

Harnessing Food Processing Potential

Gujarat's Role in Achieving Viksit Bharat

October 2024

The Associated Chambers of Commerce and Industry of India



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Shri Bhupendrabhai Patel

Hon'ble Chief Minister of Gujarat



Bhupendra Patel

Chief Minister, Gujarat State

Dt. 07-10-2024

Message

India's food processing industry is an ever-growing sector, which considerably contributes to country's economy by adding value to agricultural produce, reducing wastage, creating jobs and raising farmers' income. This sector plays an important role in enhancing the efficiency of the agricultural supply chain and ensuring food security for the nation.

As a key state in India's agro-food processing industry, Gujarat benefits from abundant raw materials, diverse crops and a record agricultural output. The state offers significant opportunities to investors with extensive MSMEs in the sector and to their strong government support.

I am happy to learn that **ASSOCHAM Gujarat Council** is organizing **9th Food Processing Summit & Awards 2024** with a theme **"Transforming Food Processing Sector for Viksit Bharat"** on **17th October, 2024** in **Ahmedabad**. I hope, this summit play a significant role in cultivating collaboration, innovation and investment. The focus on key areas such as infrastructure, technology, skill development and financial access is timely and necessary to ensure that the sector continues to thrive for. I wish the event great success and look forward to go for the positive outcomes of the discussions and deliberations during the summit. I congratulate all the award winners and stakeholders for their bright future ahead.

(Bhupendra Patel)

To,

Shri Chintan Thaker

Chairman, ASSOCHAM Gujarat Council

608, 6th Floor, Sakar-3, Opp. Old High Court,
Income Tax Crossroads, Ashram Road, Ahmedabad-380014.

Email: vipul.bg@assocham.com

Mo: 8010472950

apro/ab/2024/10/07/rs



Dr. Anju Sharma, IAS

Additional Chief Secretary, Department of Agriculture,
Farmers Welfare & Co-operation, Government of Gujarat



Dr. Anju Sharma, IAS
Additional Chief Secretary

No. : 74/ACS Office/ Agsi/2024
Agriculture, Farmers Welfare &
Co-operation Department
Government of Gujarat
Sardar Bhavan, Block No. 5, 1st Floor,
New Sachivalaya, Gandhinagar-382010
Ph. : +91-79-232 50803
E-mail : secagri@gujarat.gov.in

Date : 08/10/2024

Message

India's food processing sector plays an important role in the global market. India has emerged as a major player in the global food processing industry, assuring food security and creating jobs in both rural and urban areas. India is also a major exporter of agricultural and allied products abroad.

Gujarat, renowned for its vibrant and innovative economic landscape, provides unmatched appropriates in the food processing industry. The state's strategic location, availability of natural resources, advanced infrastructure and well-established supply chains make it an eminently good choice for investment in this area. Gujarat ensures that the highest quality standards are met across the food processing value chain by providing modern cold storage facilities, cutting-edge packaging technologies and exceptional logistics infrastructure.

The state government has developed a highly favourable business environment by providing several incentives such as reduced land rates, tax breaks & assistance in obtaining required permits. Gujarat's vibrant entrepreneurial ecosystem, trained workforce and proactive policies for agriculture, horticulture, dairy development and animal husbandry have helped the state maintain its position as a food processing sector leader. Gujarat is a top contributor in India's overall exports & prominent participant in this arena.

I commend **ASSOCHAM Gujarat Council** for organizing the '9th Food Processing Summit 2024' with Focus on Infrastructure - Technology - Skill Development - Export - Finance in Ahmedabad. Such efforts provide a platform for stakeholders throughout the sector to exchange ideas, explore innovations and collaborate on achieving sustainable growth in food processing. I am sure that the summit will surely help to strengthen Gujarat's leadership in this industry and provide useful insights for future development.

I wish the event a wonderful success.


(Anju Sharma)



Shri Chintan Thaker

Chairman, ASSOCHAM Gujarat Council



The Indian food processing sector is one of the country's largest industries, accounting for 32 percent of the country's overall food market. India is also rising a major player in Food Processing and FMCG sector; the nation holds expertise in research and development, marketing and brand outreaching, consumer satisfaction etc. The Food Processing industry is essential not only for ensuring food security but also for creating substantial employment opportunities across rural and urban areas, and for driving economic growth.

Gujarat has emerged as a prime destination for the food processing sector, setting an example for other states with its robust infrastructure, innovative approach and progressive government policies. The state's strategic location, modern cold storage and warehousing facilities and seamless supply chains make it an attractive investment hub for global and national stakeholders. With incentives like subsidized land rates, tax benefits and simplified licensing processes, Gujarat is committed to making business operations more efficient and accessible.

The upcoming ASSOCHAM Gujarat Council's '9th Food Processing Summit & Awards 2024,' scheduled for 17th October 2024, is a testament to our continued commitment to advancing the Food processing industry. As this summit will bring together industry leaders, policymakers, academicians, and other key stakeholders to discuss the challenges and opportunities facing the sector.

I am happy to know that a KNOWLEDGE PAPER Jointly Prepared by ASSOCHAM Gujarat Council & Tech Sci will be released during the summit. I am sure that the Knowledge Paper will provide valuable insights and a strategic roadmap for the future of the Food Processing industry, emphasizing the importance of sustainable practices and innovation in achieving long-term growth.

On behalf of ASSOCHAM Gujarat Council and Summit organizing committee I extend my heartiest thanks to Ministry of Food Processing Industries (MoFPI), Government of India, Government of Gujarat, Industries Commissionerate, iNDEXTb and all other stakeholders for lending their support to this summit & awards. I also thank our knowledge Partner Tech Sci for their dedicated support in making this summit successful.

I acknowledge the unwavering dedication and effort put by the Chairman of Agro & Food Processing Committee; ASSOCHAM Gujarat Council secretariat and team for organizing and the crafting such a significant event.

I not only wish the event a great success but also look forward ASSOCHAM Gujarat Council continue to organize such programs for larger industry benefits with great degree of excellence.

Chintan Thaker



Shri Jaimin Shah

Co-Chairman, ASSOCHAM Gujarat Council



Gujarat's strong infrastructure, creative regulations and ideal location make it a top state for food processing. It is a desirable investment hub due to its state-of-the-art infrastructure, supply chains & incentives including tax breaks and discounted land rates. Gujarat also performs exceptionally well in related fields including animal husbandry, dairy development, horticulture, and soil conservation, all of which provide a strong basis for an ecosystem that is connected with food processing.

In today's global food processing industry technology and automation have become the cornerstones of competitiveness. In Gujarat, we recognize the critical importance of integrating cutting-edge technology and innovative automation to boost productivity, reduce costs and end improve product quality. Our focus on upskilling the local workforce to meet the constantly changing demands of the global market ensures that Gujarat's food processing sector remains at the forefront of innovation. By empowering skilled manpower with the most recent technological know-how, we aim to improve productivity and create new opportunities for growth and development in this sector, benefiting everyone involved from farm to fork.

The ASSOCHAM Gujarat Council is committed to supporting the industry's growth and development. We believe that through collaboration, knowledge sharing and advocacy, we can create a more sustainable, resilient and innovative future for the Food Processing sector.

On behalf of the ASSOCHAM Gujarat Council and the organizing committee of the 9th food Processing Summit & Awards 2024, I would like to express our sincere gratitude to the Ministry of Food Processing Industries (MoFPI), Government of India, Government of Gujarat, Industries Commissionerate, INDEXTb and all other stakeholders for their invaluable support in making this event a success.

We are also deeply indebted to our Knowledge Partner, Tech Sci for their dedicated contributions and insights. Their expertise has been instrumental in enriching the content of this summit.

I sincerely appreciate the relentless commitment, guidance & support provided by the Chairman of the Chemical & Petrochemical Committee along with the ASSOCHAM Gujarat Council secretariat and team in curating & organizing such an impactful event. Together, we can make sure that Gujarat remains at the forefront of promoting environmentally responsible industrial practices.

Jaimin Shah



Shri Dhaval Raval

Chairman, Food Processing Committee,
ASSOCHAM Gujarat Council



Assocham Gujarat Council is very proud to organise 9th edition of Agro and Food summit 2024. Agro and food submit 2024 is design on a theme of Export, Technology, Finance, Innovation, Infrastructure and Skill Development.

As we all know our honorable prime minister Shri Narendra Modi has given us a vision of Vikshit Bharat @2047, The vision of Vikshit Bharat related to Agro and Food Processing aims to improve the availability of nutritious foods by enhancing the processing of fruits and vegetables, and augment the proportion of value-added products in India's export portfolio @2047.

Gujarat has emerged as a significant player in India's food processing sector over the last decade, particularly in the frozen foods and ready-to-eat categories. The overall industry turnover in Gujarat is estimated to be around Rs. 25,000 crores, driven by the growth of local companies. Gujarat which exported a mere 30,000 metric tons of the frozen potato products in FY 2019, now exports 1.75 lakh metric tones in FY 2024 marking an impressive jump of 483% in just Five years.

With the increase in urbanization and people abroad seeking local taste and flavours the demand for ready-to-eat food has been quite substantial over the past couple of years. Indian food processing industry market size is estimated at \$ 535 Billion by the year end 2025.

Joint efforts are required from industry, academia, R&D institutes and farmers cooperatives for procurement of residue-free, natural and organic Agri produces. Our food exports to foreign countries like Japan, USA, and in Europe market will increase and we can make Indian ethnic food items a global brand. We can create Indian brands in food sector like Herbal Products, Frozen Food, Immunity Booster food items and Millet base ready to eat food products. Which are highly demanding in international market.

I also convey thanks to all vendors, sponsors, supporters, print and Digital Media and team of the Assocham secretariate who have made this event successful by working day and night.

Warm regards,

Dhaval Raval



Mr. Karan Chechi

Director, TechSci Research Pvt. Ltd.



“India’s strength lies in its agriculture, and the future of that strength depends on how we harness the potential of our food processing industry.” The food processing sector is a key driver of India’s journey toward Viksit Bharat—a developed nation that ensures both economic growth and inclusive prosperity. In this vision, Gujarat plays an essential role as a pioneer in transforming agricultural produce into high-value products, contributing to national food security, job creation, and enhanced exports.

Gujarat’s success in this sector is built upon its robust policies, such as the Agro-Industrial Policy, which encourages infrastructure development, investment, and innovation. The state has long been recognized for its leadership in dairy, marine, and spice processing industries, but the opportunity for expansion is vast. By enhancing the value-added processing of fruits, vegetables, and grains, and by modernizing storage and logistics, Gujarat can significantly boost the nation’s food processing capabilities and meet both domestic and international demand.

As we look forward, it is not just infrastructure that will define success but the integration of technology and sustainability. The adoption of smart technologies such as AI, blockchain, and automation in food processing will enhance traceability, reduce waste, and increase efficiency. These advancements will enable Gujarat to maintain its competitive edge on the global stage while contributing to India’s broader economic ambitions. For instance, implementing IoT solutions in supply chain management can optimize inventory and reduce spoilage, ensuring that food reaches consumers in peak condition.

Equally important is skill development. For India to unlock the full potential of the food processing sector, particularly in Gujarat, we must focus on creating a workforce adept at handling modern technologies and advanced processing techniques. Collaborating with educational institutions to develop specialized training programs can equip farmers, agripreneurs, and workers with the necessary skills. This investment in human capital will not only increase productivity but also improve rural livelihoods, fostering a more equitable growth model.

Sustainability will be the cornerstone of the sector’s long-term growth. Gujarat’s leadership in renewable energy, efficient water use, and waste management in agro-processing must be amplified to ensure that economic progress does not come at the expense of the environment. Emphasizing sustainable practices, such as organic farming and resource-efficient technologies, will resonate with the growing consumer demand for environmentally friendly products.

In this transformative journey, Gujarat stands at the forefront of driving India’s food processing revolution. By fostering innovation, enhancing skills, and embracing sustainable practices, the state will play a pivotal role in realizing the vision of Viksit Bharat—where India emerges as a global leader in food processing while ensuring prosperity for its people and protecting the environment for future generations.

Thank you.

Warm regards,

Mr. Karan Chechi



Executive Summary

The food processing industry is set to play a critical role in shaping India's economic future, especially in its mission to realize the vision of "Viksit Bharat" or a developed India by 2047. This white paper, titled "Harnessing Food Processing Potential: Gujarat's Role in Achieving Viksit Bharat," provides an in-depth analysis of current trends, developments, and opportunities within the global and Indian food processing sectors, with a specific focus on Gujarat. The state's strategic geographical advantages, coupled with robust government initiatives and infrastructural developments, make it a prime destination for investment and technological advancements in food processing.

The paper explores how technology, skill development, and infrastructure are transforming the sector, highlighting the integration of digitalization and the Internet of Things (IoT) to streamline operations, improve food safety, and boost productivity. It also examines the importance of maintaining high quality standards in food production and aligning with international regulations to enhance export competitiveness.

The analysis highlights the global food processing sector's alignment with India's growth vision, focusing on investment opportunities in Gujarat. It emphasizes the role of technology—automation, digitalization, and IoT—in enhancing efficiency and sustainability, alongside the need for continuous innovation.

Skill development is key for sector growth, with a focus on evolving skills, vocational education, and strategic workforce planning. The paper addresses infrastructure challenges, including supply chain, cold storage, and logistics, and examines the impact of FDI and future improvements. It also underscores the importance of food safety standards, India's regulations, and international cooperation to facilitate trade.

Government schemes and incentives, both at the central and state levels, are explored to show how they drive growth, support infrastructure, enhance skills, and encourage investment in the food processing industry. Strategic recommendations for stakeholders aim to help capitalize on the growing opportunities within this sector.

The white paper concludes by presenting a vision for a sustainable, technologically advanced, and skill-supported food processing ecosystem in India and Gujarat. It serves as a valuable resource for policymakers, industry stakeholders, and investors seeking to understand the evolving landscape of food processing in India. By leveraging technology, enhancing skills, and utilizing government support, the sector has the potential to achieve significant growth and contribute to a resilient food economy.



Chapter 1

Introduction



Overview of Global Trends in the Food Processing Industry

Food processing refers to the conversion of agricultural products into consumable food or transforming one type of food into another. This process spans various methods, from basic activities like grinding grain

into flour or home cooking, to more advanced industrial techniques used in the production of convenience foods. Certain food processing techniques are essential for reducing food waste, enhancing preservation, minimizing agriculture's environmental impact, and supporting food security.

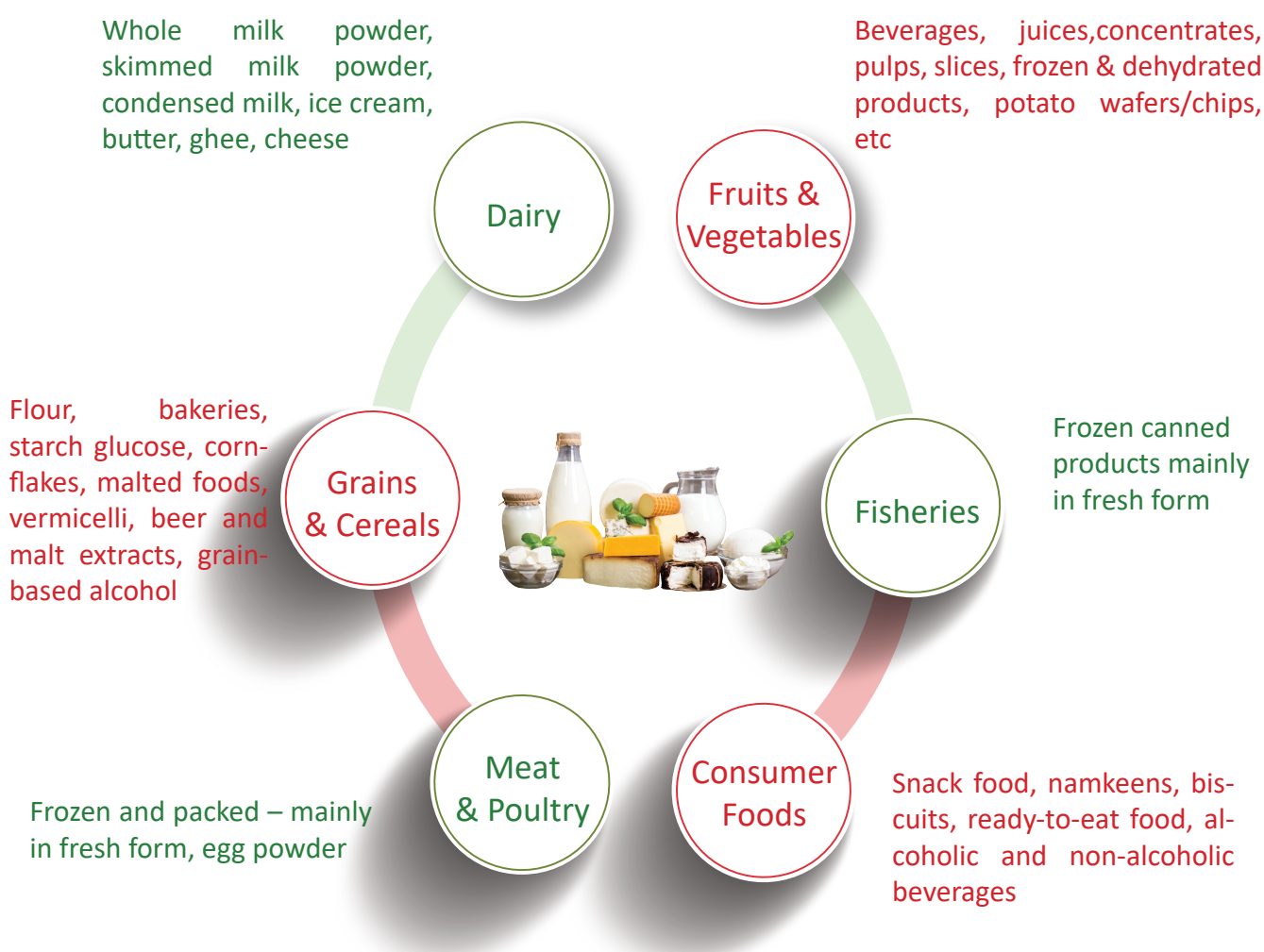


Figure 1: Segments of Food Products in India¹

Primary food processing is necessary to make many food items safe for consumption, while secondary processing transforms raw ingredients into common foods like bread. Tertiary processing, which produces ultra-processed foods, has faced significant criticism for contributing to overnutrition and obesity due to excessive sugar, salt, and a lack of dietary fibre, making these products less healthy for both humans and animals.

1. https://www.mofpi.gov.in/sites/default/files/annual_report_2017-2018.pdf

Product	Primary Processing	Secondary Processing	Tertiary Processing
Milk	Grading and refrigerating	Cottage cheese, cream, simmered and dried milk	Processed milk, spreadable fats (butter and cheese), yogurt
Fruits & Vegetables	Cleaning, sorting, grading & cutting	Slices, pulps, flakes, paste, preserved and flavoured	Ketchup, jams, juices, pickles, preserves, candies, chips, etc.
Grains & Cereals	Sorting and grading	Flour, broken rice, puff, malt & milling, oil cakes	Biscuits, cakes and other bakery items, noodles, flakes, namkeen, sunflower, groundnut, mustard, soya and olive oil.
Meat & Poultry	Sorting and refrigerating	Cut, fried, frozen and chilled	Ready-to-eat meals
Marine	Chilling and freezing	Cut, fried, frozen and chilled	Ready-to-eat meals
Beverages	Sorting, bleaching and grading	Leaf, dust & powder	Teabags, flavoured coffee, soft drinks, alcoholic beverages

Figure 2: Opportunities in different segments of the Food Processing Industry



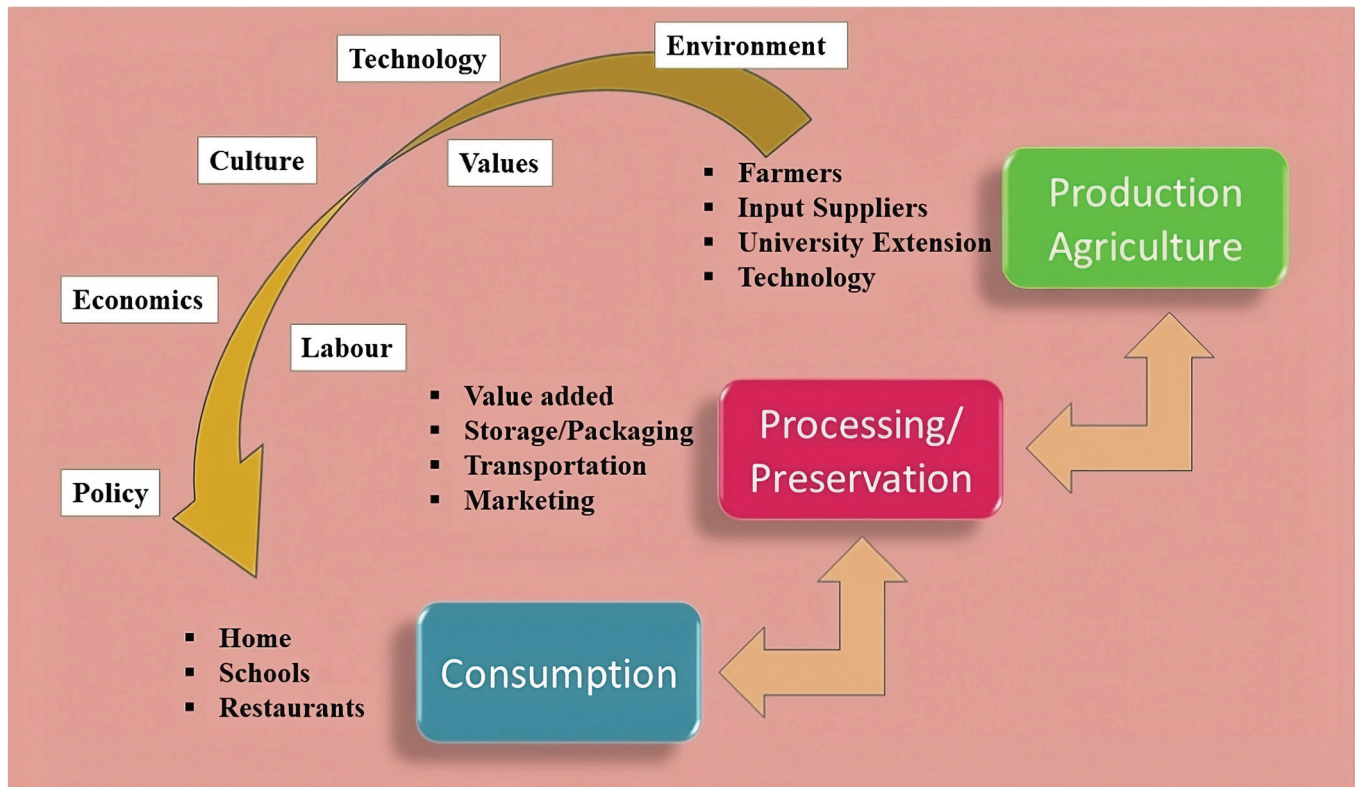


Figure 3: Elements of sustainable food system

Global food systems play a critical role in feeding, nourishing, and enhancing the social well-being of humanity. However, these systems are increasingly challenged by the Earth's ecological limits and the social boundaries of humanity, primarily driven by climate change, biodiversity loss, nutrient loading (specifically nitrogen and phosphorus), and land conversion. These factors are depleting the natural resources essential for providing adequate food for the global population. These ecological pressures are intricately linked to pressing social and economic issues, including hunger, malnutrition, obesity, and food insecurity, which affect numerous regions worldwide. By 2040, the global population is projected to reach 9.2 billion—1.2 billion more than today—necessitating a significant increase in

food production².

Concurrently, it is imperative to achieve substantial reductions in greenhouse gas (GHG) emissions and improve the planet's ecological conditions to ensure sustainability for future generations.

To facilitate this transition, global food systems must evolve towards ecologically, socially, and economically viable practices. This transformation demands a reimagining of the "art of the possible," involving collaboration among policymakers, businesses, communities, and consumers. The goal is to create a safe and equitable transition journey that addresses the challenges at each milestone.

2. United Nations, <https://population.un.org/dataportal/home>.

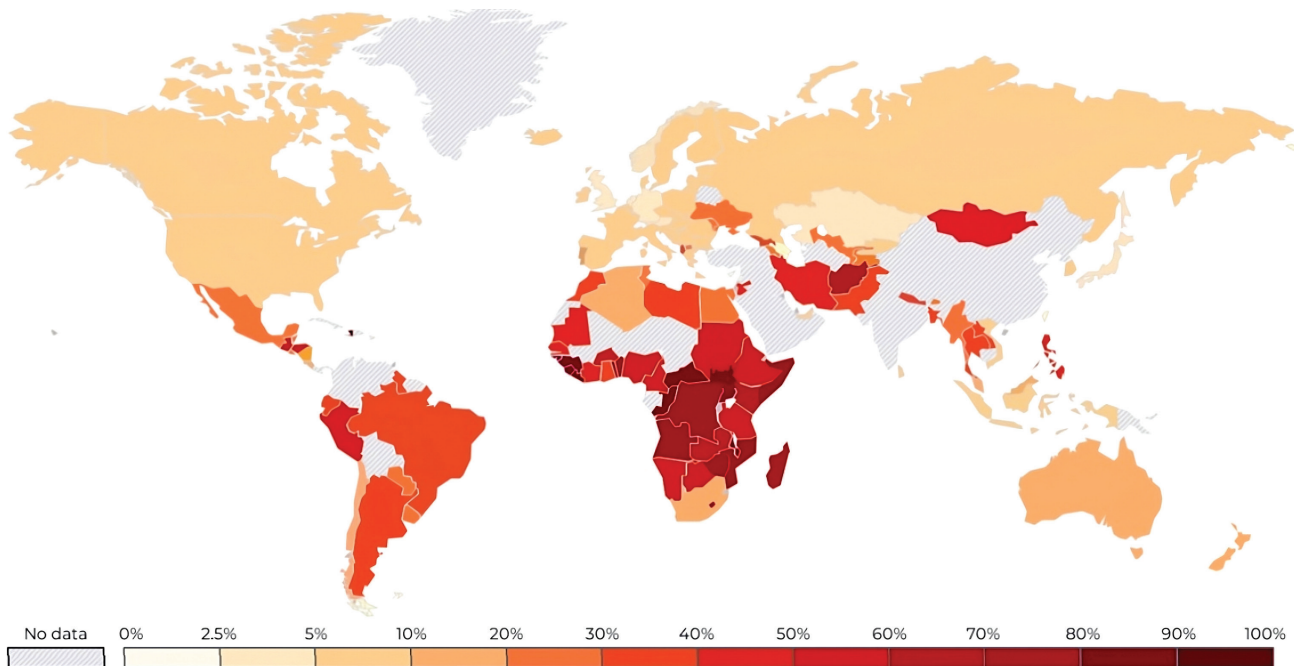


Figure 4: Share of the population that cannot afford a healthy diet (2021)³

Viksit Bharat: Role of the Food Processing Sector

A well-developed food processing industry equipped with advanced processing technologies is essential for minimizing waste, enhancing value addition, promoting crop diversity, improving farmers' income, creating employment opportunities, and increasing export revenues. Furthermore, it addresses significant challenges related to food security, inflation, and the provision of nutritious food to the general population. India ranks as the fifth-largest economy globally and is projected to be the fastest-growing economy among major G20 nations, with an estimated GDP growth of approximately 8% for the fiscal year 2024 (FY24)⁴. Over recent years, the food

processing sector has emerged as a vital contributor to India's economic landscape, driven by progressive policy initiatives from the Ministry of Food Processing Industries (MoFPI). This sector has demonstrated remarkable performance, achieving an average annual growth rate of 7.3% from 2015 to 2022. It has made significant contributions to the Gross Domestic Product (GDP), employment, and investment, representing 10.54% of the gross value added (GVA) in manufacturing and 11.57% in the agricultural sector for the fiscal year 2020-21. India's diverse agro-climatic conditions facilitate the abundant production of cereals, pulses, fruits, and vegetables, positioning the country as a leading global producer of various food items.



3. <https://www.tetrapak.com/content/dam/tetrapak/media-box/global/en/documents/white-paper-food-systems-2040.pdf>
 4. <https://www.ibef.org/industry/food-processing>



Figure 5: Food Processing in India



Notably, India emerged as a world leader in milk production, contributing approximately 25% to global milk output in the 2022-23 period. Additionally, India ranked second in the production of vegetables and fruits and eggs and fifth in meat production for the same period.

Companies	2020	2021	2022
Britannia (In USD Million)	1458.1	1651.3	1777
NESTLE India (In USD Million)	1554.9	1678.2	1849.1
LT Foods (In USD Million)	52	59.6	68.2
Kohinoor Foods (In USD Million)	2.7	3.3	1.2

Figure 6: Revenue of food processing companies⁵



5. https://ijaem.net/issue_dcp/Food%20Processing%20Industry%20in%20India%20An%20Industry%20Analysis.pdf

India is the world's largest producer of spices, with an output of 11.26 million tonnes of major spices reported in the 2022-2023 period, according to the third advanced estimate from the Spices Board of India⁶. The food processing industry in India remains nascent, contributing less than 10% to the total food output. A

study on the level of food processing in India indicated processing rates of 2.7% for vegetables, 4.5% for fruits, 15.4% for fishery products, 21.1% for milk, and 34.2% for meat in the 2020-2021 fiscal year. Strengthening the food processing sector is crucial for addressing food and nutritional security challenges in the country.

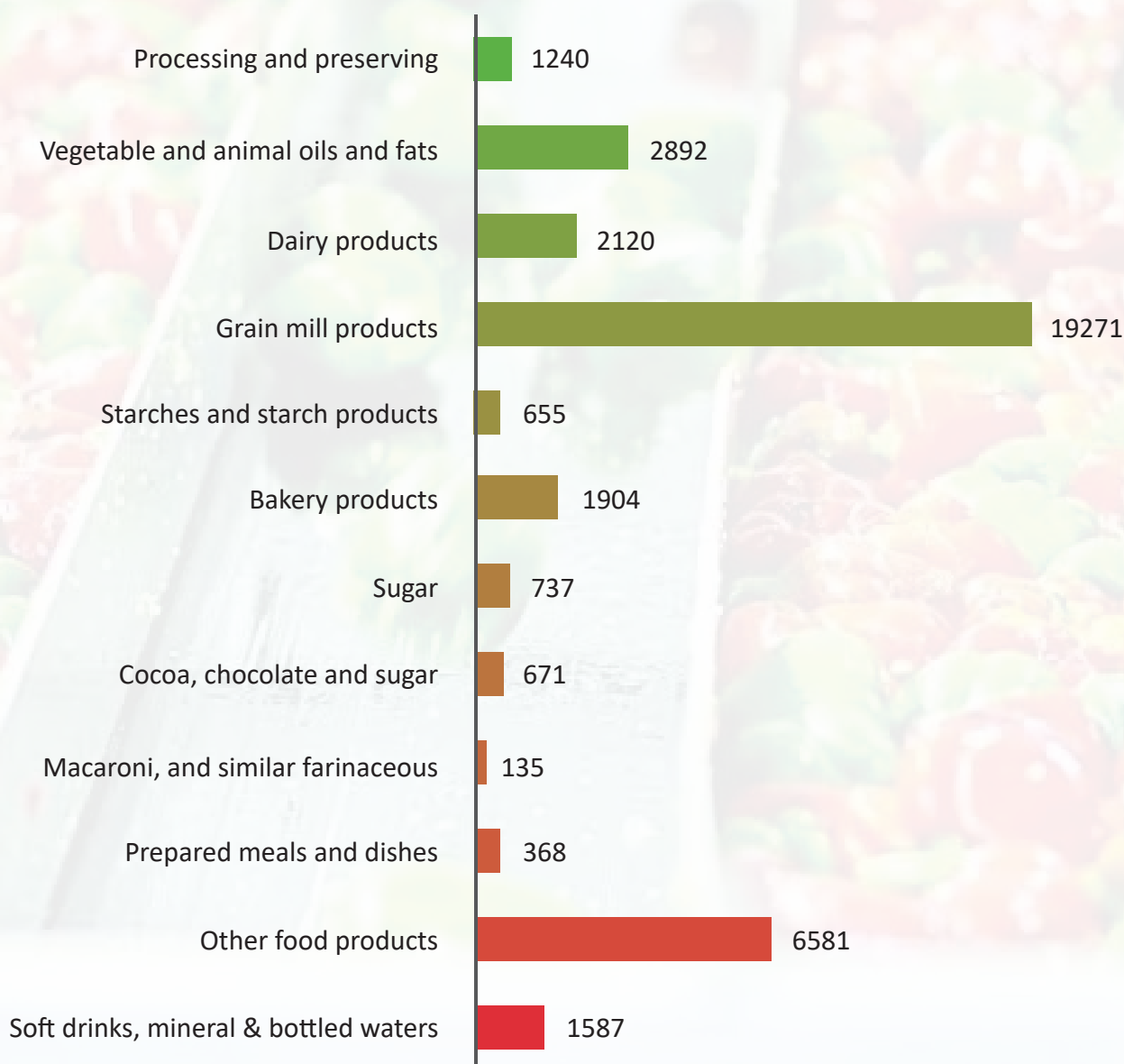


Figure 7: Estimated number of registered food processing units ⁷

6. <https://www.indianspices.com/>

7. https://indextb.com/files/2024/2/f50fe482-88ea-4412-8174-856bf28b0b78_Development%20of%20Agro%20Food%20Park.pdf

Processed foods provide numerous advantages, including convenience, extended shelf life, improved transportability to remote regions, and enhanced accessibility, thereby serving as an essential source of

nourishment. Furthermore, this sector offers farmers increased opportunities for better price realization and expanded market access.

Product Categories	Export Growth
Fruits and vegetables	59.1% (↑)
Cereals and miscellaneous processed items	37.66% (↑)
Meat, dairy, and poultry products	9.5% (↑)
Basmati rice	25.5% (↑)
Non-basmati rice	5% (↑)
Miscellaneous products	50% (↑)

Figure 8: Export Growth rate of the food processing industry⁸



8. https://ijaem.net/issue_dcp/Food%20Processing%20Industry%20in%20India%20An%20Industry%20Analysis.pdf

India is among the most populous countries globally and is projected to maintain one of the youngest demographics until 2030. The demand for food is anticipated to reach USD 1.2 trillion by the fiscal year 2025-26, driven by urbanization and evolving consumption patterns. The processed fruits and

vegetables sector was valued at USD 15.4 billion in 2019. Increased consumer awareness during the pandemic has led to a heightened demand for processed foods, particularly in the ready-to-eat (RTE) and ready-to-cook (RTC) segments, as well as dairy and fruit and vegetable products.

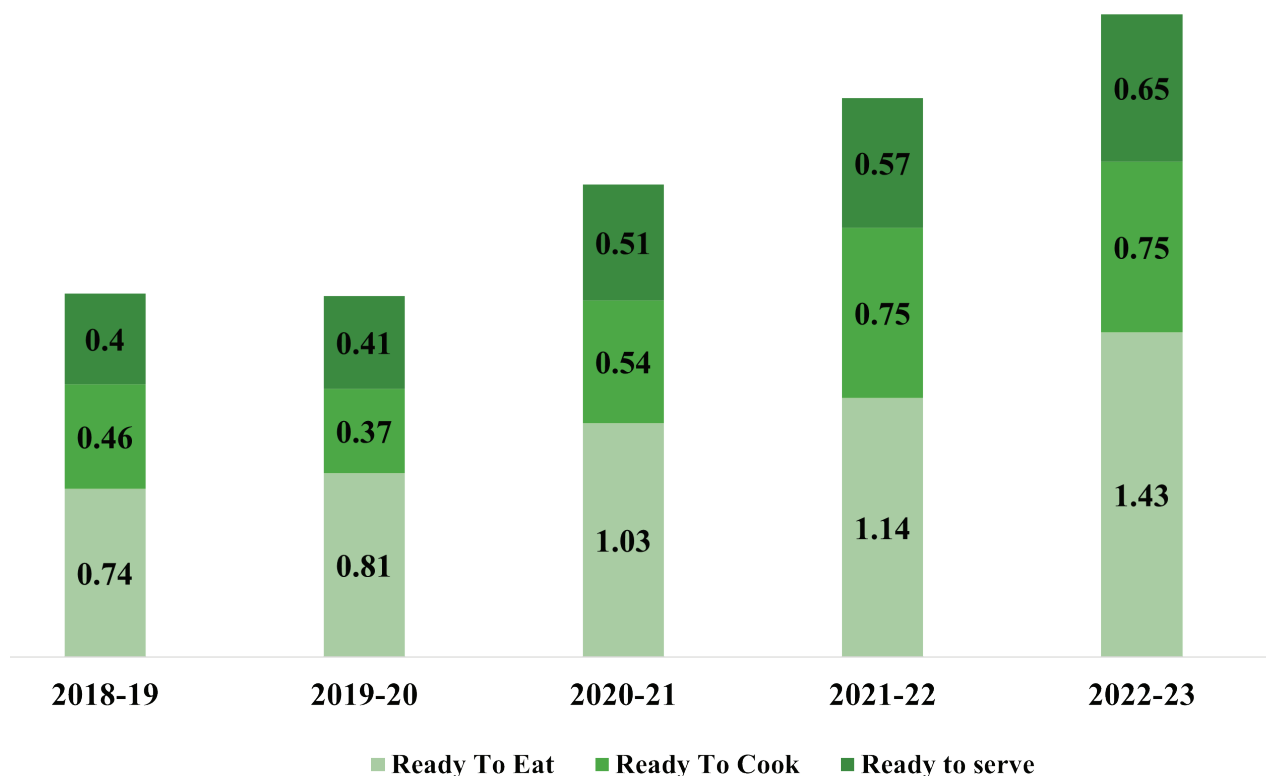


Figure 9: Export of trending sectors



The market size of the food processing sector in India is estimated to grow from USD 866 billion in 2022 to USD 1,274 billion by 2027⁹. This growth is

supported by population increases, changing lifestyles, and shifting food habits resulting from rising disposable incomes and urbanization.

Processed-Food Export

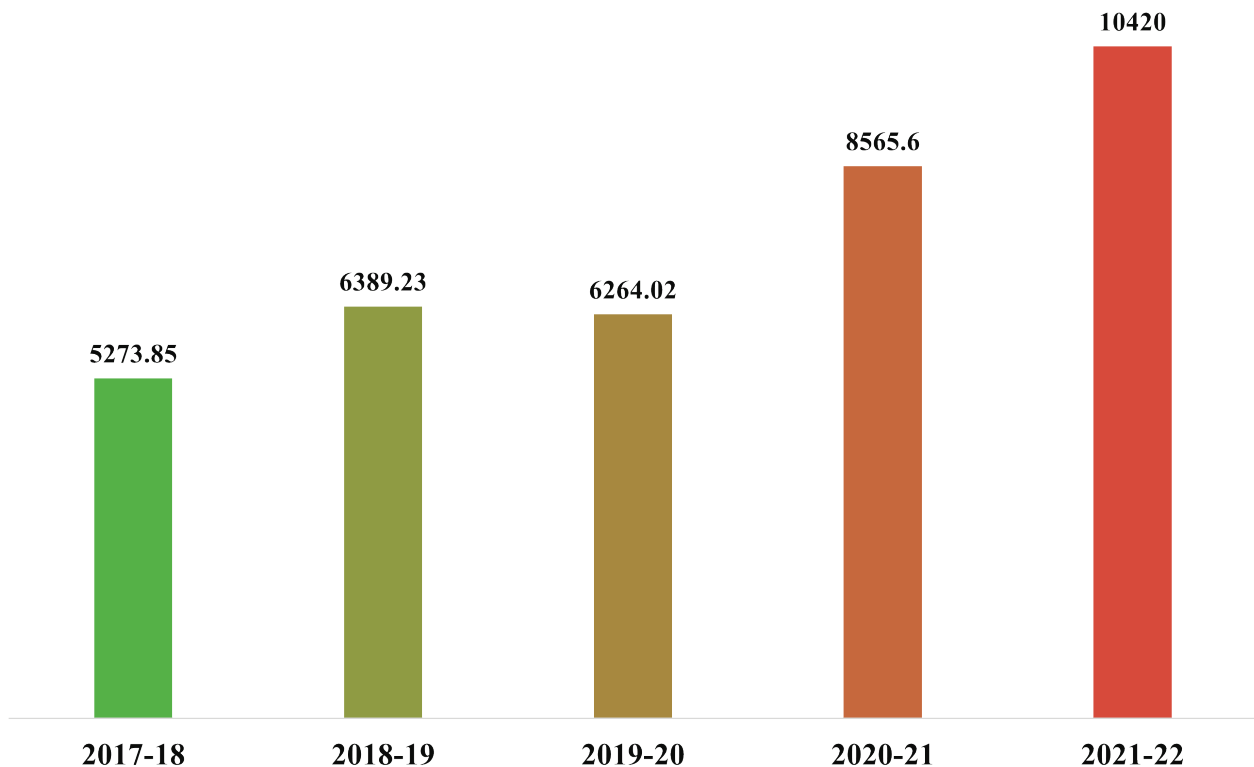


Figure 10: The export of processed food items during the last five years (Figures in USD Million)¹⁰



9. <https://www.ibef.org/industry/food-processing>

10. <https://pib.gov.in/PressReleasePage.aspx?PRID=1883151>

The food and grocery market in India ranks as the sixth largest globally. The food processing industry contributes approximately 32% to this market and is one of the largest sectors in the country, accounting for 13% of total exports and 6% of industrial

investments. Within the registered factory sector, the food processing industry employs about 1.93 million individuals, while the unregistered sector employs approximately 5.1 million workers.

S.No	Global food processing Industry	Indian food processing Industry
1	There is a change in a transition from informal and small agro and food industry to larger units.	In India, more than 75% of agro and food processing is done by informal and small enterprises.
2	They get the usedrge-scale economies. They use to advance and innovative technology.	These small and informal units suffer from technological and infrastructural challenges.
3	Follow national and international quality standards.	They cannot compete with national and international quality standards.
4	Products have national and international market coverage.	Very few products have national and international market coverage. Their products are marketed and sold in local markets.
5	They have followed contract farming and direct procurement of raw material from farmers.	They are not in a position to create a link with farmers through an integrated value chain.
6	These enterprises have conditions enabling them to run their units profitably with the transformation of rural areas.	These challenges limit their growth and prospects for higher value addition. There is a strong need to promote food processing in rural areas.

Figure 11: Comparison of Global and Indian Food Processing Industry

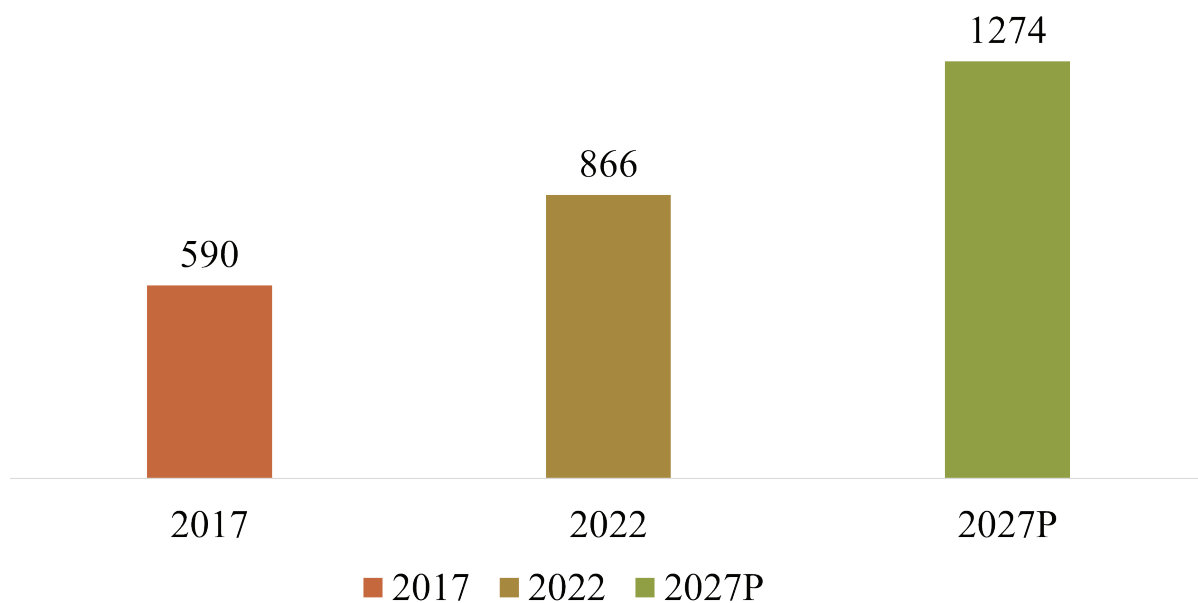


Figure 12: Market Size of The Food Processing Sector in India



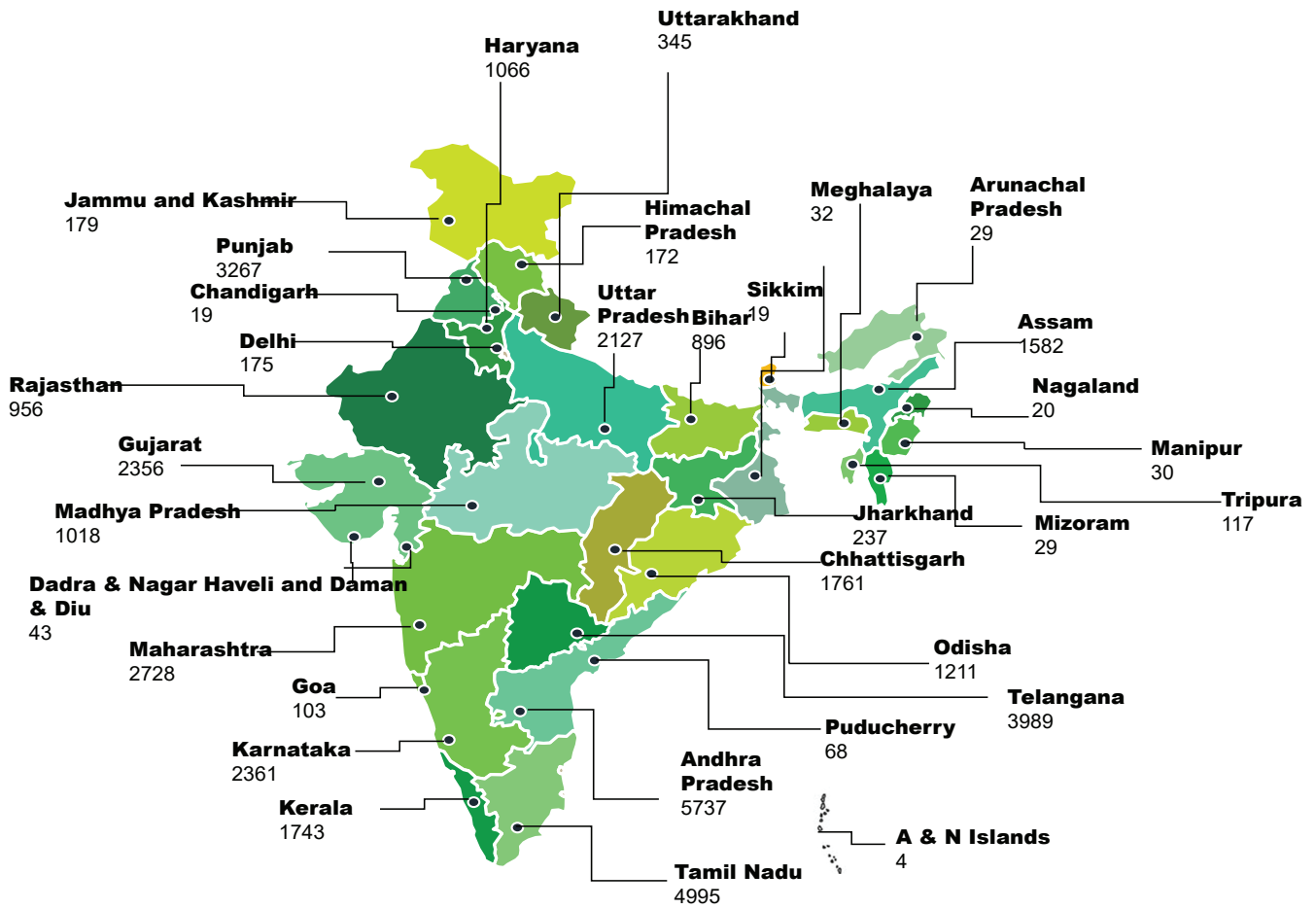


Figure 13: Number of Food Processing Units in India



Investments/Developments in the Food Processing Sector

The food processing industry has experienced significant advancements and substantial investments in recent years.

- In the Interim Budget for 2024-25, the Ministry of Food Processing Industries received a total allocation of Rs. 3,290 crore (~USD 396 million), reflecting a 13% increase compared to the revised estimates for fiscal year 2024. Out of this budget, Rs. 2,173.02 crore (~USD 261.5 million) was earmarked for central sector schemes and projects, including the Pradhan Mantri Kisan Sampada Yojana (PMKSY) and the Production-Linked Incentive Scheme for Food Processing Industry (PLISFPI). Additionally, Rs. 879.5 crore (~USD 105.8 million) was designated for centrally sponsored schemes, such as the Prime Minister's Formalization of Micro Food Processing Enterprises Scheme (PMFME).
- The food processing sector in India permits 100% Foreign Direct Investment (FDI) through the automatic route and has attracted a cumulative FDI equity inflow of USD 12.59 billion between April 2000 and March 2024. This accounts for approximately 1.85% of the total FDI equity inflows across all sectors, placing the industry among the top 15 sectors receiving FDI.
- In November 2023, the Ministry of Food Processing Industries hosted the 'World Food India' event in New Delhi. This event served as a premier platform for stakeholders across the food value chain—ranging from food processors and equipment manufacturers to cold chain operators, logistics providers, researchers, start-ups, and innovators—to engage, showcase their expertise, and collaborate.
- The United Nations General Assembly (UNGA) declared 2023 as the International Year of Millets, and India's Union Budget for 2023-24 placed special emphasis on millets, with a vision to establish India as a global hub for millets (Shree Anna). In alignment with this goal, India organized a two-day Global Millets Conference during its G20 Presidency in March 2023 in New Delhi. The event attracted participants from over 102 countries, fostering discussions on millet-related topics such as production, consumption, nutrition, value chain development, market linkages, and research initiatives. The Indian Institute of Millets Research in Hyderabad was also recognized as a Centre of Excellence for sharing best practices, research, and technology on both national and international levels.
- The Mega Food Park (MFP) Scheme was designed to integrate agricultural production with market demands by connecting farmers, processors, and retailers. This cluster-based approach involves setting up modern food processing units in well-defined agricultural and horticultural zones. Each MFP includes essential supply chain infrastructure, such as collection centres, processing units, and cold chains, along with plots developed for entrepreneurs. As of December 2023, 41 MFP projects had been approved, with 24 operational.
- In 2022, a Special Food Processing Fund of USD 263 million (Rs. 2,000 crore) was established in collaboration with the National Bank for Agriculture and Rural Development (NABARD) to provide affordable financing for the establishment of units within Mega Food Parks (MFPs) and Designated Food Parks (DFPs).
- The Production-Linked Incentive Scheme for the Food Processing Industry (PLISFPI), launched in March 2021 with a budget of USD 1.3 billion (Rs. 10,900 crore), is set to be implemented from 2021-22 to 2026-27. The scheme aims to boost manufacturing, support the production of innovative and organic SME products, and promote Indian brands in international markets. Additionally, in FY23, the government introduced a Production-Linked Incentive Scheme for Millet-Based Products (PLISMBP) with a budget of approximately USD 96 million (Rs. 800 crore).

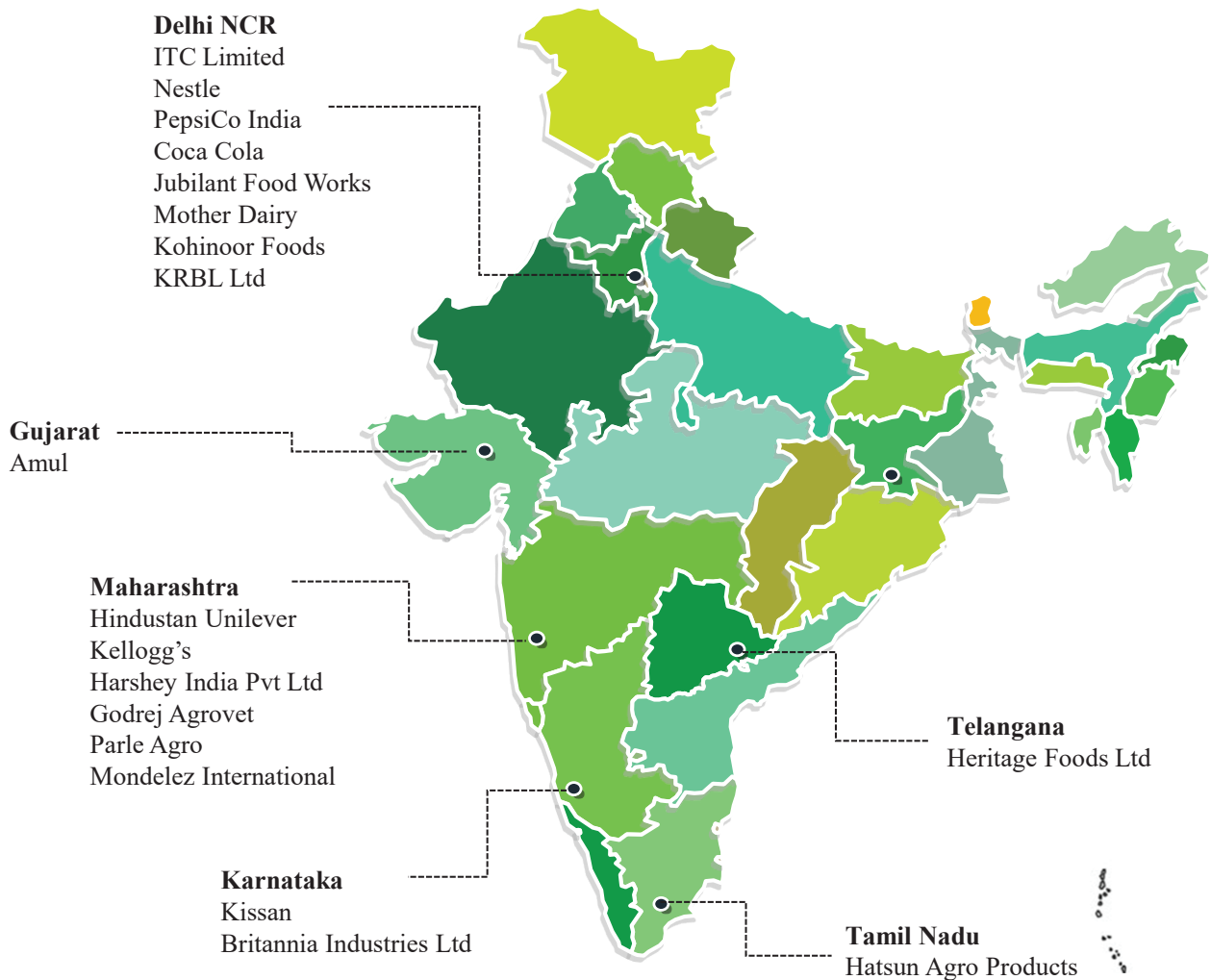


Figure 14: Prominent Agro-Food Manufacturers – India¹¹



11. https://indextb.com/files/2024/2/f50fe482-88ea-4412-8174-856bf28b0b78_Development%20of%20Agro%20Food%20Park.pdf

Opportunities for Investors/Entrepreneurs

The food processing technology sector presents a diverse array of opportunities for entrepreneurs and investors. Key areas of potential include:

Meat and Poultry	•Investment potential in eggs, egg powder, cut meats, sausages, and other value-added products, along with fish, seafood, and processing and freezing units.
Confectionery and Bakery Products	•Opportunities in the production of cookies, crackers, biscuits, bread, cakes, and frozen dough.
Fruits and Vegetables	•Opportunities in the production of preserved, candied, glazed, and crystallized fruits and vegetables, as well as juices, jams, jellies, purees, soups, powders, dehydrated vegetables, flakes, shreds, and ready-to-eat curries.
Consumer Food Products	•This includes packaged food, aerated soft drinks, packaged drinking water, and spice pastes.
Food Processing Equipment	•Investments can be made in equipment for canning, dairy and food processing, specialty processing, packaging, frozen food/refrigeration, and thermo-processing.
Food Preservation and Packaging	•Opportunities in metal can production and aseptic packaging solutions.
Grain Processing	•Focus on rice, pulse milling, and flour milling sectors.
Food Additives and Nutraceuticals	•This segment includes preservatives, colorants, flavor enhancers, emulsifiers, stabilizers, antioxidants, sweeteners, vitamins, minerals, omega-3 fatty acids, probiotics, herbal extracts, amino acids, and fiber supplements.
Dairy Products	•Investment prospects encompass liquid milk, curd, flavored yogurt, processed cheese, cottage cheese, Swiss cheese, blue cheese, ice cream, and milk-based sweets.
Food Preservation through Fermentation	•This includes the production of wine, beer, vinegar, yeast preparations, alcoholic beverages, and fruit- and cereal-based drinks.

Investors and entrepreneurs are well-positioned to explore these segments and leverage the growing demand in the food processing industry.



Unlocking Opportunities in Gujarat's Food Processing Industry

Located in Western India, Gujarat benefits from eight distinct agro-climatic zones and varied landscapes, enabling year-round crop cultivation. With a gross sown area of 13.816 million hectares, the state is a leading force in agriculture and is poised to maintain its dominance in the sector through 2040. Additionally, Gujarat's strategic 1,600-kilometer coastline and 42 ports further solidify its role as a critical player in the agricultural industry. The food processing sector in Gujarat has experienced significant growth, with its Gross Value

Added (GVA) rising from INR 1.34 lakh crore in 2014-15 to INR 2.37 lakh crore in 2020-21. This sector plays a vital role in the state's economy, contributing 10.54% to manufacturing GVA and 11.57% to agricultural GVA in the fiscal year 2020-21¹². Gujarat is a key driver of India's export economy, accounting for over 20% of the country's total exports. As the fourth-largest milk-producing state, it is also home to the iconic Amul brand. With its strong industrial capabilities, diverse climate, and well-developed infrastructure, Gujarat has established itself as a leading industrial hub, attracting significant investments and fuelling economic growth.

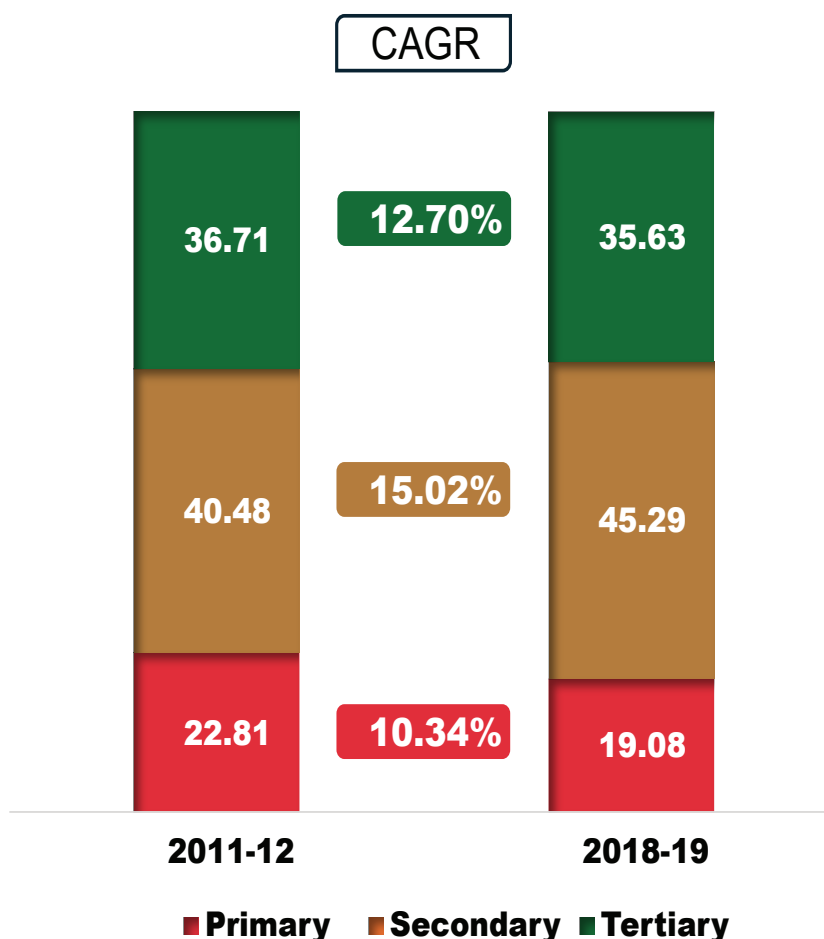


Figure 15: Percentage Distribution of GSDP in Gujarat

12. <https://indexbt.com/sector/agro-food-processing>

The food processing potential and investment opportunities in Gujarat

I. Infrastructure Projects for Horticulture

Gujarat ranks second in onion production, contributing 17% of India's total output. With the increasing cultivation of onions, there is a pressing need for additional cold storage facilities to reduce post-harvest losses, currently estimated at 20-25% of production. Furthermore, Gujarat is renowned for its Isabgul crop, primarily grown in Kutch and North Gujarat. About 90% of the Isabgul produced is exported to markets in the US, China, Japan, Australia, and Europe, with pharmaceutical companies worldwide sourcing high-quality Isabgul. However, irregular rainfall has led to a decline in Isabgul production, prompting many farmers to shift to other cash crops, a concern for policymakers. Therefore, projects related to cold storage for onions, pack houses for fresh fruits and vegetables, mechanized grain handling and storage at ports, spices and Isabgul irradiation centers, food parks, and terminal markets present significant opportunities for investment in Gujarat.

II. Export-Oriented Processing

As the second-largest producer of groundnuts and sesame, Gujarat has considerable potential to expand exports by setting up processing units in the Saurashtra region. These units could produce peanut butter, roasted peanuts, blanched and coated peanuts, de-hulled sesame seeds, and roasted sesame oil. Additionally, the coastal areas of the Gulf of Kutch district offer ideal conditions for shrimp farming and processing, tapping into the growing demand for frozen shrimp in global markets.

III. Value-Added Processing Using Local Resources

Gujarat's potato production is well-suited for value-added processing, such as potato powder and flakes, driven by rising demand for potato-based snacks like French fries. Major potato-producing districts such as Banaskantha, Mehsana, Kheda, Sabarkantha, and Anand present opportunities for establishing processing plants. Moreover, there is potential to set up facilities producing guar gum powder, refined sugar, egg powder, baker's yeast, and fish oil.

IV. Natural Resource-Based Opportunities

The food processing industry in Gujarat has new opportunities in producing natural food colors, enzymes, medicinal herb extraction, and bio-fertilizers from fish meal. Raw materials for natural food colors, such as marigold flowers and annatto seeds, are readily available, while favorable climatic conditions support the cultivation of medicinal herbs. The state's well-established dairy, chemical, pharmaceutical, cosmetic, and textile sectors create substantial demand for these natural products.

V. Technology-Based Projects/Opportunities

Newer technologies like cryo-grinding for spice processing, which preserves the aroma and color of spices, offer untapped potential in India. Though this technology is currently unavailable in the country, importing it from Japan or Germany could lead to significant advancements. Additionally, retort pouches—a modern packaging solution for ready-to-eat food—could create business opportunities for vegetable processors in Gujarat, both in domestic and international markets.

VI. Innovative Opportunities

The growing market for organic milk and milk products, driven by increasing health consciousness, aligns well with Gujarat's strong dairy industry, which has the capacity to expand into organic production. Furthermore, as the largest producer of castor seeds, Gujarat has potential to establish plants for extracting perfumery raw materials from castor oil, catering to international markets like Japan, France, and Germany. Additionally, there is an opportunity to develop banana fiber extraction facilities, turning waste banana stems into a viable resource for the textile industry in Central and South Gujarat.

Present Scenario of Food Processing in Gujarat

The agricultural landscape in Gujarat has experienced a significant transition toward high-value crops such as cotton, groundnuts, fruits, vegetables, and various spices, moving away from low-value cereals. This shift reflects a broader trend in national agriculture. Gujarat stands out as the leading producer of groundnuts in India and ranks as the third-largest producer of milk. Additionally, the state is among the top producers of marine fish. Exports from the fisheries sector have surged from USD 175 million in 2007-08 to USD 560 million in 2014-15, reflecting a compound annual growth rate (CAGR) of 18%, and accounting for 23.35% of the nation's overall value-added marine product exports.

Key Strengths of Gujarat's Food Processing Industry

The strengths of Gujarat's food processing sector include:

- Seed Spices: Cumin, Fenugreek, Fennel
- Medicinal Crops: Psyllium (Isabgol)
- Pulses: Pigeon Pea (Tur Dal), Gram
- Coarse Cereals: Pearl Millet
- Oilseeds: Groundnut

As of 2018, Gujarat is home to approximately 94,066 food processing units, with 2536 of these registered

(MOFPI, 2018). Key segments within these processing units include oilseed processing, milk processing, fruits and vegetable processing, and fish processing.

Gujarat is one of the states that have implemented a comprehensive Agro-Industrial Policy and Vision 2010, aimed at fostering the overall development of agriculture and agro-based industries (Mott MacDonald, 2014).

The state features two mega food parks: the operational Gujarat Agro Infrastructure Mega Food Park Pvt. Ltd. in Surat, and the Fanidhar Mega Food Park in Mahesana, which is currently under development. The Gujarat Agro Infrastructure Corporation (GAIC) indicates potential for establishing at least three additional major food parks, with specific locations and focuses as follows:

- Fruits & Vegetables Food Park: Surat, Anand, Kheda, and Prantij
- Spices & Isabgol Processing Park: Mehsana, Patan, and Banaskantha
- Groundnut & Sesame Food Park: Rajkot, Junagadh, and Amreli

Market Infrastructure and Logistics

Gujarat has a robust agricultural infrastructure with 224 Agricultural Produce Market Committees (APMCs), 224 Main Yard Market Committees, and 183 Submarket Yards operational across 33 districts. The state also



boasts 956 cold storage units with a total capacity of 380,000 metric tonnes, primarily for potatoes and vegetables, as well as fish processing units with a capacity of 2 million metric tonnes.

Additionally, Gujarat has 207 warehouses across 45 centers and one irradiation unit in Bavla. The state features 20 agro-export zones focused on commodities such as mangoes, vegetables, onions, and sesame seeds. Furthermore, 79 APMCs are integrated with the National Agriculture Market (eNAM), and to support food exports, the state has established an air cargo complex. The Delhi and Mumbai Industrial Corridor also passes through Gujarat.

Processing units in Gujarat primarily handle products such as mango pulp, pickles, tomato ketchup, dehydrated onions, and tutti-frutti.

Challenges and Recommendations

Despite these strengths, the state faces challenges due to a low level of processing, primarily stemming from inadequate post-harvest infrastructure. Post-harvest losses for various fruits and vegetables range from 25% to 30%. Therefore, it is crucial to enhance and expand existing post-harvest infrastructure and processing facilities to mitigate these losses.

Promising Opportunities in Gujarat's Food Processing

Industry

Gujarat presents significant opportunities in the food processing sector, particularly in dairy, fruits, vegetables, and spices. The state excels in the production of Sapodilla, pomegranate, papaya, lemon, coriander, banana, and brinjal. With Geographical Indicator tags for Gir Kesar Mango and Bhalia Wheat, Gujarat's agricultural prowess is further recognized.

• **Fruits and Vegetables: Growth Potential in Gujarat**

As the 5th largest producer of fruits and the 6th largest of vegetables nationwide, Gujarat is positioned to expand its food processing capabilities. With a total fruit production of 8.26 million MT and vegetable production of 1.6 million MT, the state holds immense potential for value-added processing. Key fruit crops include papaya, banana (48% of total production), lemon, pomegranate, and gooseberry, while onion and potato dominate the vegetable sector.

Value-Added Processing: Gujarat's abundant produce opens avenues for processing ready-to-eat meals, tetra pack juices, jams, jellies, and other packaged food items.

Ready-to-Eat: The state can capitalize on the growing demand for healthy snacks through dehydrated fruit chips and vegetable crisps.

Value-Added Products: There are opportunities to produce fruit purees and salad dressings, catering to both food service industries and the packaged retail sector.



- **Dairy Processing Industry**

Gujarat, home to Amul and the country's 4th largest milk producer, offers vast potential for value-added dairy products such as cheese, paneer, ghee, yogurt, and traditional items. The introduction of high-pressure technologies and innovations in sustainable dairy protein ingredients further positions the state for growth.

Value-Added Dairy Products: Opportunities include the production of a wide array of dairy products—cheese, paneer, ghee, ice cream, and traditional items like Sandesh, Payasam, Burfi, and Srikhand.

Innovation: Investment in clean-label dairy products using high-pressure technologies and cold microfiltration to create sustainable dairy proteins can drive future growth.

- **Ready-to-Eat and Ready-to-Cook Products**

Gujarat's culinary heritage presents exciting opportunities in the ready-to-eat (RTE) and ready-to-cook (RTC) segments, with a focus on traditional dishes such as Dhokla and Phaphda. Integrated processing units can meet the growing demand for convenient and authentic food options.

RTE Snacks: Packaged traditional snacks like Dhokla, Phaphda, Khandvi, and Thepla offer a ready market for consumers seeking convenience.

RTC Kits: Ready-to-cook kits featuring pre-measured ingredients for Gujarati dishes can cater to time-conscious consumers while preserving authenticity.

Innovative Products: Value-added innovations, such as frozen or microwaveable versions of traditional foods like Dhokla, Thepla, and Khakhra, provide further opportunities to meet modern consumer needs.



Gujarat Government Initiatives and Schemes

The Gujarat State Government has introduced investor-friendly reforms, such as a Single Window Portal and a State Industrial Land Bank, aimed at enhancing the business environment. Additionally, initiatives like “Saat Pagla Khedut Kalyanna” and the Start-up Policy are designed to support farmers and foster innovation within the food processing sector.

Single Window Portal (Gujarat Investor Facilitation Portal)

The Gujarat Investor Facilitation Portal serves as a comprehensive platform that allows investors to easily access and apply for all state-related business approvals tailored to their specific needs. This portal aims to support investors by providing a transparent, efficient, and streamlined process, eliminating unnecessary complications.

State Industrial Land Bank

The State Industrial Land Bank utilizes a Geographic In-

formation System (GIS) to display available land and infrastructure. It provides detailed information about all state-owned industrial estates, including current land rates, connectivity options, and utility infrastructure.

Central Industrial Land Bank Portal

The Central Industrial Land Bank Portal is a centralized repository for industrial parks across India, offering essential infrastructure-related information. This includes connectivity details, available natural resources, terrain information, plot-level data on vacant plots, and contact details for relevant authorities.

Scheme for Assistance for Start-ups

In August 2020, the Government of Gujarat launched the Start-up Policy as part of the Scheme for Assistance for Start-up/Innovation 2020. This initiative aims to promote and support start-ups while strengthening the overall ecosystem in Gujarat. Under this policy, the government offers incentives, including seed funding, with start-ups eligible for support of up to INR 30 Lakhs based on their expenses related to market research, testing, trials, and raw materials.



State Trivia

“Milk cooperatives of India owe their origin to the state of Gujarat. The AMUL model is world famous and the most successful one in India. The Anand city of Gujarat is also known as the milk capital of India.”

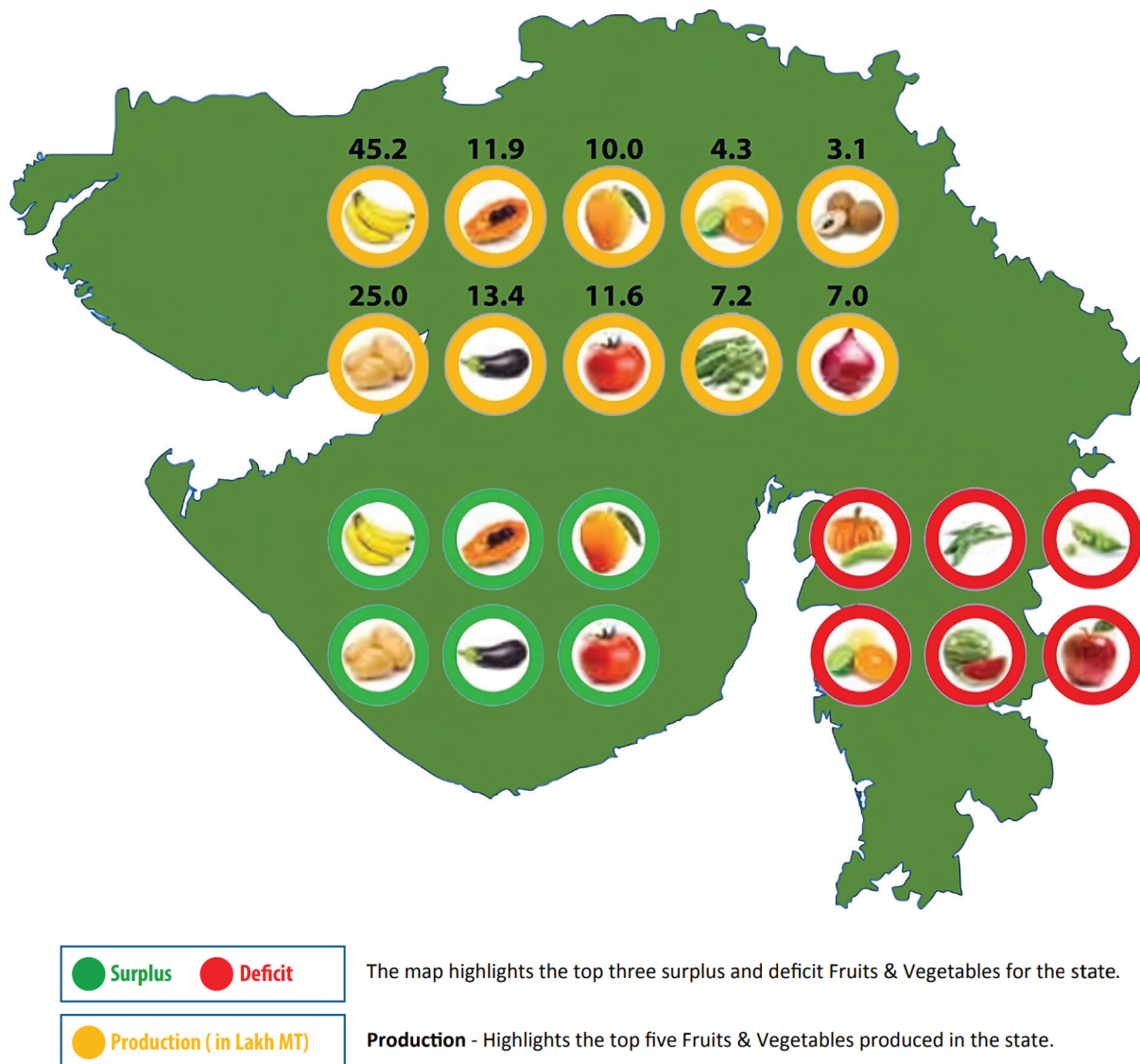


Figure 16: Fruits & Vegetables Availability Map Gujarat

Agro Products	Districts
Banana based products	Anand, Surat, Bharuch, Narmada
Coriander based products	Jamnagar
Cumin based products	Mehsana, Patan, Surendranagar
Date based products	Kutch
Finger Millet based products	Dang
Gram based products	Porbandar
Groundnut based products	Amreli, Devbhoomi Dwarka, Jamnagar, Rajkot
Guava based product	Botad
Maize based product	Chhota Udaipur, Panchmahal
Mango based products	Gir Somnath, Navsari
Okra based products	Gandhinagar
Onion based products	Bhavnagar
Papaya based products	Mahisagar
Pomegranate based products	Banaskantha
Potato based products	Aravalli
Rice-based products	Kheda
Sapota based product	Valsad
Wheat based product	Ahmedabad
Tur based product	Vadodara
Soyabean based product	Dahod

Figure 17: Agro Production Clusters in Gujarat

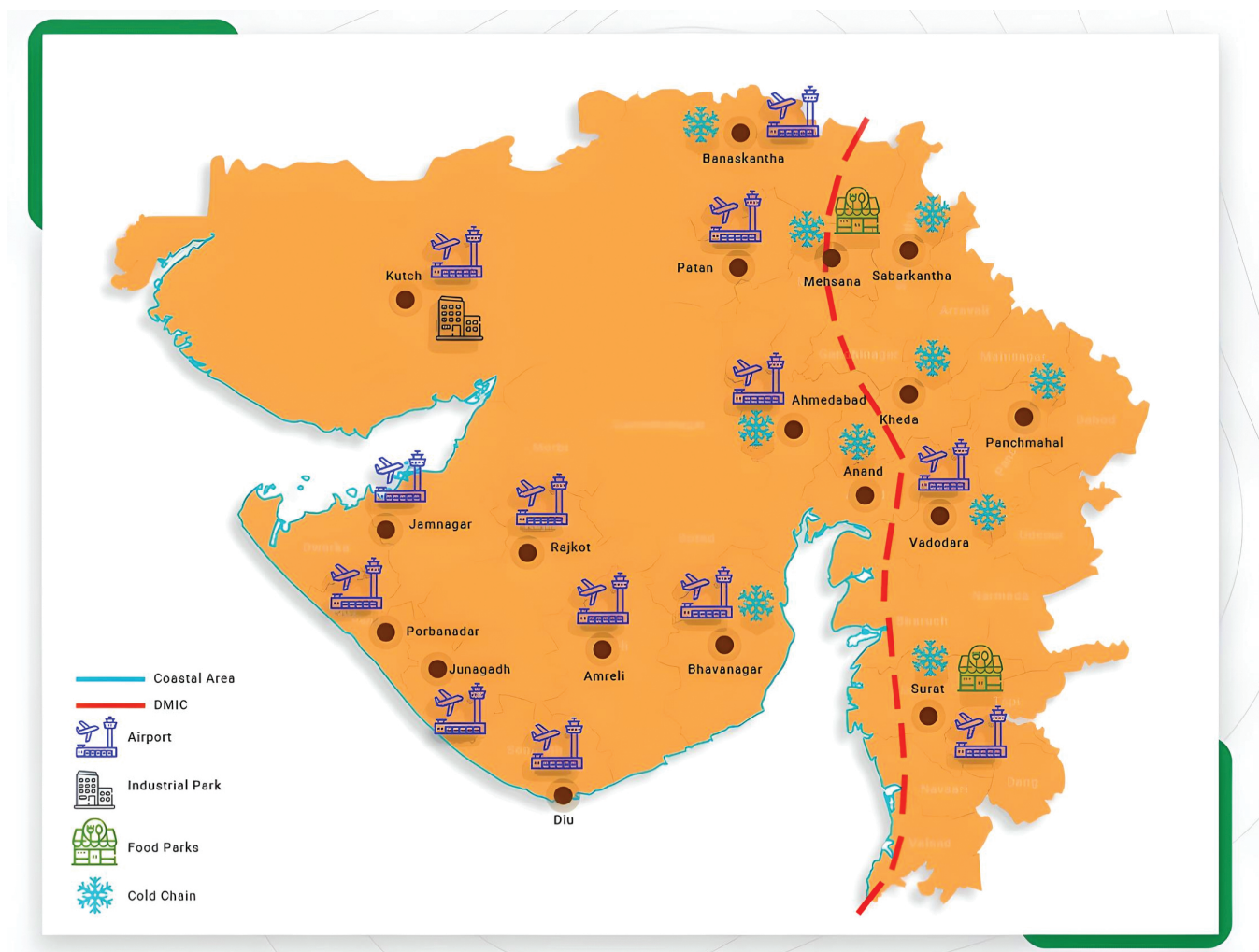
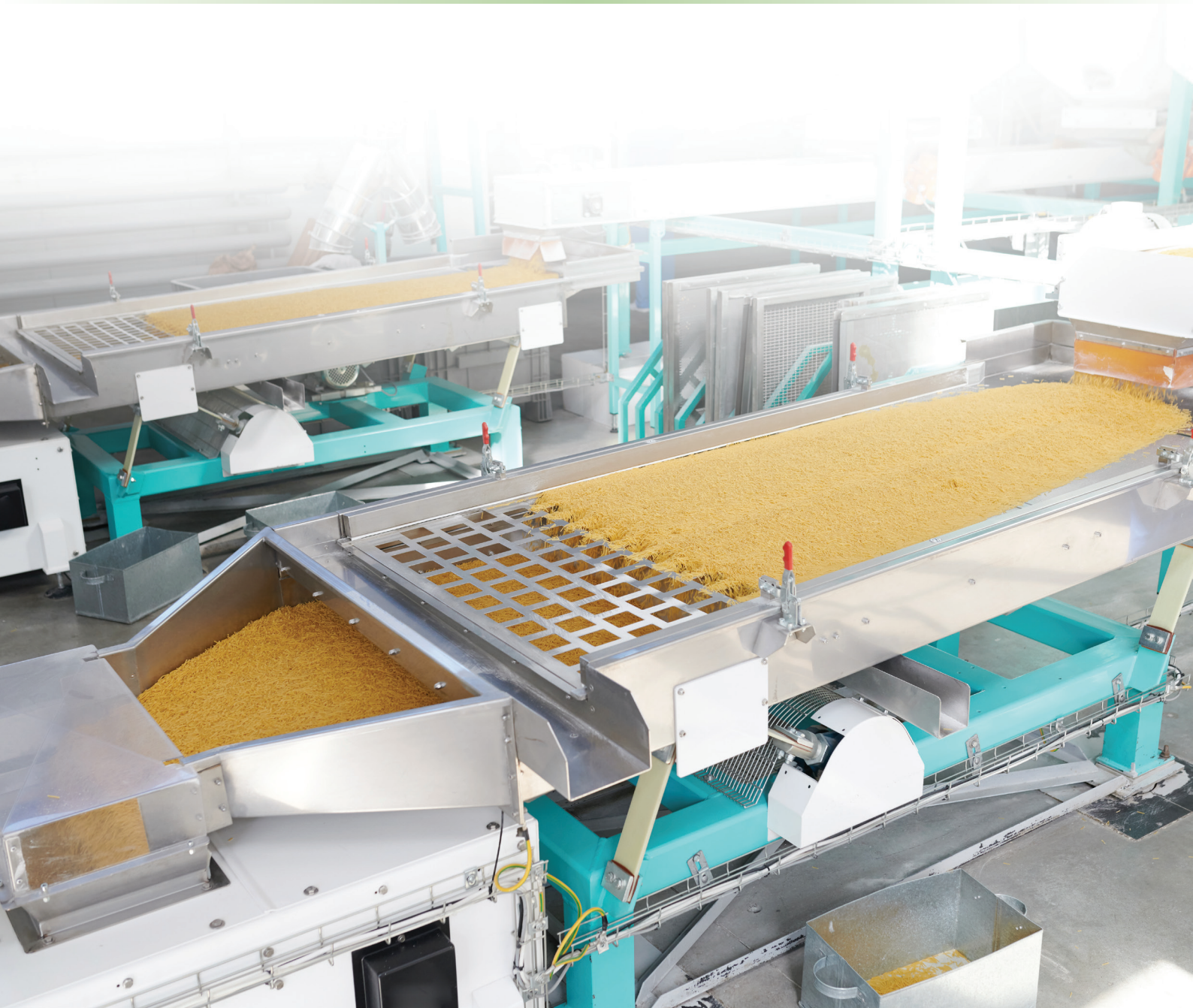


Figure 18: Infrastructure availability in Gujarat



Chapter 2

The Role of Technology in Food Processing



The Indian food processing industry is currently experiencing transformation due to evolving consumer behaviours and the rapid adoption of technology. A significant driver of this shift is the millennial demographic, with approximately 49% participating in online grocery shopping and shaping the industry's direction. Notably, there is a rising trend toward online purchasing in categories with longer shelf lives, such as snack bars and cereals, where it is projected that around 40% of volume will transition online by 2025.

Consumer preferences have shifted to emphasize speed, affordability, accessibility, safety, transparency, and reliability. In response, food and beverage (F&B) companies are rapidly integrating artificial intelligence (AI) and machine learning (ML) to digitize their supply chains. This technological adoption enables companies to collect extensive data, leading to a more comprehensive understanding of key variables and improved operational efficiency and predictability.

The adoption of artificial intelligence (AI) in the food and beverage sector was valued at USD 3.07 billion in 2020 and is projected to soar to USD 29.94 billion by 2026, reflecting an impressive compound annual growth rate (CAGR) of over 45.77%. AI is significantly influencing the industry, particularly in enhancing flavor profiles and developing healthier, environmentally sustainable recipes, with trends such as lab-grown meat, plant-based alternatives, and innovative processing methods like

vacuum and freeze-drying for healthier snacks gaining momentum.

Businesses are increasingly leveraging technology to deliver transparent product information in real-time through simple scans, driven by the widespread availability of handheld devices. Blockchain technology is gaining traction in the food and beverage industry for its ability to ensure transparency and build consumer trust through immutable transaction records. Additionally, Internet of Things (IoT) technology is instrumental in capturing real-time data, such as temperature and humidity during product storage, thereby improving efficiency and regulatory compliance in international trade.

Cloud kitchens have emerged as a significant development following the COVID-19 pandemic, focusing exclusively on fulfilling online orders. Strategically located for optimal food delivery, these kitchens are becoming more popular as consumers increasingly prefer online ordering. In India, food ordering is experiencing a CAGR of 16%, expected to reach USD 17 billion by 2023. Cloud kitchens are projected to achieve a market size of USD 1.05 billion by 2023, prompting many restaurants to consider this model either as a standalone business or as part of a hybrid strategy. Despite initial challenges, industry leaders anticipate that this model will establish itself as a dominant channel within the food and beverage landscape in the coming years.



Four Strategies for Food Processors and Manufacturers to Minimize Their Environmental Footprint

1. Adopt Eco-Friendly Packaging

Packaging is a major contributor to environmental waste, with over 78 million metric tons of plastic packaging produced annually, of which only 14% is recycled. Most plastic is derived from non-renewable resources like oil or natural gas, ultimately contributing to landfill waste. A growing trend among manufacturers is the shift towards wood- and paper-based alternatives, which are biodegradable, renewable, and recyclable—provided they are sourced from sustainably managed forests. Additionally, innovative materials such as biodegradable packaging from seaweed, crops, and even fish skin offer promising solutions to replace single-use plastics. For metal packaging, sustainably sourced aluminum stands out as a responsible option, as recycling aluminum requires only 5% of the energy needed to produce new material.

2. Reduce Food Waste

The Food and Agriculture Organization (FAO) estimates that one-third of food produced for human consumption is wasted annually, equating to 1.3 billion tons. Food waste not only results in the loss of consumable goods but also squanders the resources used in production—water, soil, energy, and labor. Almost half of all food waste occurs during processing and manufacturing, often due to inefficiencies. By optimizing operational processes, measuring losses, and implementing targeted training programs, manufacturers can significantly cut down on food waste. In alignment with the EU's goal to halve food waste by 2030, legally binding targets are being set to drive waste reduction across the supply chain.

3. Enhance Energy and Water Efficiency

Food processing and manufacturing are resource-intensive, accounting for roughly 23% of the food industry's total energy consumption in the U.S. and requiring significant water usage for various processes. While maintaining production standards and safety requirements is paramount, there are substantial opportunities for improving efficiency. Implementing smart meters and adopting energy-efficient systems, alongside sustainable water management practices, can help reduce resource consumption without compromising output.

4. Source Sustainable Ingredients

The production of certain agricultural commodities, such as palm oil, cocoa, and coffee, is often linked to environmental degradation and social issues like deforestation, habitat destruction, and labor exploitation. Similarly, nearly 90% of global fisheries are either overexploited or depleted, threatening marine ecosystems and local communities. Food processors and manufacturers can mitigate these impacts by sourcing high-risk ingredients responsibly through certification programs such as the Roundtable on Sustainable Palm Oil (RSPO), the Marine Stewardship Council (MSC), and the Rainforest Alliance. These initiatives promote environmentally and socially responsible farming and fishing practices to ensure a more sustainable supply chain.

Opportunities for Technological Upgradation

Innovative technology has become the foundation for transforming the food processing industry, driving it towards remarkable growth. Advances in this sector enable food processing companies to improve shelf life, ensure food safety, and enhance overall quality standards. These technologies are redefining the future of food processing by pioneering methods that preserve freshness and flavor.

- **High-Pressure Processing (HPP)**

HPP serves as an effective method for microbial inactivation, eliminating pathogens without exposing food products to high temperatures. This results in an extended shelf life for products such as deli meats, juices, and ready-to-eat meals, while maintaining their original taste and nutritional value, thereby aligning with consumer demand for minimally processed foods. High-pressure processing (HPP) is widely utilized across various sectors, including dairy, seafood, and meat processing. This technology effectively reduces pathogens in products such as yogurt and fresh fruit juices, ensuring food safety while maintaining quality. In the ready-to-eat meals segment, HPP is essential for preserving the safety and freshness of items like salads and sandwiches. Overall, HPP represents a critical technology in the quest for safe, minimally processed, and high-quality food offerings that meet contemporary consumer expectations.

Case Study: High-Pressure Processing (HPP) in Cheese Production

High-Pressure Processing (HPP) presents several advantages in cheese production. It disrupts casein micelles, denatures whey proteins, raises the pH of milk, and enhances cheese yield, while simultaneously reducing rennet coagulation time (RCT). These benefits suggest that HPP could serve as an effective alternative to traditional heat treatment of milk. While heat treatment is effective at eliminating harmful pathogens, it can negatively impact cheese-making by increasing RCT and delaying maturation. Research demonstrates that HPP significantly reduces RCT and boosts cheese yield. Studies indicate a 15% increase in yield and a 30% reduction in whey proteins in the whey from cheeses produced with HP-treated milk. This improvement is likely due to interactions between whey proteins and casein. Furthermore, cheeses made from HP-treated milk exhibit higher moisture, salt, and total free amino acid content compared to those produced from raw or pasteurized milk.





Figure 19: Potential benefits of high-pressure processing method



- **Pulsed Electric Field (PEF) Technology**

Pulsed Electric Field (PEF) technology is gaining traction in the food processing industry as an effective method for deactivating microorganisms and enzymes, thereby extending the shelf life of various products without the need for traditional heat treatments. PEF enhances the extraction of intracellular compounds, preserving the quality and nutritional value of liquid foods, including juices and dairy products. Additionally, it is employed in meat tenderization, improving product quality without requiring lengthy marination or mechanical processes. Furthermore, PEF aids in the decontamination of food contact surfaces, enhancing overall food safety. The integration of Pulsed Electric Fields (PEF) technology necessitates meticulous consideration of optimal parameters and the acquisition of regulatory approvals for specific food applications. This cutting-edge technology effectively addresses microbial inactivation and enzyme deactivation while offering sustainable solutions for enhancing the extraction of valuable compounds and maintaining the quality of various food products.

Case Study: Pulse Electric Field (PEF) Technology in French Fries and Chips Production

PEF technology has become a global standard for pretreatment in the production of French fries and chips, offering significant process and quality improvements. By softening potato tissues through the release of cell fluid and reducing turgor pressure, PEF effectively replaces traditional pre-heating methods. This innovation leads to up to 90% reductions in both water and energy consumption, while also eliminating the need to heat the product.

The PEF process itself is highly efficient, with the treatment lasting only a few microseconds and a total cycle time of 5-8 seconds, depending on production capacity. Additionally, PEF ensures uniform treatment across all potatoes, regardless of size, resulting in smoother cuts and more flexible raw sticks. This reduces breakage and boosts yield. The technology also enhances product quality by lowering oil absorption by approximately 10% during deep-frying, promoting more even browning, and producing longer French fries.



- **Cold Plasma Technology (CPT)**

Cold Plasma Technology (CPT) is rapidly gaining traction in the food processing sector due to its versatile applications in enhancing food safety and extending shelf life. This technology generates a cold plasma state, composed of ions, electrons, and neutral gas particles. In food processing, CPT is utilized for surface decontamination, significantly reducing microbial loads on the surfaces of fruits, vegetables, and other food items. The reactive species produced during cold plasma treatment disrupt the cell membranes of bacteria and molds, effectively inactivating them and improving food safety.

CPT offers distinct advantages, including minimal impact on the sensory and nutritional attributes of treated food products. Unlike conventional thermal processes, CPT does not expose food to high temperatures, thereby preserving the original taste, texture, and nutritional value. This characteristic makes it particularly suitable for heat-sensitive items, such as fruits and vegetables, ensuring the maintenance of product quality while complying with stringent safety standards. As research and development in this field advance, CPT promises broader applications within the food industry, providing a sustainable and efficient method for enhancing food safety and quality.

Case Study: Cold Plasma Technology in Meat Processing

Cold plasma technology is increasingly being utilized in the meat processing industry to improve the quality of pork, beef, and chicken. It enhances product safety by addressing microbial contamination and extending shelf life. Research has demonstrated that cold plasma effectively eliminates harmful pathogens such as E. Coli, Salmonella, Listeria monocytogenes, as well as yeast and mold on various types of meat. In addition to its decontamination capabilities, cold plasma treatment enhances the functional properties of meat by reducing water immobilization within the protein myofibrillar network. This has proven particularly useful for surface decontamination of eggshell membranes, targeting pathogens like Salmonella enteritidis and S. typhimurium.

Furthermore, the application of atmospheric plasma jets on sliced ham and chicken meat surfaces has shown promising results in improving meat quality, making cold plasma a valuable tool for the industry.



- **Irradiation in Food Preservation**

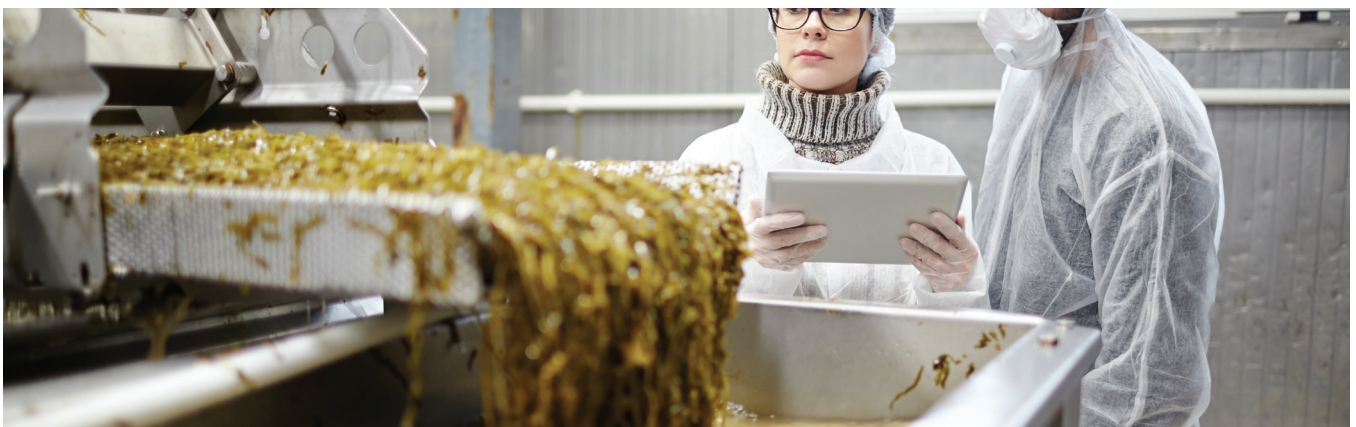
Irradiation is an effective food preservation technique that effectively eliminates or reduces microorganisms while maintaining the quality of the food. This method has gained widespread approval in over 55 countries, including major markets such as the USA, various European nations, Japan, and China. By utilizing gamma rays or X-rays, irradiation achieves microbial inactivation without the application of heat, allowing for the preservation of the food's natural characteristics. This process significantly reduces post-harvest losses, enhances meat colour, prevents sprouting, and controls contamination across a range of products. However, its effectiveness varies depending on the type of food, with limitations for products like milk and those high in lipids and vitamins, which may be susceptible to oxidative rancidity. Additionally, there are ongoing discussions regarding the impact of irradiation on packaging materials, particularly concerning the potential formation of harmful radiolytic hydrocarbons. Despite these concerns, the industrial adoption of irradiation continues to increase as consumers become more aware of the advantages of irradiated food products.

- **3D Printing**

3D printing, also known as additive manufacturing, is a transformative technology that is revolutionizing the food industry by enabling the layer-by-layer creation of edible products from digital models. This innovative method allows for personalized and customized food production, offering flexibility in modifying texture, flavor, shape, and size according to individual preferences. Additionally, 3D printing promotes sustainability by utilizing food waste and byproducts, thereby supporting eco-friendly practices within the sector. The food industry employs various 3D printing techniques, each with unique characteristics. For instance, extrusion-based printing deposits semi-plastic materials layer by layer, providing design freedom suitable for a range of food materials. Selective sintering uses lasers or hot air to fuse particles, facilitating the integration of different components. Binder jetting selectively binds powdered materials, while inkjet printing dispenses droplets, making it particularly effective for low-viscosity materials like chocolate.

Case Study: 3D Printing in Sustainable Packaging

In alignment with sustainability goals, researchers have pioneered the development of biodegradable cups infused with energy drink ingredients, requiring only the addition of water to prepare the beverage. This innovative approach can be extended to various packaging solutions, showcasing the potential of additive manufacturing (AM) to support plastic waste reuse and integrate biopolymers into food packaging. Leading food industry companies are now exploring the possibilities of AM for creating smart and intelligent packaging prototypes, further enhancing sustainability and product innovation.



- **Advanced Robotics**

Advanced robotics has become essential in the food processing industry, enhancing various stages of production through increased efficiency and precision. Automated robotic systems are utilized for tasks such as picking, sorting, and packaging, optimizing speed and accuracy while reducing the need for manual labor. In processing plants, robotic arms equipped with sensors and computer vision technology perform intricate tasks, including cutting, slicing, and portioning, ensuring consistent quality and minimizing product waste. These robotic systems contribute to higher production rates and operational efficiency, streamlining processes in the fast-paced food manufacturing environment. Moreover, advanced robotics significantly enhances food safety and hygiene. Robots equipped with sensors and cameras conduct routine inspections for quality control, effectively identifying and removing defective products from the production line. Autonomous robotic vehicles navigate food processing facilities, transporting raw materials and finished products while mitigating the risk of contamination associated with human handling. Overall, the integration of advanced robotics in the food processing industry not only boosts productivity and quality but also addresses key challenges such as labour shortages and stringent hygiene standards.

Case Study – Advanced Robotics

The dairy processing industry is increasingly embracing automation and robotics to improve efficiency, enhance product quality, and optimize production workflows. Robotics are now being integrated into multiple stages of cheese processing, including curd stirring and cheese slicing, alongside the implementation of automated milking systems.



- **Value Chain Optimization**

Technology plays a crucial role in enhancing efficiency throughout the food value chain, addressing complex challenges and promoting sustainability. From transforming agricultural practices and establishing transparent supply chains to reducing global food waste and influencing consumer behaviour, digital innovation is the cornerstone of positive change. The integration of technology improves operational processes while also contributing to environmental conservation, waste reduction, and informed decision-making, ultimately fostering a more sustainable and efficient food industry.

- **Farm-Level Technologies for Improved Yields and Post-Harvest Quality**

Farm-level technologies are vital in addressing the challenge of post-harvest loss (PHL) among smallholder farmers (SHFs), particularly in countries like India, where over 80% of farmland is managed by SHFs. The persistently high levels of loss at the SHF level, despite the availability of effective tools and practices to mitigate these losses, highlight a critical issue. The adoption of these technologies is essential for enhancing both yields and post-harvest quality. A key element is the implementation of efficient storage solutions and transportation methods. Advanced storage facilities with climate control features can significantly reduce spoilage and deterioration of crops, thereby minimizing PHL. Furthermore, improved transportation infrastructure ensures that produce reaches markets quickly, reducing the risk of damage during transit. Another crucial component is the utilization of precision agriculture technologies. These innovations, including sensor-based monitoring and data analytics, empower SHFs to optimize crop management. By providing real-time information on soil health, weather conditions, and crop maturity, farmers can make informed decisions that enhance productivity and reduce losses. Additionally, the adoption of sustainable farming practices, combined with training and educational initiatives, equips SHFs with the tools necessary for effective post-harvest management strategies, leading to increased yields and improved overall quality. Addressing the barriers to widespread adoption of these technologies is critical for realizing their potential impact on mitigating post-harvest losses and ultimately ensuring food security for communities that depend on agriculture for their livelihoods.



Benefits of Technological Integration

Automation has emerged as one of the most effective strategies in today's business landscape. A significant number of food processors are now adopting automated techniques. In the food industry, automation offers numerous advantages, including reduced labour costs, enhanced efficiency, and minimized risks of human error or contamination. Additionally, it helps maintain high food safety standards.

For manufacturers of food processing machinery, automation facilitates the maintenance of production quality, minimizes waste, and enhances operational efficiency. This allows businesses to allocate resources and time to other critical areas. Leveraging technologies such as robotics, artificial intelligence, and the Internet of Things (IoT), these systems can work collaboratively to improve overall performance.

Impact of Digitalization and IoT on the Food Manufacturing Industry

Improved Food Safety: The integration of IoT in the food processing sector has significantly reduced the risk of foodborne illnesses. Various sensors—monitoring temperature, production status, and shipping times—are now widely employed. Notably, real-time tem-

perature tracking sensors enable facilities to remotely monitor critical food safety data points, ensuring effective management of the cold chain. This data supports collaborative operations within the supply chain and ensures compliance with local and global food safety regulations. Furthermore, automated Hazard Analysis and Critical Control Points (HACCP) checklists throughout manufacturing, production, and transportation processes empower companies with actionable data to implement necessary food safety solutions.

Increased Operational Efficiency: IoT platforms, enhanced by machine learning algorithms, promote profitable and sustainable growth across the supply chain. These technologies provide valuable insights through digital data analysis, facilitating predictive maintenance, equipment performance monitoring, and real-time inventory tracking. IoT devices can capture operational data to identify inefficiencies in production lines, enabling companies to implement targeted solutions. Remote connectivity of these devices improves field support and enhances visibility in packaging operations. By monitoring equipment remotely, potential issues can be anticipated, resulting in significant time and cost savings.



Logistics Optimization: GPS systems and RFID (Radio Frequency Identification) transmitters allow for comprehensive monitoring of the distribution chain from storage to shipping to retail locations. RFID tracking enhances visibility within the food supply chain, automates shipping and delivery processes, and ensures temperature control during transit. This technology enables companies to track product locations via GPS, providing insights into customer behaviour, improving responsiveness to market demands, and reducing surplus. IoT technology also facilitates product tracking for both companies and consumers, enhancing supply chain transparency and fostering customer loyalty and trust.

Production and Storage Enhancements: Sensors play a critical role in quality control, workforce activities, and real-time analysis during food production. For instance, sensors can analyze flour for colour, moisture content, and protein levels, enabling real-time optimization of

the production process and allowing for immediate rectification of any discrepancies.

Waste Reduction: Globally, significant amounts of food are wasted annually, leading to financial losses and environmental damage due to greenhouse gas emissions. IoT technology facilitates the monitoring of food product conditions, providing real-time information to handlers and thereby reducing food wastage.

The Industry 4.0 revolution continues to drive the food industry toward innovative methods of connecting the supply chain with real-time product data. This advancement opens new opportunities for food manufacturers and retailers to leverage IoT technologies, maintain the highest quality standards in production, identify and resolve inefficiencies in the supply chain, exceed food safety regulations, and enhance transparency for customers.



Chapter 3

Skill Development in the Food Processing Sector



Over the years, India has made considerable strides in ensuring food security and achieving self-sufficiency in agriculture. As one of the world's largest producers of rice, wheat, milk, pulses, and various fruits and vegetables, India's agricultural output is substantial. However, despite this high level of production, the country's food processing industry remains underdeveloped when compared to other developed and developing nations.

The dairy sector leads with 35% of its production being processed, while the processing rates for fruits and vegetables are at a mere 2.2%, and meat and poultry products are at 21%—levels that highlight the need for greater expansion in food processing. Increasing this processing capacity will create opportunities for value addition, reduce food waste, and open up various employment prospects.

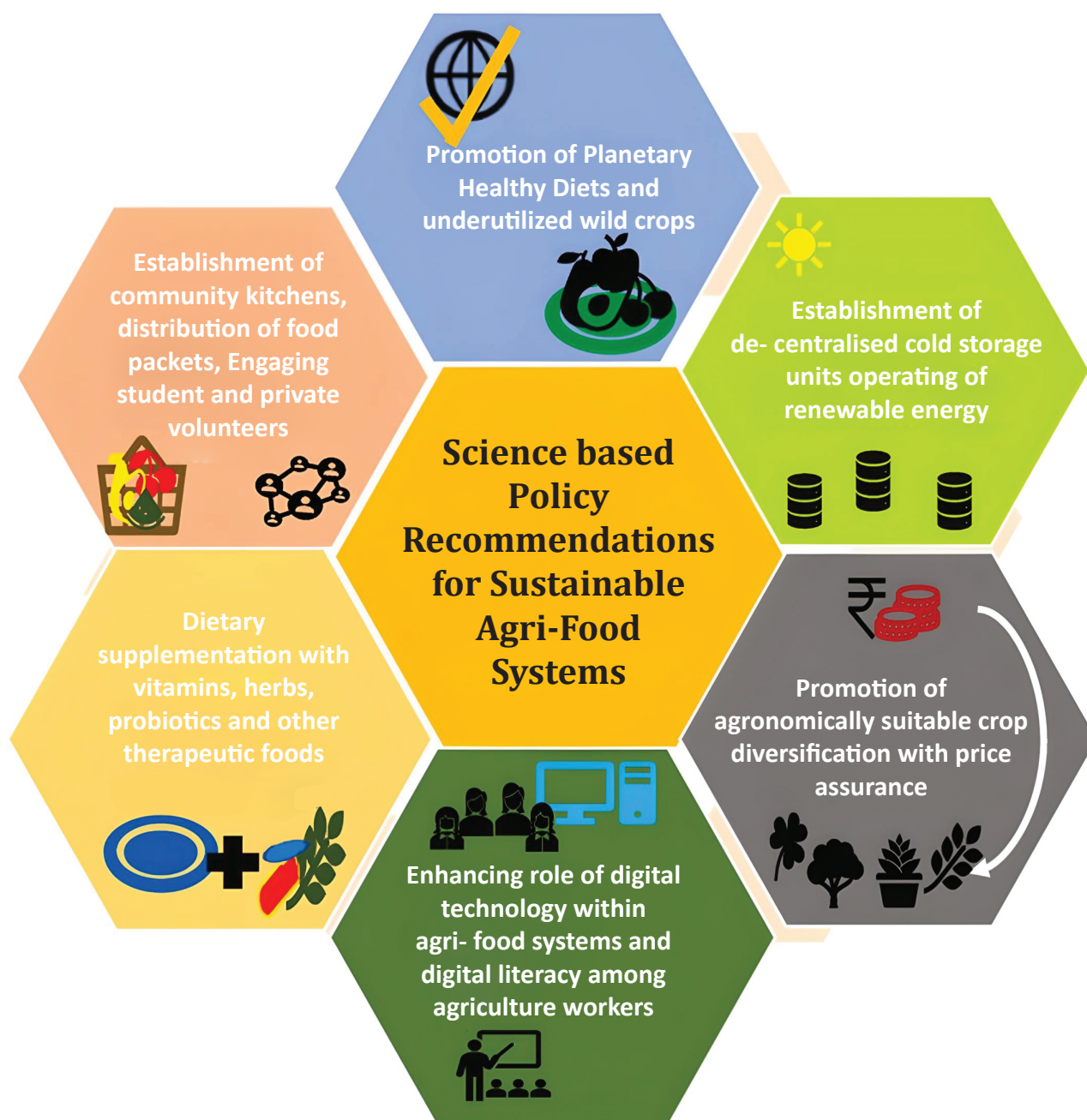


Figure 20: Science-based Policy Recommendations for Sustainable Agri-Food Systems

India's food processing sector is highly fragmented, largely dominated by the unorganized segment. Approximately 42% of manufacturing is handled by this unorganized sector, with 25% coming from the organized sector, and the remaining 35% contributed by small and local businesses. A significant portion of the workforce in the unorganized sector lacks formal skill training or educational qualifications, leading to a substantial skills gap. Recent technological advancements brought by Industry 4.0 are driving rapid changes in the sector, and the demand for a digitally skilled workforce with advanced technological literacy is set to grow.

Consumers are becoming increasingly conscious of safe, diverse, and nutritious foods. They are more concerned with the origin of their food, the methods of processing, storage, and shelf life, and are looking for greater variety to meet their specific needs. The rising awareness of processed foods, coupled with India's growing capabilities in creating a safe environment for food processing and the implementation of supportive policies and initiatives, is fuelling industry growth. With the potential for skill development in this sector, the future looks promising, presenting significant employment opportunities. The Indian food processing sector offers significant potential for skill development, as there is a considerable need for trained personnel across all ar-

reas, particularly for those with short-term training or education levels below Grades 10–12. A large portion of the workforce in the food processing industry lacks adequate education and possesses limited skills. This shortage of education and skills is hindering the industry's ability to fully capitalize on its workforce potential, contributing to stagnation. Additionally, there is a notable mismatch between the supply and demand of skilled labor in the market. Several critical skill gaps exist across various stages of the Indian food processing value chain, which must be addressed.

The growing consumer demand for quality products highlights the need for a workforce trained in basic hygiene and sanitary practices. Major skill gaps exist in areas such as food processing fundamentals, raw material storage, food safety, product development, and operational expertise. The industry urgently requires skilled personnel trained in these essential concepts. Furthermore, with the increased adoption of mechanization and technology, there is a growing demand for personnel with technical expertise who can operate specialized machinery, including imported equipment in specific sub-sectors. Emerging technologies, such as 3D printing and edible packaging, are entering the market, further emphasizing the need for highly trained and skilled professionals.

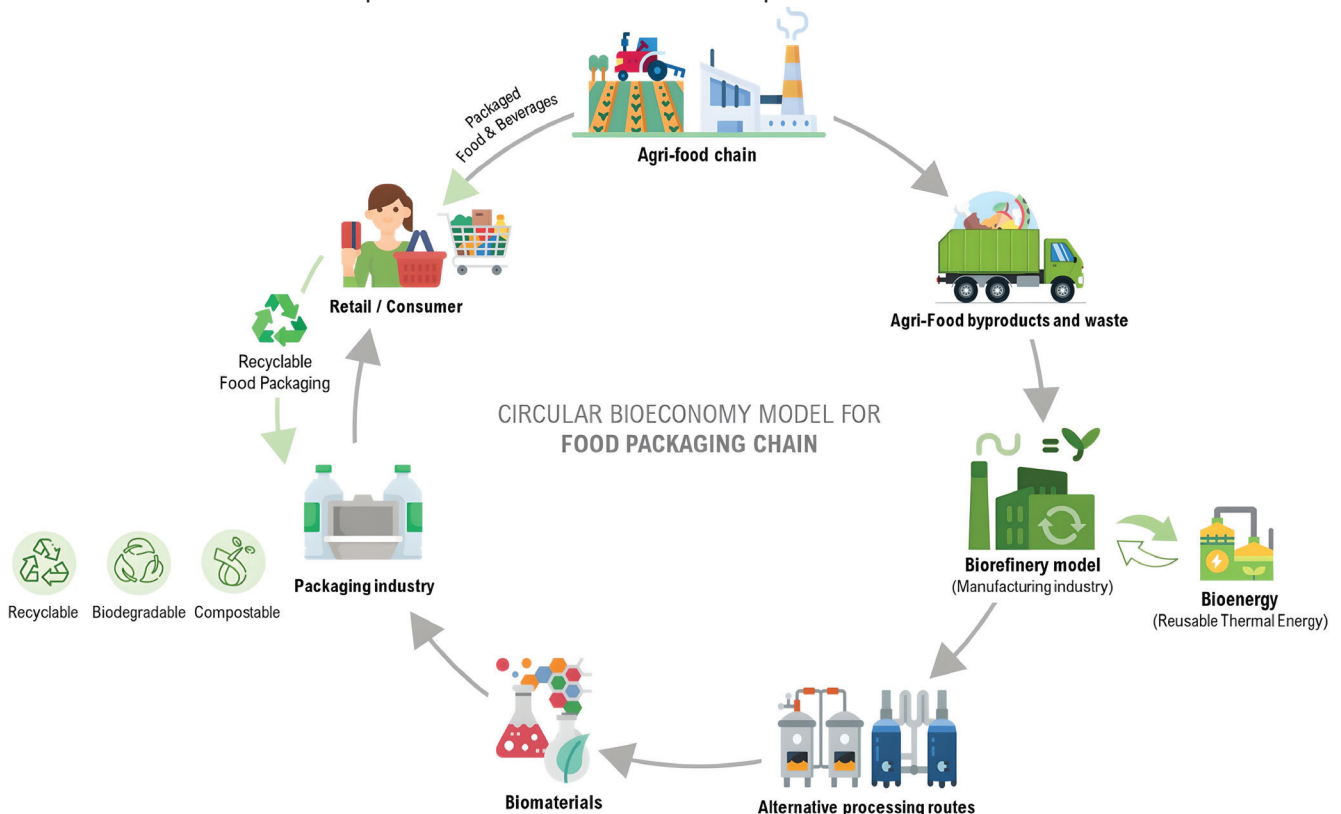


Figure 21: Circular Bioeconomy Model for Food Packaging Chain

As industrial processes become increasingly automated and digitized, the workforce will be responsible for more complex tasks. Skills in numeracy, literacy, problem-solving, information and communication technology (ICT), and soft skills like autonomy, teamwork, and coordination will be essential. Additionally, decision-making, critical thinking, and independent problem-solving are considered crucial for technical roles, such as production operators and control technicians. Front-end staff must also develop customer relationship management skills to effectively maintain relationships with institutional clients, such as hotels, restaurants, and retailers.

Farm procurement is another critical area that requires improvement. Processing units must streamline the supply of raw materials to meet rising demand. At the farm level, growers are often poorly equipped and lack awareness of best practices. Procurement staff must take a proactive role in providing crop and production advisory services. Additionally, the increasing emphasis on environmental sustainability has created a perception that “green skills” will be essential for maintaining the industry’s competitive edge. Consequently, the future workforce in the food industry will be expected to possess sustainability-oriented skills.

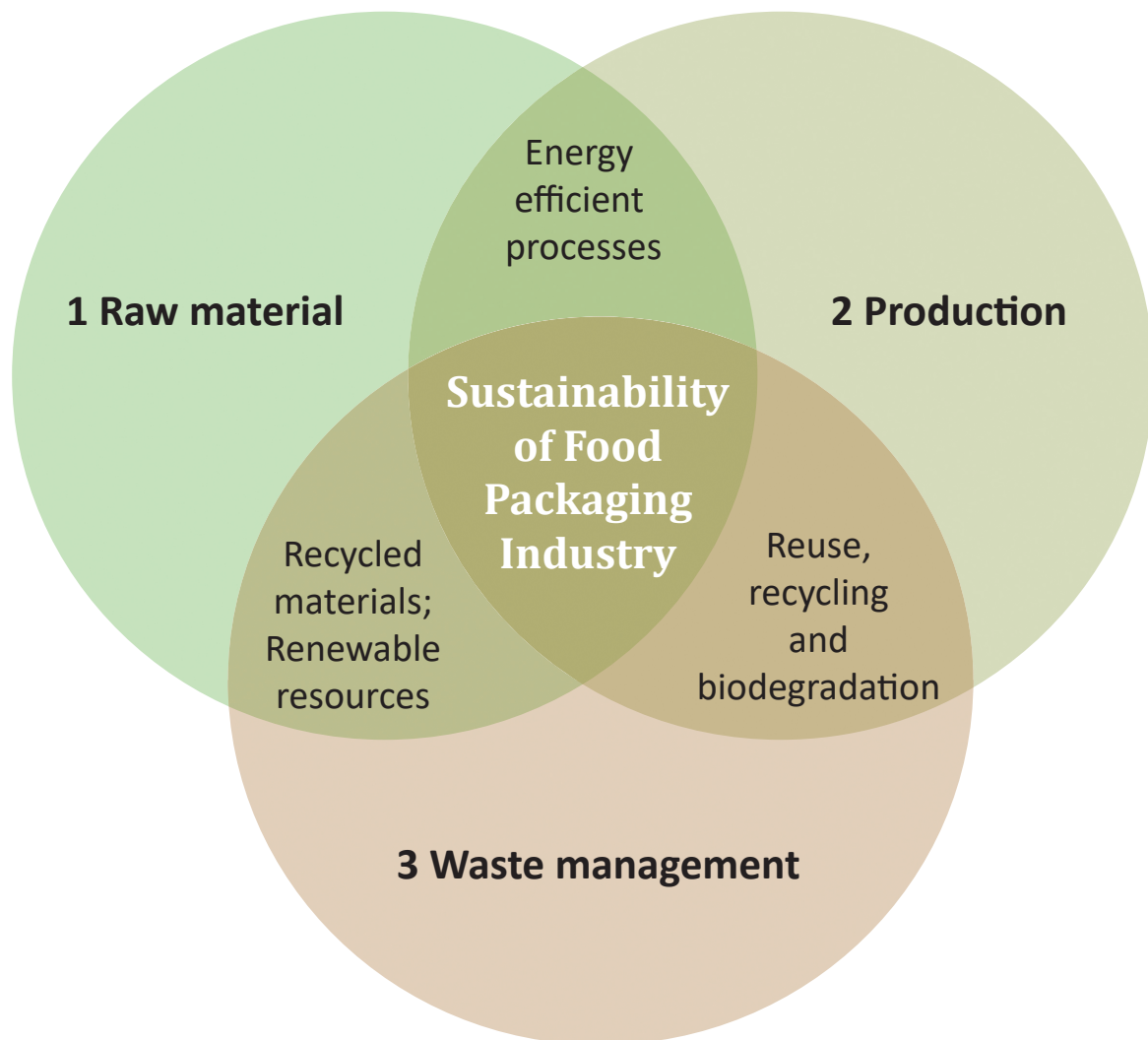


Figure 22: Sustainability of Food Packaging Industry

Skills Needed in the Food Processing Industry

The agriculture and food processing sectors are projected to account for approximately 24.5% and 33.7% of the total workforce demand, respectively. The addition-

al human resource and training needs are estimated to represent 6% of this overall demand. The Food Industry Capacity & Skill Initiative (FICSI) has identified a set of high-demand skills specific to the food processing sector¹³, as outlined in the table below.

Segment of Food Processing	Skills needed in the segment
Innovation and recipe formulation	Food Fortification experts, Value-added Nutritional product experts
	Plant-based Protein Developer, meat alternative foods, Vegan Foods
	Flavourists
Laboratory	Food Analyst
Auditing	Internal auditor- Food Safety Systems and quality assurance
	Internal auditor- lab
	Export Requirement
Start ups and entrepreneurship	Experts to Facilitate Food Start-ups
	Entrepreneurship skills in food processing
	Artisanal & Home-based entrepreneurs in various food processing sector
Sales and marketing	Marketing and sales personnel
	Food sales promoters
	Experts to automate the manual processes in the food industry
Industry 4.0 & Automation	Food Packaging Developer, Smart Packaging
	Automation engineers
	Robotic engineers
Food Safety and Hygiene	Food Safety team leaders
	Food Sanitation workers
	Hygiene or sanitation supervisors
Data analytics	Process control operators
	Statistical data experts
Quality control Quality Assurance	Consumer complaints handlers
Fruits and Vegetables	Food Preservation technicians
	Fruit technologists

Figure 23: Skills Needed for Food Processing

13. <https://facilities.aicte-india.org/KARMA/ssc-documents/Sector%20Skill%20Council%20Food%20Processing.pdf>

Industry growth, alongside the increasing need for quality standards and the adoption of advanced manufacturing technologies, is driving demand for new skills and upskilling in the sector. The Grain & Oilseed and Packaged Foods segments have seen the highest job growth between 2013 and 2022. However, technological advancements in sectors like Meat & Marine and Beverages are expected to reduce labour elasticity to 0.3-0.4 over the same period, leading to slower employment growth.

There will be significant demand for supervisory and technician roles at NSQF Levels 4, 5, and 6 from 2013 to 2022. As technology and automation become more widespread, technical roles, especially in maintenance, will become increasingly vital. Additionally, quality assurance roles will see higher demand due to stricter

quality standards and a focus on exports.

Employment Opportunities in Food Processing

In terms of GDP, employment, and investment, the food processing sector has become a critical component of the Indian economy. The industry directly employs approximately 13 million people and indirectly supports 35 million more. It contributes around 14% to the manufacturing GDP, valued at ₹2,80,000 crores. As per the NSSO's 73rd round (2015-16), the unregistered food processing sector employs 5.1 million people, accounting for 14.18% of employment in the unregistered manufacturing segment¹⁴. By 2022, the sector is projected to create 4.43 million new jobs, primarily in entry-level and supervisory roles.



Figure 24: Job Opportunities in Food Industry

14. Food Processing in India: Scope and Significance. Retrieved from: <https://www.geksforgeeks.org/food-processing-in-india-scope-and-significance/> Choudhury, R., N. (2022). Nutraceutical Demand Soaring in India. Future Market Insights (FMI).

With the growing population, the demand for processed food is rising, driving the need for more food processing industries (FPIs). However, significant skill gaps exist across the food processing supply chain, particularly in subsectors such as bottling and packaging. Given its unique blend of agriculture and industry, the food processing sector presents numerous opportu-

nities for growth. The industry's expansion, combined with increasing consumer demand for higher quality standards and the adoption of industrial technologies, underscores the need for targeted skill development and upskilling. Key demand drivers for the food processing industry, as illustrated in the figure, are discussed below:

Food Processing Demand Drivers

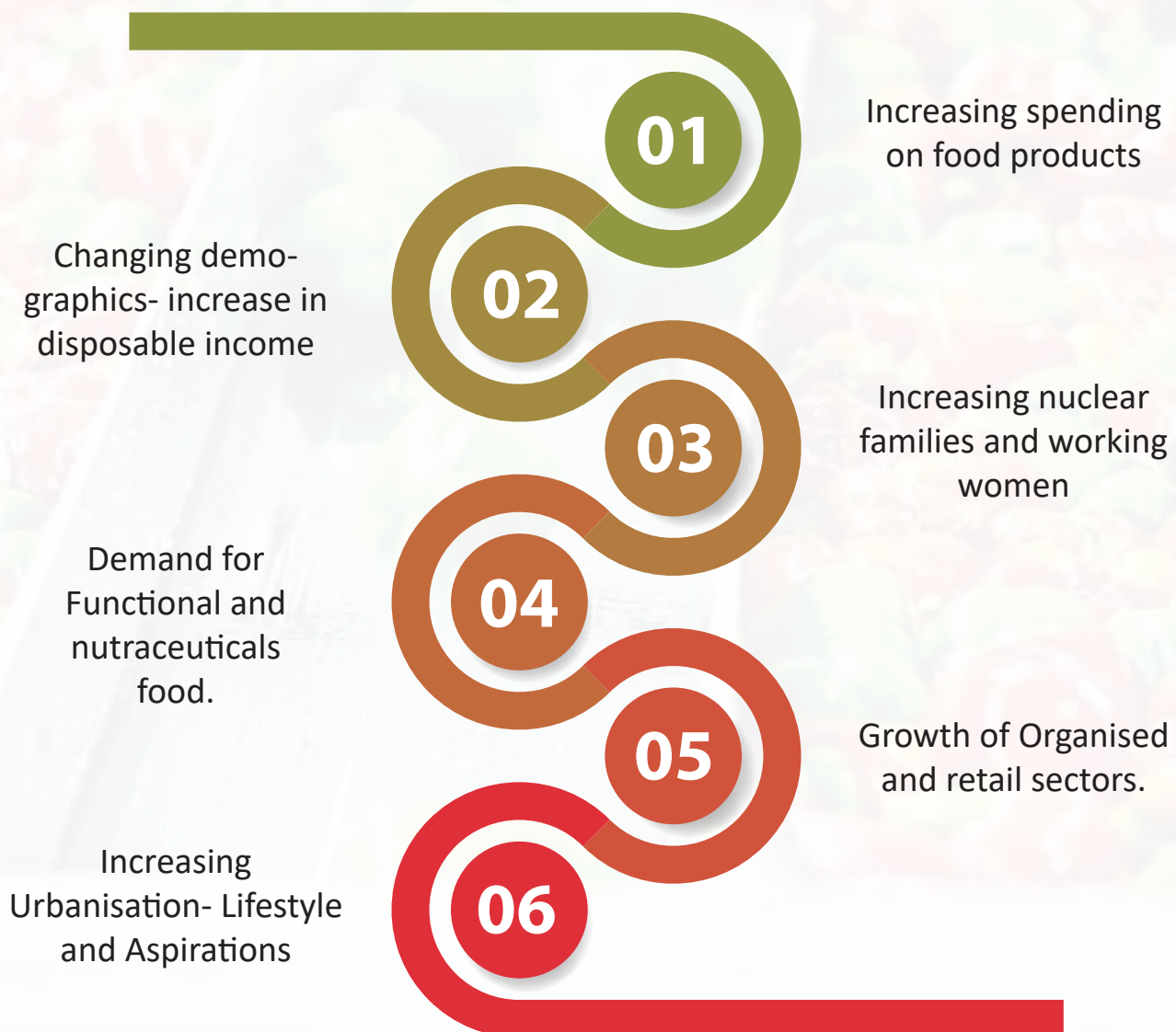


Figure 25: Food Processing Demand Drivers

According to the Indian government, India is the world's second-largest producer of dairy products, various fruits (such as bananas, guavas, papayas, and mangoes), and grains (including rice and wheat). This provides the country with a substantial supply of raw materials to support investments in the food manufacturing sector, both for domestic consumption and export¹⁵.

India's vast population, which is growing at an annual rate of 1.3%, presents significant market opportunities for both domestic and international stakeholders in the processed food industry. The country's expanding middle class, evolving dietary preferences among its younger population, and other demographic factors are driving the growth of the processed food sector. The development of India's food processing industry is closely

linked to the rise of the middle class, which has been a direct result of economic liberalization. Factors such as rapid urbanization, technological advancements, industrialization, the influence of Western lifestyles, increased female workforce participation, and higher disposable incomes are expected to further accelerate the growth of the food processing industry. This growth will demand greater utilisation of agricultural production, as well as significant improvements in food transportation and marketing¹⁶. Additionally, the evolving food system will lead to a shift in employment patterns, with a decline in the agricultural workforce and an increase in jobs related to transportation, wholesale, retail, food processing, and vending.

Strength	Weakness	Opportunities	Threats
- Year-round availability of raw materials. - Social acceptance of agro-processing as a significant sector, supported by the central government. - Extensive network of manufacturing facilities nationwide. - Large domestic market.	- High demand for working capital. - Limited availability of reliable, high-accuracy instruments and equipment. - Insufficient automation in information management. - Less competitive remuneration compared to contemporary disciplines, making it challenging to attract talent. - Underdeveloped connections between research and development laboratories and industry.	The country's extensive crop and material resources, driven by agro-ecological variability, present significant opportunities for agro-processing activities. The integration of advancements in contemporary technologies—such as electronics, materials science, computer technology, and biotechnology—provides ample scope for rapid enhancement and development. The opening of global markets could enable the export of our advanced technologies, facilitating additional income generation and creating new employment opportunities.	- Competition from global players. - Attrition of trained personnel to other industries and professions offering due to better working conditions may contribute to an increasing shortage of skilled labor. - Additionally, the rapid advancements in industry standards and requirements could result in the quick obsolescence of skills.

Figure 26: SWOT Analysis of Agro-Processing Industry Infrastructure in India

15. Impact of FDI on the Food Processing Industry in India. Retrieved from: <https://foodsafetyhelpline.com/impact-of-fdi-on-food-processing-industry-in-india>

16. The Food Price Crisis and Urban Food (in) Security. *Environment and Urbanization*, 22(2), 467-482.

India also boasts a rich diversity of medicinal plants, offering a wide array of indigenous ingredients for the nutraceutical sector. The country's tradition of Ayurveda and other forms of traditional medicine, which focus on natural products and self-care, is in high demand for delivering affordable health benefits globally. Reflecting this, the Union Budget 2021 proposed a 137% increase in healthcare spending, amounting to USD 30 billion, to support investments in nutraceutical supplements. In the coming years, there is expected to be strong demand for vitamin and mineral supplements, with herbal and protein/amino acid supplements anticipated to contribute significantly to market revenues, collectively representing half of total market income¹⁷.

India, the world's second most populous nation, presents significant potential for retail sector growth, driven by increasing urbanization and rising consumerism (PIB, 2022). The Indian government has adopted a liberal and transparent approach to attracting foreign direct investment (FDI), with most sectors open to FDI under the automatic route. Between 2000 and 2016, FDI inflows were estimated at approximately USD 7.5 billion, representing a 2.3% global share. The highest investment during this period occurred in 2013-14, totaling USD 3.98 billion.

From April 2014 to September 2021, FDI equity inflows into the sector reached USD 4.99 billion¹⁸.

Vocational Education and the Food Processing Sector

India, as the world's youngest country, stands to gain significantly from its demographic dividend if it equips its workforce with the right skills. By integrating vocational education at the school level, the nation can

better align its workforce with the demands of rapidly evolving industries. However, the diverse nature of this demographic makes it challenging to implement a one-size-fits-all skilling program that meets the needs of various regions. Global frameworks for skill development typically categorize competencies into two main types: basic, universal skills required by all potential and current employees, and specialized, profession-specific skills. To maximize the benefits of its workforce, India must embed Vocational Education and Training (VET) as a key element throughout the education system.

In the food processing sector, VET programs can focus on areas such as food preservation, safety, quality, and production. These programs should be designed with strong collaboration between industry and academia to ensure they address both current and emerging industry needs. The goal of vocational education in this sector is to equip students with culturally relevant, sustainable skills tailored to the demands of food processing. Vocational training in food processing technologies encompasses specialized modules on recent industry trends, global food markets, advanced processing techniques, food preservation and storage, value-added product development, and supply chain management. The curriculum also includes training on the latest technological advancements and commercial viability within the food industry. A unique aspect of the program is the inclusion of managerial skills workshops aimed at fostering leadership, capacity building, and assertiveness—key attributes for future entrepreneurs in the food processing sector. National initiatives such as Atmanirbhar Bharat, Skill India, Make in India, the National Mission on Food Processing, the Pradhan Mantri Kisan Sampada Yojana (PMKSY), and the PM Formalization of Micro Food Processing Enterprises further emphasize the importance of skill development in supporting the country's transition to Industry 4.0.



17. Government Initiatives and Measures in the Food Processing Sector. Retrieved from: <https://www.insightsonindia.com/agriculture/food-processing-and-related-industries-in-india/government-initiatives-and-measures-in-food-processing-sector/>

18. https://www.indiabudget.gov.in/economicsurvey/ebook_es2022/files/basichtml/page282.html#:~:text=The%20sector%20has%20witnessed%20FDI,the%20corresponding%20period%20last%20year

Factors Affecting Production, Processing, and Distribution in India

	Production	Output Trading	Processing	Distribution/ Retailing
Skill	Traditional methods of farming	Subscale farm sizes Farmer indebtedness 70 % rainfall dependent	Exposure to low scale operations. Limitations in Retail Man-agreement purchase skills and management of large operations.	Skills required for modern retail formats relatively unknown.
Technology	No/low use of technology Low levels of mechanization. Low use of hybrids, biotechnology.	Very low investment in storage & handling technology Few upcoming commodity exchanges	Outdated technology due to small scale operations Low capacity units	Skills required for modern retail formats relatively unknown.
Regulations	Corporates not allowed in non-plantation farming No enforceability in contract farming	Procurement intervention by Govt. agencies MSP policy Restriction on storage and movement	Favorable to small scale investments Scope for large processors limited	Foreign Direct Investment not allowed Land costs are high due to inaction on land development
Capital	Funds availability to farmers are poor 80% borrow from adthiyas at very high rates	Controlled by small trader financiers	High-cost finance	The flow of capital is restricted due to ban on FDI
Structure	Subscale farm sizes Farmer indebtedness 70 % rainfall dependent	Large number of small trader-financiers Upcoming exchanges High wastage and transaction costs	Predominant small scale sector Low efficiency	The dominance of the informal sector Small traditional family owned stores are the norms No/limited backward linkages Large MNCs have good distribution channels

Figure 27: Factors Affecting Production, Processing, and Distribution in India

Chapter 4

Infrastructure Development for Food Processing



The food processing industry in India plays a critical role in the country's economy, contributing significantly to employment, agricultural sustainability, and food security. To meet the growing demand for processed food both domestically and internationally, India has been focusing on developing robust infrastructure to support this sector. The government's initiatives, advancements in technology, and investments from the private sector have all contributed to the rise of infrastructure development, positioning India as a global food processing hub.

Gujarat Agro Infrastructure Mega Food Park

Gujarat Agro Infrastructure Mega Food Park is an industrial estate dedicated exclusively to the food processing sector. It provides essential infrastructure and mechanisms to enhance the agricultural value chain, connecting farmers, food processors, and end consumers, including wholesalers, retailers, and exporters. The park strives to be recognized within the food and agricultural industry for its pivotal role in linking agricultural production to the marketplace through the use of cutting-edge technologies, innovation, high-quality service standards, and ethical business practices.

Key Infrastructure Developments in the Sector

- **Mega Food Parks:** Mega Food Parks have been one of the flagship schemes of the Indian government to strengthen the food processing sector. These parks provide a well-integrated infrastructure with state-of-the-art facilities for processing, packaging, logistics, and storage. Spread over 50 to 100 acres, they offer common facilities like cold storage units, testing labs, and warehouses, benefiting both farmers and food processors.

As of 2024, 42 Mega Food Parks have been approved, with several operational across various states. These parks have been strategically placed near key agricultural zones, improving farm-to-fork connectivity and minimizing wastage. The scheme also promotes Public-Private Partnerships (PPP), encouraging investment from the private sector in food processing infrastructure.

S. No	State/ UT	SPV/ IA Name	Date of Final/ in-principle Approval	Project Cost (INR Cr)	Amount of grant approved (INR Cr)	Amount of grant released (INR Cr)	Status
1	Gujarat (2 Projects)	Gujarat Agro Infrastructure Mega Food Park Pvt. Ltd., Surat	22.05.2014	121.86	50	45	Operational
		Fanidhar Mega Food Park Pvt. Ltd., Mehsana	16.08.2017	151.05	50	37.67	Under Implementation

Figure 28: Status of Implementation of 2 Mega Food Park Projects in Gujarat, As of December 2022¹⁹

19. https://www.mofpi.gov.in/sites/default/files/mofpi_annual_report_for_web_english.pdf

- **Cold Chain Infrastructure:** The development of cold chain infrastructure has been a priority for the Indian government, given that nearly 30-40% of perishable produce in India is wasted due to a lack of proper storage. To address this issue, the government launched the Pradhan Mantri Kisan SAMPADA Yojana (PMKSY), which provides financial assistance to develop cold storage facilities and refrigerated transportation.

India's cold chain infrastructure is being expanded to enable better preservation and reduce post-harvest losses. The number of cold storages has grown, particularly in agricultural regions, and there has been an increase in refrigerated trucks and railcars for temperature-controlled transportation of processed and fresh produce.

Facility	Required	Available	Gap	% gap
Cold storage (in million MT)	35.1	31.8	3.2	9.3%
Pack-houses	70,080	249	69,831	99.6%
Reefer vehicles	61,826	9,000	52,826	85.4%
Ripening chambers	9,131	812	8,319	91.1%

Figure 29: Gaps in Cold Chain Infrastructure 2014²⁰

- **Agri-Infrastructure Fund:** The Agri-Infrastructure Fund, launched in 2020, is another major initiative aimed at boosting infrastructure development in the food processing industry. With a corpus of INR 1 lakh crore (USD 13.5 billion), this fund provides financial support to farmers, farmer producer organizations (FPOs), and start-ups for developing farm-gate infrastructure like warehouses, processing units, and cold storage.

The fund emphasizes the creation of efficient supply chains by establishing decentralized infrastructure closer to the farm-gate. This move not only reduces transportation costs but also increases the quality and shelf life of agricultural produce.



20. <https://prsindia.org/theprsblog/food-processing-infrastructure-in-india>

- **Logistics and Supply Chain Modernization:** The food processing industry requires an efficient logistics network to transport raw materials and finished goods across the country and for export. The Indian government has made efforts to modernize and upgrade the logistics infrastructure by investing in highways, railways, and ports. The Dedicated Freight Corridors (DFCs) and Bharatmala Pariyojana highway projects are expected to provide faster connectivity between agricultural regions and food processing clusters.

In addition, Indian ports have been upgrading their capacity to handle food exports. The Sagarmala project focuses on port-led development, improving port connectivity for perishable and non-perishable processed food exports, further promoting India's role in global trade.

- **Food Testing and Research Facilities:** Quality and safety are crucial for the success of processed food products, both in domestic and international markets. India has been increasing its investments in food testing labs and research centers to ensure products meet international standards. Food safety laboratories and research institutions have been established to promote innovation, develop new processing techniques, and ensure the quality of processed food.

These facilities are helping Indian food processing companies access export markets by complying with strict international regulations on food safety and quality. On October 7, the Union Food Processing Minister announced that the government plans to establish 100 food testing laboratories and 50 food irradiation centers. This initiative is part of the government's strategy to enhance processing capabilities and ensure food quality²¹.

In global exports, the processed food segment is expanding significantly faster than the unprocessed food segment. Secondary and higher processed foods are experiencing a 5-6% compound annual growth rate (CAGR), compared to the 1-3% CAGR for unprocessed and primary foods²².



21. <https://money.rediff.com/news/market/govt-to-set-up-100-food-testing-labs-50-irradiation-centers/16775820241007>

22. <https://www.ibef.org/economy/economic-survey-2023-24>

Scope and Opportunities of Food Processing Industry (FPI)

The Food Processing Industry (FPI) in India is well-positioned to capitalize on a range of opportunities, driven by its inherent strengths and favorable conditions:

1. **Abundant Raw Material Supply:** India's leading global position in the production of milk, spices, pulses, grains, fruits, and vegetables ensures a reliable and diverse raw material base, providing a solid foundation for the food processing sector.
2. **Government Support:** The sector benefits from government initiatives, including attractive fiscal incentives and significant investments in ports, logistics, and supply chain infrastructure, which bolster the growth outlook for the FPI.
3. **Favorable Geographical Conditions:** India's diverse soil types, favorable agro-climates, vast freshwater resources, and extensive coastline offer ideal conditions for agricultural production and food processing.
4. **Established Manufacturing Network:** India's well-developed manufacturing facilities, coupled with its strategic location and proximity to key food-importing regions, create strong export opportunities for processed foods.
5. **Demographic Advantage:** A large, youthful population, along with focused skill development initiatives, ensures a steady supply of skilled labor, which is particularly beneficial for the labour-intensive nature of the FPI.
6. **Rapid Growth:** The impressive growth of the FPI in recent years underscores its potential as a dynamic and expanding sector with attractive investment prospects.
7. **Growing Domestic Demand:** With a population exceeding 1.4 billion and rising demand for branded and processed food products, the domestic market offers significant opportunities for growth.
8. **Global Market Expansion:** The removal of trade barriers and enhanced access to international markets provide Indian food processors with opportunities to expand globally and meet international demand.
9. **Infrastructure Investment:** There are lucrative opportunities for investment in advanced infrastructure, including cold storage, ripening chambers, food testing laboratories, modern storage facilities, and R&D, driving growth and innovation in the industry. On September 20, 2024, Tetra Pak, a global leader in food processing and packaging, entered into a Memorandum of Understanding (MoU) with the National Institute of Food Technology Entrepreneurship and Management (NIFTEM-K) in Kundli. This collaboration aims to foster innovation within the Indian food processing industry²³.
10. **Diversification of Processed Products:** The development of new product categories such as fortified foods, health foods, traditional Indian specialties, and convenience foods addresses changing consumer preferences and opens new avenues for market expansion and value addition within the FPI.



23. <https://www.aninews.in/news/business/tetra-pak-and-niftem-sign-mou-to-advance-food-processing-innovation-in-india20240920182830/>

Challenges for Food Processing Industry

Supply Chain Challenges

The complexity of the food supply chain, combined with irregular and unreliable raw material supplies, insufficient cold storage facilities, and inadequate transportation infrastructure, leads to inefficiencies and higher logistics costs.

High Storage and Packaging Expenses

Elevated storage costs for processed foods, compounded by the high cost of packaging materials, contribute significantly to overall production costs, reducing profitability for food processors.

Export Infrastructure Limitations

The lack of robust export infrastructure, such as efficient ports and airports, restricts the ability of Indian food processors to access international markets and compete effectively with global leaders.

Food Wastage

Food wastage remains a critical issue, with approximately 40% of produce lost, as per FAO estimates. Additionally, low processing rates of agricultural goods hamper the sustainability and efficiency of the food processing industry (FPI).

Export Infrastructure Limitations

The lack of robust export infrastructure, such as efficient ports and airports, restricts the ability of Indian food processors to access international markets and compete effectively with global leaders.

Marketing Challenges

Indian food products face stiff competition from established global brands. Limited funding for branding and marketing further constrains market penetration and growth opportunities, both locally and internationally.

Skilled Workforce Shortage

The shortage of adequately skilled manpower, particularly in food processing, reduces the efficiency and productivity of FPI operations.

Quality Standards Compliance

Non-compliance with international quality standards, due to a lack of infrastructure for standardization and certification, as well as insufficiently trained personnel, undermines consumer confidence and market competitiveness.

Cultural Preferences

India's strong cultural preference for fresh, unprocessed foods and a societal reluctance towards processed foods create barriers to consumer acceptance of processed food products.

Insufficient R&D Funding

Limited investment in research and development within the food processing sector stifles innovation, technological progress, and product diversification, reducing competitiveness.

Ineffective Government Schemes

Overlapping, unclear government policies, coupled with inefficient execution, fail to address critical sectoral challenges, leading to resource wastage and ineffective policy outcomes.

Reliance on Imported Equipment

The reliance on imported food processing machinery, due to inadequate domestic production capabilities, hampers technological innovation and progress within the sector.



Foreign Direct Investment (FDI) in Food Processing Sector

In the Food Processing sector, 100% Foreign Direct Investment (FDI) is permitted through the automatic route. However, for trading food products manufactured or produced in India, including e-commerce, 100% FDI requires government approval. The sector attracted FDI equity inflows of USD 4.99 billion from April 2014 to September 2021. During the April to September 2021 period alone, FDI equity inflows reached USD 410.62 million, up from USD 220.42 million in the same period the previous year.

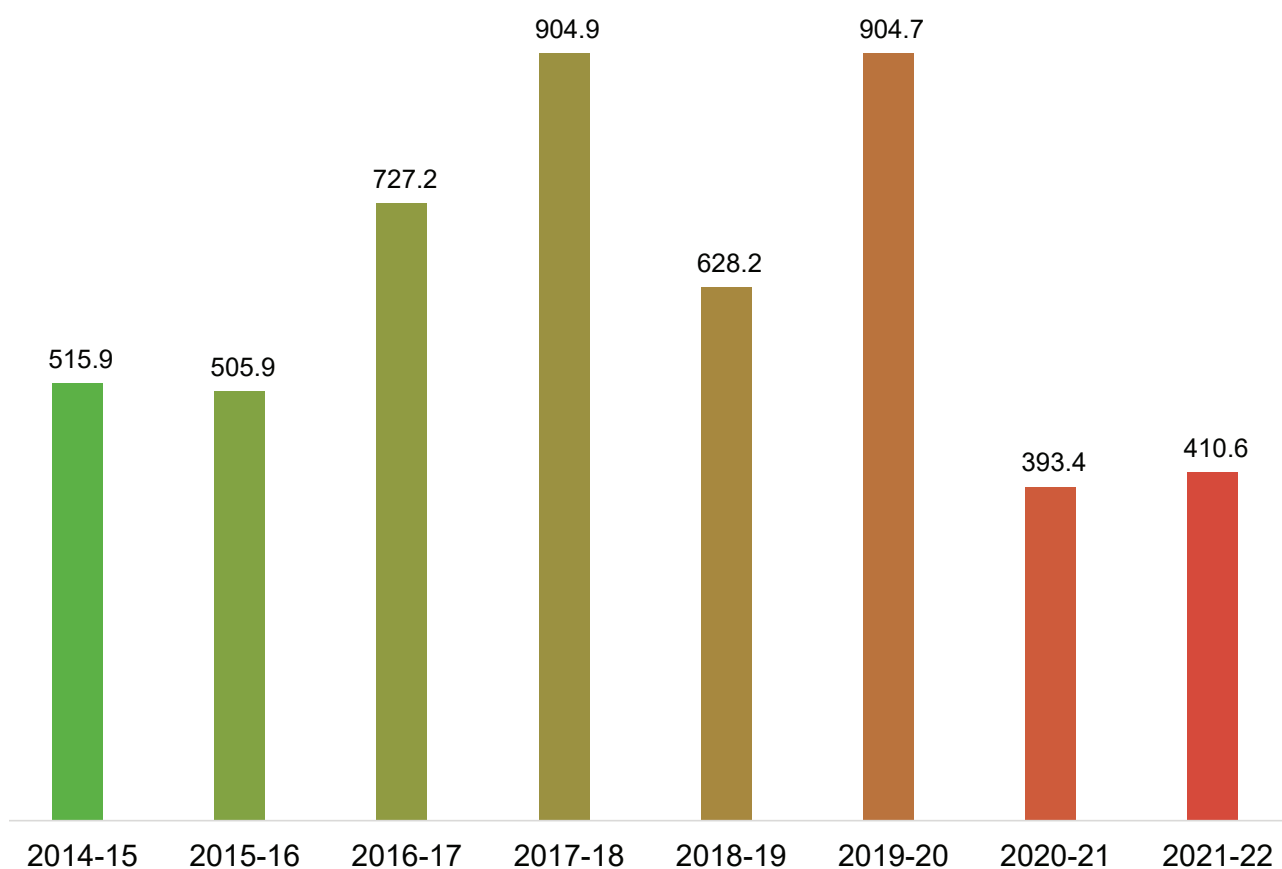


Figure 30: FDI Inflows in the Food Processing Sector (in USD million)



Factors responsible for localization of agro-based food processing industries in North-West India

Entrepreneurship Before and After Independence: North-West India has a strong entrepreneurial legacy, bolstered by a robust banking network even before independence. This enabled easy access to credit for entrepreneurs, laying the foundation for industrial growth.

Green Revolution: Punjab and Haryana were key beneficiaries of the Green Revolution, which modernized agriculture and significantly increased production. This agricultural abundance provided a solid base for the development of food processing industries.

LPG Reforms in the 1990s: The Liberalization, Privatization, and Globalization (LPG) reforms of the 1990s paved the way for multinational companies, such as PepsiCo, to engage in contract farming in Punjab. This initiative, which focused on crops like potatoes, chilies, and tomatoes, stimulated the growth of processing industries producing chips, snacks, and other related products.

Raw Material Availability: Punjab and Haryana possess well-established dairy industries, and local availability of key raw materials such as wheat and milk supports the food processing sector. Additionally, the region's favorable soil, climate, and topography are ideal for cultivating wheat, rice, and other food grains.

Government Support: The creation of Mega Food Parks in Punjab, Haryana, and Rajasthan, featuring shared infrastructure for weighing, packaging, labeling, and marketing, has significantly boosted the food processing industry. This government-backed initiative has encouraged further investment and growth in the sector.

Proximity to Market: The North-West region, especially Delhi-NCR and Uttar Pradesh, benefits from a high population density, driving demand for processed food products like bread, biscuits, and spices. Furthermore, the substantial Punjabi NRI diaspora presents an additional market for processed and canned food products from regional companies.





Chapter 5

Quality and Safety in Food Processing



Food safety and quality are essential at the household level, but they are even more critical in large-scale food production, processing, and environments where food is freshly prepared and served. Historically, much of the food consumed was processed at home. However, advancements in technology, processing, higher disposable incomes, and increased consumer demand have driven the production of a wide variety of processed and functional foods aimed at promoting health. Ensuring the safety of these products is paramount.

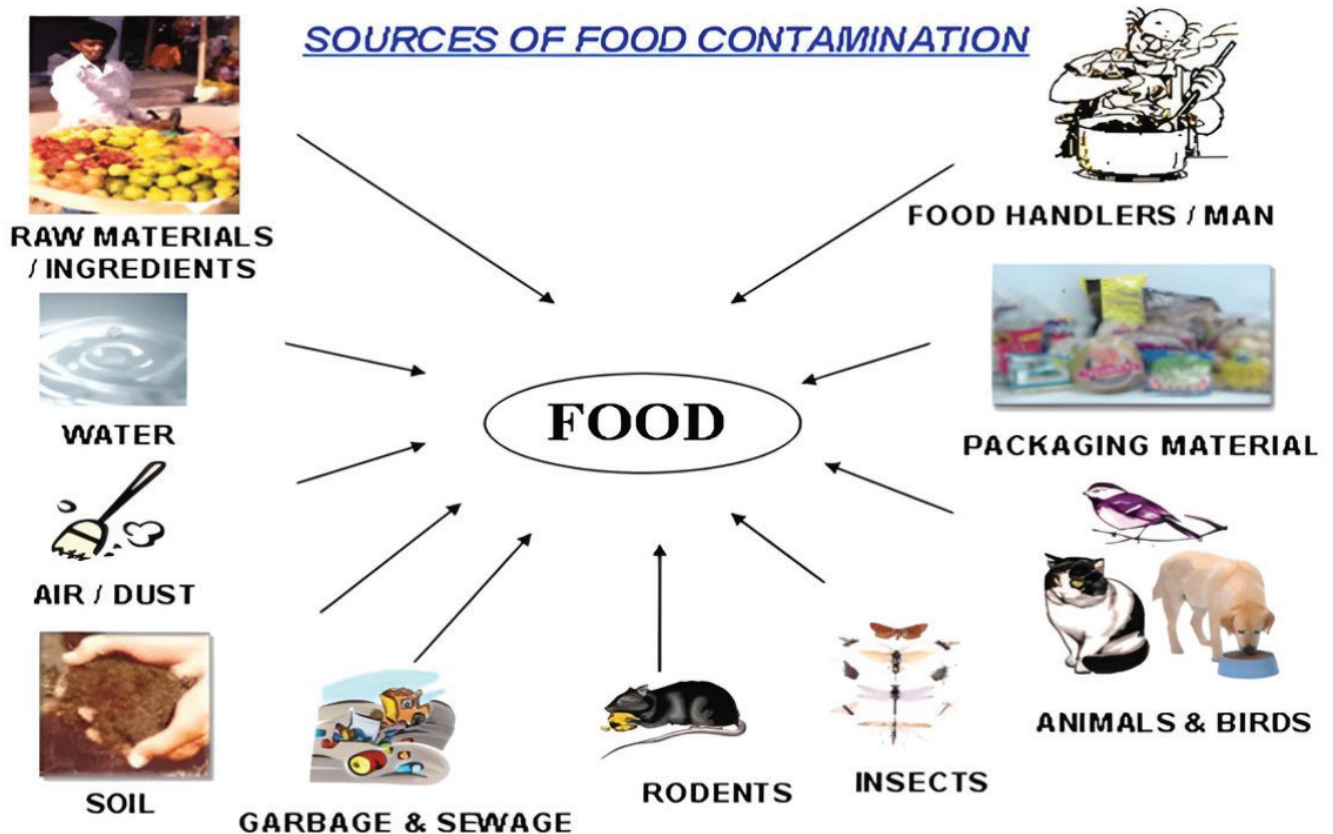


Figure 31: Sources of Food Contamination



The quality of both raw and processed food is a significant public health concern and requires proper attention. Over the past decade, food safety challenges—both globally and in India—have evolved, placing increasing importance on food quality and safety. Several factors contribute to this:

- With rapidly changing lifestyles and eating habits, more people are consuming meals outside the home. In commercial settings, where food is prepared in bulk and handled by multiple individuals, there is a heightened risk of contamination. Additionally, food is often prepared hours in advance, posing spoilage risks if not stored correctly.
- The prevalence of processed and packaged foods has increased, necessitating a focus on their safety.
- In the past, spices, condiments, and oilseeds were processed at home, and concerns about purity were minimal. Today, there is a high demand for pre-packaged spices, condiments, spice powders, and mixes, particularly in urban areas. This shift underscores the need to address the quality of both raw and processed foods.
- The logistics of transporting bulk food are complex, with significant time lapses between processing and consumption. Therefore, risk assessment and safety management during mass production and distribution are crucial.
- Factors such as microbial adaptations, antibiotic resistance, altered human susceptibility, and increased international travel have led to a rise in foodborne illnesses. Approximately half of all known foodborne pathogens have been discovered

in the past 25-30 years, and many foodborne illnesses remain of unknown origin. This presents a global public health concern, emphasizing the need for detecting and identifying emerging pathogens, as well as establishing active national and international surveillance networks.

- As a signatory to the World Trade Organization's (WTO) non-tariff agreement, India has gained greater access to global markets, presenting opportunities for international trade. In this context, every nation needs to protect the safety and quality of its food supply and ensure that imported products are of high quality and safe for consumption. Effective food standards and control systems are necessary to safeguard domestic food production and facilitate global trade. All food manufacturers must meet prescribed quality and safety standards and subject their products to regular testing.
- Environmental pollutants, including pesticides used in agriculture, contribute contaminants to the food supply. Additionally, the use of additives such as preservatives, colorants, flavoring agents, and stabilizers requires rigorous analysis of food for both nutrients and potential contaminants.

Given these factors, there is increasing concern for safe, wholesome, and nutritious foods in an ever-evolving food business landscape. This concern has significantly expanded the scope of the sector and created numerous career opportunities. Before exploring various career paths in this field, it is important to understand fundamental concepts related to food quality, food safety, risk assessment, food standards, and quality management systems.



WHO's response on food safety

- The World Health Organization (WHO) aims to enhance global prevention, detection, and response to public health threats arising from unsafe food. A key objective is to foster consumer trust in authorities and confidence in the safety of the food supply. To achieve this, WHO supports Member States in building their capacity to prevent, detect, and manage foodborne risks through several initiatives:
- Independent Scientific Assessments: WHO provides independent evaluations of microbiological and chemical hazards, which serve as the foundation for international food standards, guidelines, and recommendations known as the Codex Alimentarius, ensuring food safety regardless of origin.
- Safety Assessment of New Technologies: The organization assesses the safety of emerging technologies in food production, including genetic modification and nanotechnology.
- National Food Systems Improvement: WHO assists in enhancing national food systems, legal frameworks, and infrastructure to effectively manage food safety risks. The International Food Safety Authorities Network (INFOSAN), developed in collaboration with the UN Food and Agriculture Organization (FAO), facilitates rapid information sharing during food safety emergencies.
- Promotion of Safe Food Handling: WHO promotes safe food handling practices through systematic disease prevention and awareness programs, utilizing the WHO Five Keys to Safer Food messaging and training materials.
- Advocacy for Food Safety: WHO advocates for food safety as a vital component of health security and emphasizes the integration of food safety into national policies and programs, aligning with the International Health Regulations (IHR - 2005).
- To ensure food safety throughout the entire food chain, from production to consumption, WHO collaborates closely with FAO, the World Organization for Animal Health (OIE), and other international organizations.



Food Standards and Regulations in India

Voluntary Product Certification

Voluntary product certification includes grading and marking schemes such as the ISI mark from the Bureau of Indian Standards (BIS) and the Agmark certification. The BIS is responsible for the standardization of various consumer goods, including food products, and administers a voluntary certification program known as the 'ISI' mark for processed foods. Similarly, Agmark serves as a voluntary certification scheme for agricultural products, both raw and processed, aimed at ensuring consumer health.

Due to the complexity of multiple government regulations and laws, the food industry found compliance challenging. To address this issue, there was a recognized need to consolidate these regulations governing food quality. In response, the Indian Government enacted the Food Safety and Standards Act (FSSA) in 2006, which unifies various laws related to food safety under one comprehensive framework.

Food Safety and Standards Act, 2006

The primary objective of the FSSA is to consolidate food-related laws. The Food Safety and Standards Authority of India (FSSAI) was established under this Act to unify the various acts and directives previously governing food safety across different ministries and departments. The FSSAI is tasked with establishing science-based standards for food and regulating its manufacture, storage, distribution, sale, and import to ensure the availability of safe and wholesome food for human consumption.

The Act includes provisions for maintaining hygienic conditions in and around manufacturing facilities, as well as for the scientific assessment and management of health risk factors, which were not clearly defined in the Prevention of Food Adulteration Act (PFA). The FSSA represents a significant shift in food legislation from a focus on compositional or vertical standards to an emphasis on safety or horizontal standards, aligning with international best practices.

The Food Safety and Standards Authority of India (FSSAI) has been established under the Food Safety Standards Act, 2006, with the following key responsibilities:

Develop regulations that establish standards and guidelines for food products, along with enforcing compliance with these standards.

Establish mechanisms and guidelines for the accreditation of certification bodies overseeing food safety management systems in food businesses, as well as for the accreditation and notification of laboratories.

Offer scientific advice and technical support to both the Central and State Governments in formulating policies and regulations related to food safety and nutrition.

Collect and analyze data regarding food consumption, the incidence and prevalence of biological risks, food contaminants, and the presence of various residues in food products, while identifying emerging risks and implementing a rapid alert system.

Create a national information network to ensure that the public, consumers, local governments, and other stakeholders have access to timely, reliable, and objective information on food safety and related issues.

Provide training programs for individuals involved in or seeking to enter the food industry.

Contribute to the development of international technical standards related to food safety, sanitary, and phytosanitary measures.

Foster public awareness about food safety and relevant standards.

International Organizations and Agreements in the Area of Food Standards, Quality, Research and Trade

Since ancient times, governing authorities worldwide have sought to establish and enforce food standards to safeguard consumer health and prevent dishonest practices in the food industry. Numerous international organizations and agreements have contributed to improving food safety, quality, and security, while also facilitating research and trade. The primary organizations playing a pivotal role in this endeavour include:

1. Codex Alimentarius Commission (CAC)
2. International Organization for Standardization (ISO)
3. World Trade Organization (WTO)

Codex Alimentarius Commission (CAC)

The Codex Alimentarius Commission (CAC) is an inter-governmental organization established to develop international standards aimed at safeguarding consumer health and facilitating food and agricultural trade. As of 2017, CAC comprises 187 member countries and one Member Organization (the European Community), with India represented through the Ministry of Health and Family Welfare.

The primary objectives of the CAC include:

- Establishing mechanisms and guidelines for the accreditation of certification bodies for food safety management systems and laboratories, including the notification of accredited laboratories.
- Providing scientific advice and technical support to Central and State Governments in formulating policies and regulations related to food safety and nutrition.
- Collecting and analysing data on food consumption, the incidence and prevalence of biological risks, food contaminants, and residues, as well as identifying emerging risks and implementing rapid alert systems.
- Developing a national information network to ensure that the public, consumers, local governments (Panchayats), and other stakeholders receive timely, reliable, and objective information regarding food safety concerns.
- Offering training programs for individuals involved in or seeking to enter the food business sector.
- Contributing to the establishment of international technical standards for food safety, as well as sanitary and phytosanitary standards.
- Promoting general awareness of food safety and standards.



Spectrum of Processed Food

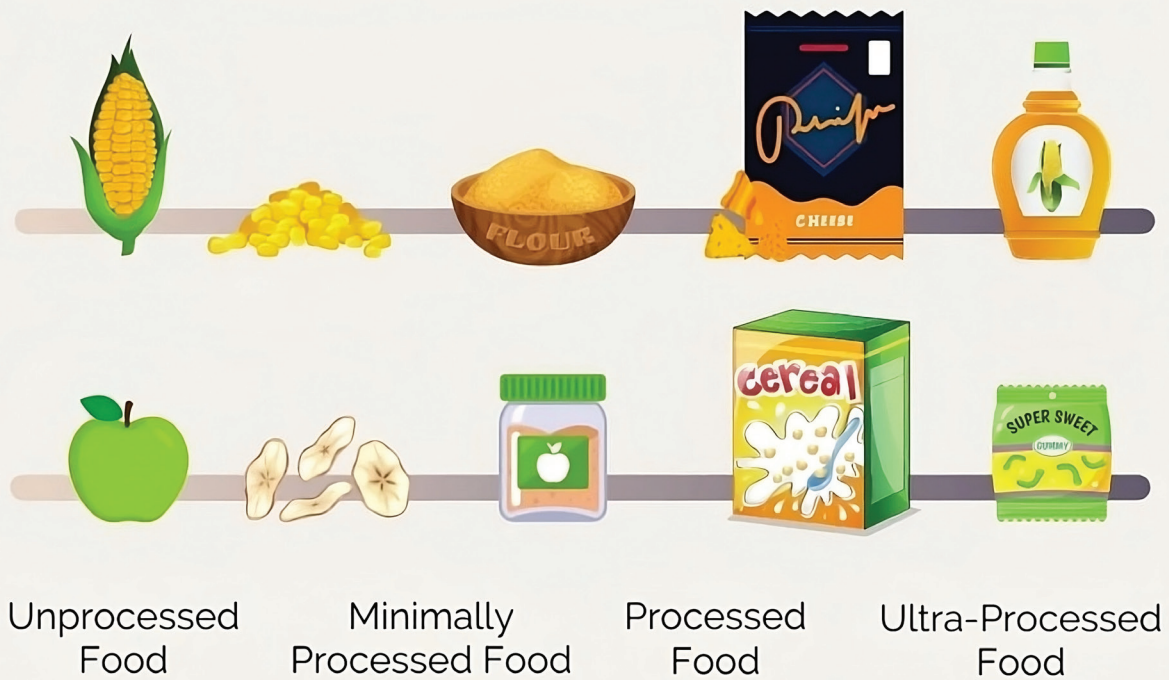


Figure 32: Spectrum of Processed Food

International Organization for Standardization (ISO)

The International Organization for Standardization (ISO) is a global, non-governmental federation of national standards bodies (ISO member bodies). ISO's mission is to promote the development of standardization and related activities worldwide, facilitating international trade in goods and services, and fostering cooperation in intellectual, scientific, technological, and economic

fields. The outcomes of ISO's work are published as International Standards.

ISO 9000 serves as an international reference for quality requirements, focusing on "Quality Management" within organizations. The adoption of these standards is voluntary.



Codex	ISO
• Used to develop national regulations • Slow to change • Describe the minimally acceptable practices	• Voluntary • Standards are reviewed every five years. • Describe current standard industrial practices.

Figure 33: A comparative overview of Codex Alimentarius and ISO standards

World Trade Organization (WTO)

Established in 1995, the World Trade Organization (WTO) aims to ensure the smooth, free, fair, and predictable flow of trade by administering trade agreements, resolving trade disputes, and assisting countries with trade policy matters. The WTO Agreement encompasses goods, services, and intellectual property.

To effectively implement and enforce standards, a robust Food Control System is essential. This system should include:

1. Food Inspection: Product conformity to standards is verified through inspection, ensuring that all food items are produced, handled, processed, stored,

and distributed in accordance with regulations and legislation. Food inspectors, appointed by government or municipal authorities, are responsible for assessing quality conformity in laboratories.

2. Analytical Capability: There is a need for state-of-the-art, accredited laboratories equipped to conduct food analysis. Additionally, personnel trained in laboratory management principles and proficient in physical, chemical, and microbiological food analyses are essential. A comprehensive range of analytical capabilities is required to detect food contaminants, environmental chemicals, biotoxins, pathogenic bacteria, food-borne viruses, and parasites.



Chapter 6

Government Schemes and Support



Central Government Initiatives

- The Government of India (GOI) introduced the Pradhan Mantri Kisan SAMPADA Yojana (PMKSY), overseen by the Ministry of Food Processing Industries (MoFPI), to promote the development of modern infrastructure and optimize supply chain management from farm to retail. The program seeks to stimulate growth in the food processing sector, enhance farmer incomes, create rural employment opportunities, reduce agricultural waste, improve processing levels, and increase exports of processed food products.
- The Agro Processing Cluster Scheme under PMKSY is focused on developing modern infrastructure and shared facilities to support the establishment of food processing units, following a cluster-based approach. This initiative connects groups of producers and farmers with processors and markets via a well-equipped supply chain. Each agro-processing cluster includes Basic Enabling Infrastructure (such as roads, water supply, electricity, and drainage systems) and Core Infrastructure/Common Facilities (such as warehouses, cold storage, individual quick freezing (IQF), tetra packing, sorting, and grading facilities). At least five food processing units, requiring a minimum investment of INR 25 crore (approximately USD 3 million), must be established in each cluster, with at least 10 acres of land procured through purchase or lease for a minimum period of 50 years.
- The “Integrated Cold Chain and Value Addition Infrastructure” Scheme under PMKSY aims to create an uninterrupted cold chain from farm to consumer, including pre-cooling, storage, and distribution. The scheme supports the development of temperature-controlled storage, packing, and transportation infrastructure for various product categories, such as horticulture, dairy, and meat. By October 2023, the cold chain infrastructure built through 372 completed projects included 1.03 million metric tons of cold storage capacity, Controlled Atmosphere (CA) and Modified Atmosphere (MA) storage, 335 metric tons per hour of IQF capacity, 175.8 lakh Liters per day of milk processing/storage capacity, and 1,860 reefer vehicles. Milk processing capacity is projected to double, from 53.5 MMT to 108 MMT, by 2025.
- The Mega Food Park (MFP) Scheme, also under PMKSY, integrates agricultural production with the market by connecting farmers, processors, and retailers. This scheme adopts a cluster-based approach, establishing modern food processing units in clearly defined agricultural and horticultural zones. Each park is equipped with supply chain infrastructure, including collection centers, processing units, and cold chains, as well as developed plots for entrepreneurs. As of December 2023, 41 projects were approved under the MFP scheme, with 24 operational.
- In the Union Budget for 2018-19, the “Operation Greens” initiative was introduced with a budget of



INR 500 crore (USD 71.5 million). Modelled after “Operation Flood,” the scheme aims to enhance Farmer Producer Organizations (FPOs), Agri-logistics, processing facilities, and professional management, initially targeting the Tomato, Onion, and Potato (TOP) value chains. Following the COVID-19 pandemic, the scheme was expanded to cover all fruits and vegetables (TOTAL) as part of the “Aatmanirbhar Bharat” economic revival package. The Union Budget for 2021-22 further extended long-term interventions, including Integrated Value Chain Development Projects, from TOP crops to 22 perishable crops.

- MoFPI also launched the PM Formalization of Micro Food Processing Enterprises (PMFME) Scheme, offering financial, technical, and business assistance to micro food processing enterprises to upgrade their operations.
- The One District One Product (ODOP) initiative under PMFME leverages economies of scale in input procurement, service provision, and product marketing. It aims to facilitate value chain development

and support infrastructure alignment. ODOP is approved for 713 districts across 35 States/UTs, encompassing 137 unique products.

- The Branding and Marketing Support Scheme offers a 50% financial grant to groups of FPOs, Self Help Groups (SHGs), and cooperatives to promote their existing or proposed brands, helping to market their processed food products.
- Food processing units benefit from complete profit tax exemptions for the first five years, followed by a reduced tax rate of 25% (30% for companies) for the subsequent five years. Additionally, 100% deductions on capital expenditure for cold chains or warehouses are allowed.
- Loans to food and agro-based processing units and cold chain projects are classified under agricultural activities for Priority Sector Lending (PSL).
- The government permits 100% Foreign Direct Investment (FDI) in the food processing sector through the automatic route, facilitating a streamlined and efficient investment process.

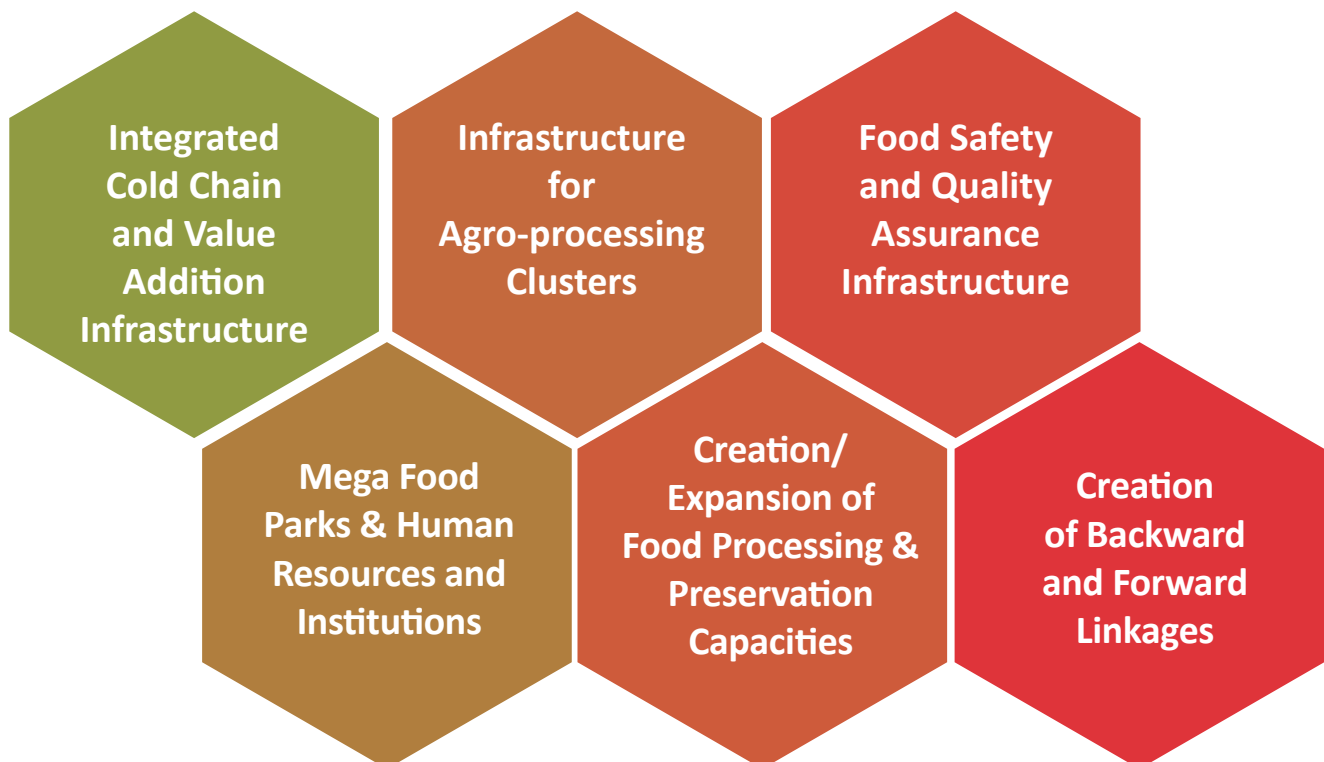


Figure 34: Government of India – Initiatives under the SAMPADA Scheme

The Union Cabinet, chaired by Prime Minister Shri Narendra Modi, has approved the implementation of the Production-Linked Incentive (PLI) Scheme for Food Products, aimed at enhancing India's manufacturing capabilities and boosting exports as part of the Atmanirbhar Bharat initiative. Under this scheme for the food processing industry, a total of 158 applications have been approved across various categories, including 22 out of 30 selected applicants focusing on millet-based products, which are primarily Micro, Small, and Medium Enterprises (MSMEs). The PLI scheme is expected to expand food processing capacity by nearly INR 30,000 crore and create approximately 250,000 direct and indirect employment opportunities by the year 2026-27. According to reports from PLI scheme beneficiaries, investments totaling around INR 7,099 crore have been made under this initiative.

Figure 35: Production Linked Incentive (PLI) Scheme ²⁴



24. <https://www.investindia.gov.in/sector/food-processing>

Central Government Initiatives

The Government of Gujarat has introduced several initiatives aimed at attracting investment, promoting sustainable agro-food processing, and enhancing the livelihoods of communities reliant on these sectors. These initiatives include various food processing and welfare schemes designed to support these objectives.

Particulars	Details
Assistance for Interest Subsidy	Mega Industries: Interest subsidy @ 7% on term loan for 10 years with a maximum ceiling of 1.2% of eFCI p.a. Large Industries: Interest subsidy @ 7% on term loan for 10 years with a maximum ceiling of 1% of eFCI p.a. MSME Industries: Interest subsidy @ 6% on term loan for 6 years with maximum ceiling up to 30 lakhs p.a.
Net SGST Reimbursement	Mega Industries: 100% of net SGST for 10 years with maximum ceiling 0.9% of eFCI p.a. for 20 years Large Industries: 90% of net SGST for 10 years with maximum ceiling 7% of eFCI p.a. MSME Industries: 90% of net SGST for 10 years with maximum ceiling 6.5% of eFCI
EPF Reimbursement	100% of employer's statutory contribution with ceiling of incentive to be 12% of the employee's basic salary plus applicable dearness / retaining allowance or ₹ 1800 per month, whichever is lower after 10 years of commencement of operations
Reimbursement of SGST on capital goods for Mega industries	100% reimbursement of input SGST paid on capital goods to the extent input tax credit is admissible under Gujarat GST act, 2017
Reimbursement of stamp duty and registration fees for Mega Industries	100% reimbursement for purchase and/or lease of land
Other incentives as per Electricity Act 2003	100% electricity exemption for first 5 years from date of commercial production – as per Gujarat Electricity Act, 2003

Figure 36: Atmanirbhar Gujarat Scheme 2022

Particulars	Details
Credit-linked capital subsidy	Credit linked subsidy @35% of the eligible project cost, maximum ceiling ₹ 10 lakh per unit Technical civil work should not be more than 30% of the eligible cost A minimum 10% of the project cost shall be from beneficiary contribution.
Support for setting up common infrastructure facilities	Credit linked subsidy @ 35% of the eligible project cost, maximum ceiling ₹ 3 Cr. per unit Total project cost should not exceed ₹ 10 Cr. Assistance of ₹ 50,000/- per case is provided to the applicant organization for the preparation of the Detailed Project Report.
Support to Self-Help Group	Seed Capital @ ₹ 40,000/- per member of SHG for working capital and purchase of small tools.
Reimbursement of SGST on capital goods for Mega industries	Grant up to 50% for branding and marketing support to a group of FPOs/ SHGs/ Cooperatives or an SPV of micro food processing enterprises. This is also applicable to ODOP products at the state / regional level.

Figure 37: Pradhan Mantri Formalization of Micro Food Processing Enterprises Scheme (PMFME)



Chapter 7

Conclusion



Conclusion

The food processing industry is recognized as a growing sector with significant development potential and social impact. It not only generates revenue but also adds value, earns foreign currency, reduces food waste, and enhances manufacturing competitiveness. With the right investments in food processing, technological innovation, and agricultural infrastructure, India has the potential to become a global food hub.

Food processing plays a vital role in addressing key challenges such as malnutrition through value-added products, food security through increased production and utilization, and food inflation by attracting foreign investment and boosting income growth.

To meet industry demands, skill-building programs must be tailored to the sector's specific needs and the learners' comprehension levels, ensuring quality, accessibility, evaluation, and monitoring. One of the biggest challenges posed by the industrial revolution in food processing is developing a skilled workforce capable of handling emerging technologies. This can only be achieved by bridging the current skills gap between the workforce and industry requirements, forecasting future skill needs, and delivering relevant training and education programs.

To foster the growth and competitiveness of the food processing industry, several strategic policy measures should be considered and implemented. The proposed establishment of a Food Processing Bank could effectively address the challenge of credit accessibility for entrepreneurs in the sector.

Moreover, the adoption of the Model Contract Farming Act would enable vital backward linkages, essential for scaling operations and ensuring the economic sustainability of food processing ventures. Prioritizing sector-specific credit for all related activities, along with offering fiscal incentives for the technological modernization of existing facilities, would further stimulate industry development.

Ensuring quality control through globally aligned standards, supported by specialized institutions, is critical to maintaining the safety and quality of processed food products. Additionally, integrating courses in food packaging, processing, and biotechnology into Agricultural University curricula would help cultivate the skilled workforce required for the sector.

Ultimately, the food processing industry has the potential to significantly reduce the wastage of perishable agricultural products, enhance export revenues, and promote agricultural sustainability, contributing to overall economic growth. Adopting food quality control as a strategic priority allows businesses to meet evolving customer demands while maintaining top-tier standards. Food manufacturers should assess current quality practices to identify opportunities for cost savings, enhanced efficiency, and improved product quality.

Food safety is a multifaceted issue that cannot be quantified by a single indicator. It requires the collective effort of all stakeholders within the food supply chain, including producers, manufacturers, transport and storage operators, subcontractors, retail and food service outlets, and service providers.

Furthermore, the growing complexity of global food systems calls for enhanced communication among all involved parties—scientists, risk assessors, risk managers, and consumers. Failures in food safety often stem from the numerous entry points for hazards throughout the production chain. The acceptable levels for food safety hazards are generally implicit and need to be clarified to facilitate a better understanding of food safety improvement processes for producers.

Given the aging population and the increasing number of individuals at risk for foodborne illnesses due to medical conditions, food and nutrition professionals need to engage in collaborative food safety initiatives within educational, research, and policy development contexts. Additionally, further research is required to assess the strengths and weaknesses of each country's legal framework and its impact on incentives for producing safer food.

While there are several encouraging factors indicating strong growth potential for the food processing industry in India, significant constraints remain that could hinder future expansion if not addressed promptly.

A primary challenge is the capital-intensive nature of the industry, which creates substantial barriers to entry and limits the number of market participants, thereby reducing competition and stifling efforts to enhance quality standards.

Key challenges include educating consumers about the nutritional benefits of processed foods, navigating low price elasticity for processed food products, establishing a robust distribution network, developing effective marketing channels, streamlining food regulations, improving food quality standards and strengthening food testing infrastructure, and enhancing the institutional framework to cultivate skilled manpower and bolster research and development capabilities to tackle global challenges. Addressing these challenges is essential to unlock the full potential of the Indian food processing industry.





About ASSOCHAM

The Associated Chambers of Commerce & Industry of India (ASSOCHAM) is the country's oldest apex chamber. It brings in actionable insights to strengthen the Indian ecosystem, leveraging its network of more than 4,50,000 members, of which MSMEs represent a large segment. With a strong presence in states, and key cities globally, ASSOCHAM also has more than 400 associations, federations, and regional chambers in its fold. Aligned with the vision of creating a New India, ASSOCHAM works as a conduit between the industry and the Government. The Chamber is an agile and forward-looking institution, leading various initiatives to enhance the global competitiveness of the Indian industry, while strengthening the domestic ecosystem.

With more than 100 national and regional sector councils, ASSOCHAM is an impactful representative of the Indian industry. These Councils are led by well-known industry leaders, academicians, economists, and independent professionals. The Chamber focuses on aligning critical needs and interests of the industry with the growth aspirations of the nation.

ASSOCHAM is driving four strategic priorities – Sustainability, Empowerment, Entrepreneurship and Digitisation. The Chamber believes that affirmative action in these areas would help drive an inclusive and sustainable socio-economic growth for the country.

ASSOCHAM is working hand in hand with the government, regulators, and national and international think tanks to contribute to the policy making process and share vital feedback on implementation of decisions of far-reaching consequences. In line with its focus on being future-ready, the Chamber is building a strong network of knowledge architects. Thus, ASSOCHAM is all set to redefine the dynamics of growth and development in the technology-driven 'Knowledge-Based Economy'. The Chamber aims to empower stakeholders in the Indian economy by inculcating knowledge that will be the catalyst of growth in the dynamic global environment.

The Chamber also supports civil society through citizenship programmes, to drive inclusive development. ASSOCHAM's member network leads initiatives in various segments such as empowerment, healthcare, education and skilling, hygiene, affirmative action, road safety, livelihood, life skills, sustainability, to name a few.



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New Age TechSci Research Pvt Ltd
B – 44, Sector 57, Noida,
National Capital Region, India - 201301
Tel: 0120-4523900 | 0120-4523920
Email: sales@techsciresearch.com
Web: www.techsciresearch.com



The Associated Chambers of Commerce and Industry of India

ASSOCHAM Corporate Office:

4th Floor, YMCA Cultural Centre and Library Building, 01

Jai Singh Road, New Delhi – 110 001

Ph: 011-46550555 • Fax: 91-11-23017008/9

Web: www.assochem.org

ASSOCHAM Regional Office (Gujarat)

*608, 6th Floor, Income Tax Cross Road, SAKAR III,
Ashram Rd, opposite Old High Court Road, Usmanpura,
Ahmedabad, Gujarat 380014*

Follow us on:



New Age TechSci Research Pvt Ltd

B-44, 2nd Floor, Sector-57 Noida,

National Capital

Region, India - 201301

+91- 7428761330