Intelligence (AI) technology in India, consumers are increasingly looking for AI-powered solutions to enhance their daily lives and businesses. Artificial Intelligence (AI) in food processing marks a significant shift towards greater efficiency, safety, and sustainability in the food industry. AI technologies such as machine learning, computer vision, and robotics are being implemented throughout different stages of food processing to streamline production lines, improve quality control, and reduce waste. For example, AI-powered predictive maintenance can anticipate equipment malfunctions before they happen, minimizing downtime and ensuring smooth production. In terms of quality control, computer vision systems are employed to inspect and sort products with

unparalleled precision and speed, exceeding human capabilities.

AI in the food processing industry enhances efficiency, quality, and sustainability. AI-driven automation increases production speed and reduces costs, improving efficiency by up to 25% (McKinsey). According to Food Quality Assurance Survey AI-powered quality control systems achieve up to 99% accuracy in defect detection. AI improves supply chain management, reducing waste by up to 50% (FAO) and enhancing food safety by detecting anomalies faster. Additionally, AI optimizes resource use, reducing food waste by 30% (European Food Safety Authority). These advances contribute to higher productivity, lower costs, and reduced environmental impact.

Conclusion

Currently, India is processing less than 10% of its agricultural output, thus presenting immense opportunities for increasing processing level and leading to immense investment potential in this sector. To strengthen the processing infrastructure and value chain, reduce perishable wastage, and improve the global competitiveness of the food processing industry, an Inter Ministerial Committee was established. The committee aims to recommend strategies and measures to address the industry's concerns effectively. In conclusion, the food processing sector in India has immense potential for growth and sustainability. With an abundant supply of raw materials, increasing demand for food products, and the support of the government, the industry is expected to continue its rapid growth in the coming years. Overall, the food processing sector has the potential to be a major contributor to the Indian economy and to promote sustainability and inclusivity. One key trend in the AI in Food Processing market is the integration of AI with other emerging technologies, such as Internet of Things (IoT) and robotics. This integration allows for a more comprehensive and interconnected approach to food processing.

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