



FOOD PROCESSING

Towards Sustainable Growth Opportunities

The background of the lower half of the page is a photograph of several wooden crates filled with ripe, green pears. The crates are arranged in rows, and the pears are neatly packed. The lighting is bright, highlighting the texture and color of the fruit.

SECTOR PROFILE

FRUITS & VEGETABLES



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ABSTRACT

The Indian food processing sector has witnessed remarkable growth, surpassing a 9% average annual growth rate since 2014-15. The Gross Value Addition (GVA) in the food processing sector has shown a Compound Annual Growth Rate (CAGR) of 7.27% in the past five years. The sector contributes approximately 20% to the overall GVA at basic prices, highlighting its competitiveness and ability to cater to international markets. India's processed food exports have experienced a significant surge, reaching US\$13.07 billion in 2022-23. The Ministry of Food Processing Industries has provided support and incentives to the sector through its flagship schemes, such as the Pradhan Mantri - Kisan Sampada Yojana, Pradhan Mantri Formalisation Micro Food Processing Enterprises, and the Production Linked Incentive Scheme.

India holds the distinction of being the world's largest producer and consumer of milk, with significant advancements in the dairy processing ecosystem. The dairy sector has grown at a rate of 6.08% since 2014-15. India's milk production accounts for about 24% of the global milk production. The dairy processing sector in India offers a wide range of products, including milk, butter, cheese, ghee, yogurt, flavoured milk, lactose-free dairy products and value-added products like ice creams and yogurts.

The dairy processing sector in India is experiencing a favourable outlook, as there is a growing demand for dairy products both within the country and globally. Factors such as rising disposable incomes, changing consumption patterns, and demand for healthy food supplements contribute to the sector's growth. The growth of the dairy processing sector in India is supported by a strong regulatory framework, research and development initiatives, and government schemes focused on the sector's development.

The document also provides insights into the global trends in processed dairy products, highlighting the increasing demand for plant-based replacements and the potential impact of environmental regulations on the dairy industry. India can capitalise on the growing demand for dairy products globally as global demand for dairy products is projected to experience growth in various product categories including Skimmed Milk Product, cheese, whey powder, butter, and Whole Milk Powder. This document provides an overview of the global trends in processed dairy products, highlighting India's strength in dairy processing and its opportunities.

Overall, the Indian food processing and dairy processing sectors demonstrate significant potential and play a crucial role in contributing to the country's economy and meeting rapidly evolving consumer demand.

01.

INTRODUCTION

India has diverse agro-climatic zones and soil profiles enabling the growth of wide variety of tropical, sub-tropical and temperate fruits and vegetables. India is the second largest producer of fruits and vegetables worldwide. The extensive production base in India caters to its domestic demand and presents tremendous export opportunities.

The advance estimates of horticultural production, projects an increase in production for both fruits and vegetables is around 2.10%, which translates to approximately 7.03 million tons as compared to 2020-21. The value of output from fruits and vegetables increased consistently over the years a formed a prominent share of total value of agricultural outputs.

India is the world's largest producer of vegetables such as ginger and okra, and the world's second largest producer of potatoes, onions, cauliflowers, brinjal, and cabbages. While it is the leading producer of fruits including bananas, papayas, and mangoes.

In tapping the potential of fruits and vegetables processing in India, there is a significant possibility in the form of frozen (IQF), canned, pulp, puree, paste, sauces, snacks, dressings, flakes, dices, dehydration, pickles, juices, slices, chips, jams and jellies.

VALUE OF OUTPUT FROM FRUITS AND VEGETABLES VIS-À-VIS ALL AGRICULTURAL CROPS

ITEMS / YEAR	2015-16	2016-17	2017-18	2018-19	2019-20
Total Fruits and Vegetables	3,107	3,260	3,407	3,423	3,523
Total Horticultural Crops	4,000	4,215	4,434	4,555	4,660
All Agricultural Crops	12,067	12,775	13,318	13,209	13,706
Share of Fruits and Vegetables in All Agriculture Crops (%)	25.75	25.52	25.58	25.91	25.70

SOURCE: POCKET BOOK OF AGRICULTURAL STATISTICS, 2020²

¹ Ministry of Agriculture and Farmers Welfare, Second Advance Estimates (2021-22) of Area and Production of Horticultural Crops released

² Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare¹

³ Invest India

⁴ Study to Determine Post-Harvest Losses of Agri Produces in India, MoFPI

According to DGCI&S preliminary data, processed fruits and vegetables increased by 30.36 percent (April-December 2022), while fresh fruits and vegetables increased by four percent in comparison to the same months the previous year.

Fresh fruits were shipped to the tune of \$ 1078 million from April to December 2021, increasing to \$ 1121 million in the corresponding months of fiscal year 2022-23. Exports of processed F&V increased to \$ 1472 million in the first nine months of the current fiscal year, up from \$ 1129 million in the same period last year.

Since fruits and vegetables perish rapidly, increase in production can correspondingly result in significant post-harvest losses every stage of the supply chain. As a product group, fruits and vegetables stands second and third in contribution to post-harvest economic losses in India. Consequently, processing of fruits and vegetables assumes immense importance in curtailing post-harvest losses, improving productivity and improving farmers income. A study commissioned by the Ministry of Food Processing Industries estimated the level of processing for fruits and vegetables in 2018-19 at 4.48% and 3.17% respectively of the net production in India.⁵

Processing and value addition to fruits and vegetables has grown steadily over the years, driven by increasing demand as well as push given by proactive government policies. Some of fast-growing segments of food processing industries are listed in figure below:

1. FRUIT PULPS, PUREES, PASTAS, KETCHUP

2. PICKLES, SAUCES, BRINES

3. JAMS, MARMALADES, CRUSH

4. PACKED JUICE, SQUASH, CONCENTRATES

5. CANNED FRUITS & VEGETABLES

6. FROZEN & PACKED PRODUCTS

In global scenario, The Food and Agriculture Organisation (FAO) declared 2021 as the International Year of Fruits and Vegetables, raising awareness about increasing the dietary consumption of fruits and vegetables for improving global health. The consumption of processed fruits and vegetables have increased globally, driven by rising demand from emerging economies in Asia and Africa.

This sector report highlights the global trends in processed fruits and vegetables sector, India's potential in processing fruits and vegetables, opportunities in the sector, the supporting regulatory framework, R&D and skill development ecosystem and proactive initiatives taken by the Government of India to support the sector

⁵ Study to Determine the Level of Food Processing in India, MoFPI

02. GLOBAL OVERVIEW OF PROCESSED FRUITS AND VEGETABLES

Globally, fruits and vegetables, as a form of dietary preference are predominantly consumed in fresh or semi-processed form. Over the years, preference for convenience and taste has however driven the demand for processed forms of fruits and vegetables across the world, dominated by higher consumption in the west.

2.1 GLOBAL CONSUMPTION SCENARIO

Europe dominates global consumption of processed fruits and vegetables, driven by demand for canned tropical fruits, vegetables, dried fruits etc, followed by the US market. Emerging economies in Asia, South-East Asia, Middle East and Africa have shown increasing demand for processed fruits and vegetables, due to rising incomes, preference of safe food options, growth of online retail etc.

The growth of processed Fruits and Vegetables is expected to be highest in emerging economies, whereas the volume of trade will be dominated by Europe in the coming years. About 26% of import of processed Fruits and Vegetables in European countries is met by emerging economies in South America and Asia. Many ports in Europe and US have dedicated ports with processed fruits and juice handling capacities, complete with cold storage and aseptic container tanks.

The demand for processed fruits and vegetable products as dietary intake is estimated to increase across all regions globally, driven by growing population, rapid urbanisation, higher labour force participation and a strong spurt of app based online retail.

⁶ Centre for Promotion of Imports from Developing Countries, Ministry of Foreign Affairs, Netherlands, 2023

2.2 GLOBAL TRENDS

With increasing awareness about health and global efforts to tackle issues of non-communicable diseases arising from public obesity, there has been efforts to promote fresh fruits and vegetables produce rather than processed commodities. This is very evident in high income countries like the USA where preservatives and high sugar content in processed products being responsible for public health issues.



In global trade, the processed fruits and vegetables value chain is dotted with challenges of food safety issues, food regulations, standards and labelling requirements impacting the global supply. On similar account, the European Green Deal and sustainability certificate initiatives in the EU to ensure sustainability from farm to fork, has the potential to impact exports from emerging economies to western countries, making the cost of regulatory compliance prohibitively high.

There has also been growing demand for organic, vegan and fortified products from the processed fruits and vegetables sector, from climate and sustainability conscious young urban population in high income countries. This segment has the potential to generate more revenue for producers in emerging economies and small processors

03. OVERVIEW OF FRUITS & VEGETABLES PROCESSING IN INDIA

As discussed in the introductory section, the levels of processing for fruits and vegetables in 2018-19 was estimated at 4.48% and 3.17% respectively of the net production in India. The value of output from processed fruits and vegetables sector in India was estimated at INR 26,90,909 lakhs generating a net income of INR 4,20,921 lakhs in 2019-20⁷.

3.1 STATUS, MARKET SIZE & SCOPE

The fruit and vegetable processing industry in India benefits from the country's status as the second-largest producer of horticultural crops, as it provides access to wide raw material base. To increase the shelf life of seasonal fruits and vegetables, various methods such as canning, dehydration, pickling, provisional preservation, and bottling are used in the processing of these foods.

3.2 MARKET OVERVIEW

India is currently the fastest-growing economy in the world and is a leading producer of several agricultural commodities. It is expected to grow at a Compound Annual Growth Rate (CAGR) of 3.0% from 2022 to 2030⁸.

- India is the largest producer of ginger and okra among vegetables and ranks second in the production of several other vegetables including potatoes and onions.
- India ranks first in the production of bananas, mangoes, and papayas among fruits.
- Grapes, pomegranates, mangoes, bananas, and oranges are the major fruits exported, while onions, mixed vegetables, potatoes, tomatoes, and green chili are the major vegetables exported.
- Major destinations for Indian processed fruits and vegetables are the USA, UAE, China, Netherland, UK, and Saudi Arabia.

⁸ Annual Survey of Industries, Estimates of Factory Sector by 4-digit industry class (NIC-2008)

⁹ APEDA



3.3 MAJOR PRODUCING & PROCESSING STATES

Maharashtra, Andhra Pradesh, Uttar Pradesh, Gujarat, and Karnataka are the leading producers of fruits in India. For vegetables, major producers include West Bengal, Uttar Pradesh, Bihar, Madhya Pradesh, and Gujarat⁸. In terms of processing capacities of fruits, the top states are Andhra Pradesh, Tamil Nadu, Maharashtra, Gujarat and Karnataka⁹.

For vegetables, the top states with maximum processing capacity are Tamil Nadu, Andhra Pradesh, Maharashtra, Rajasthan and Karnataka¹⁰.

¹⁰ Study to Determine the Level of Food Processing in India, MoFPI

¹¹ Ibid

3.4 MAJOR PRODUCING & PROCESSING STATES

In the year 2021-22, India exported processed food products worth 5,559.84 USD Millions. The major products exported include mango pulp (124.11 USD Millions), processed vegetables (534.98 USD Millions), prepared and preserved cucumber and gherkins (199.46 USD Millions), processed fruits, juices, and nuts (486.58 USD Millions), and guar gum (446.77 USD Millions)¹².



EXPORT IN VALUE (FY 2021-22)

SOURCE: AGRICULTURAL AND PROCESSED FOOD PRODUCTS EXPORT DEVELOPMENT AUTHORITY

¹² APEDA

3.5 KEY GROWTH DRIVERS

The Key Growth Drivers of Food Processing Industry that India presents can be summarized as follows :

Demographics:

India's huge consumer base by virtue of its population size and predominance of young citizens in the population pool creates huge demand for processed fruits and vegetables. This is one of the most important growth drivers for the sector

Rich raw-material base:

India's dominance in world horticulture production is aided by its diverse agro-climatic zones and soil profiles. This provides India with an opportunity to processed diverse products ranging from tropical, sub-tropical, temperate fruits, vegetables and nuts that has immense export potential.

Rising Disposable Incomes:

The food processing industry is experiencing growth due to an increase in disposable income. India has seen a rise in household level disposable incomes, largely due to urbanization and the prevalence of dual-income households. This progress has been further stimulated by positive macroeconomic factors on the demand side such as population growth.

Structural Shift in Consumption Pattern:

There is a growing trend among consumers to prioritize convenience when making purchases, which is largely due to the increasingly busy lifestyles people lead regardless of their geographic location. Even consumers in India are willing to pay more for a product if it saves them time. This shift towards convenience is expected to have a significant impact on the processed food industry, with a likely increase in demand for quick and easy meal options like frozen, canned, or pre-packaged foods. Therefore, food items categorized as "Convenience Food" have a significant potential for growth such as :

SHELF – STABLE OR FROZEN CONVENIENCE FOODS :

Ready-to-Eat (RTE) and Ready-To-Serve (RTS) food :

Ready-to-serve and ready-to-eat processed fruits and vegetables are those that have undergone significant processing and are ready for consumption without any further preparation. Here are some examples of such products:

- **FRUIT CUPS** - Pre-cut and packaged fruits such as apples, peaches, and oranges that are ready-to-eat and served in cups or bowls.
- **VEGETABLE DIPS** - Pre-made dips made from vegetables such as hummus, guacamole, and salsa that are ready to be eaten with chips or as a spread on sandwiches.
- **CANNED FRUIT COCKTAIL** - A mixture of pre-cut and canned fruits such as pears, pineapples, and peaches that are ready-to-eat and served in syrup.
- **FRUIT BARS** - Pre-packaged bars made from a variety of fruits such as apples, apricots, and berries that can be eaten as a snack.

- Veggie burgers - Pre-made vegetable patties made from a variety of vegetables such as peas, carrots, and beans that are ready-to-eat and served on a bun.
- Frozen fruit smoothie packs - Pre-portioned packs of frozen fruits such as berries, bananas, and mangos that can be blended with juice or yogurt to make a quick smoothie.

READY-TO-COOK FOOD :

These are pre-cut and diced vegetables, such as carrots, peas, and green beans, that are sold in frozen packets, ready to be used in various dishes.

- **FROZEN FRUIT CHUNKS** - These are pre-cut and frozen fruit chunks, such as mango, papaya, and pineapple, that can be used in smoothies, desserts, or as a snack.
- **CANNED FRUITS AND VEGETABLES** - These are pre-cooked and canned fruits and vegetables, such as corn, peas, and pineapple, that can be used in various dishes or eaten as a snack.
- **FRESHLY CUT FRUITS AND VEGETABLES** - These are pre-washed, peeled, and chopped fruits and vegetables, such as watermelon, carrots, and cucumber, that are sold in ready-to-eat packets.
- **SALAD MIXES** - These are pre-mixed salad greens, including lettuce, spinach, and arugula, that are ready to be eaten or used in various recipes.

DEMAND FOR HEALTHY FOOD SUPPLEMENTS:

Another consumer megatrend expected to drive the increase in processed food consumption is the rising focus on health and wellness. Globally, consumers are increasingly becoming health conscious. Growing concerns with quality of life, desire to stay healthy, and need to prevent illness are leading to consumers planning to spend more on these products and services. examples of healthy food supplements made from processed fruits and vegetables include:

- **FRUIT AND VEGETABLE POWDERS:** These powders are made by dehydrating fruits and vegetables and then grinding them into a fine powder. They can be added to smoothies, juices, or other recipes for an extra boost of vitamins, minerals, and antioxidants.
- **FREEZE-DRIED FRUITS AND VEGETABLES:** Freeze-drying is a process that removes the moisture from fruits and vegetables while preserving their nutrients. These can be eaten as a snack or added to various recipes.
- **GREEN SUPERFOOD POWDERS:** These powders are made from a combination of green vegetables such as kale, spinach, and broccoli that are ground into a fine powder. They are rich in vitamins, minerals, and antioxidants and can be added to smoothies, juices, or other recipes.
- **FERMENTED VEGETABLES:** Fermentation is a process that involves the conversion of sugars in vegetables into beneficial bacteria. Examples include sauerkraut and kimchi, which are rich in probiotics and can promote gut health.
- **VEGETABLE AND FRUIT JUICES:** These can be made from fresh or processed fruits and vegetables and can provide a quick and convenient way to consume a variety of nutrients. However, it's important to choose ones that are low in added sugars or make your own at home to avoid excessive sugar intake.

3.6 KEY PROCESSED FRUITS & VEGETABLES PRODUCT CATEGORIES IN DOMESTIC MARKET

There are several processed fruits and vegetables that are widely used in India, both in households and in the food industry. Some of the examples include:

- Tomato puree/paste
- Mango pulp
- Frozen green peas
- Canned pineapple
- Pickles (mango, lime, mixed vegetables)
- Frozen french fries etc.
- Fruit juices (orange, apple, grape, pineapple, mixed fruit)
- Dried fruits (raisins, apricots, figs, dates)
- Tomato ketchup
- Fruit jam and jelly

3.7 KEY INDUSTRY PLAYERS

Table below lists major players engaged in processed fruits and Vegetables:

ITC LIMITED	ASHIRVAAD, B NATURAL, SUNFEAST
DABUR INDIA LIMITED	REAL, ACTIV
MOTHER DAIRY FRUIT & VEGETABLE	CANNED FRUIT, JUICES
DEL MONTE INDIA	DEL MONTE CANNED FRUIT AND VEGETABLE
MCCAIN FOOD INDIA PVT. LTD.	MCCAIN FROZEN FRUITS AND VEGETABLES
NESTLE INDIA	MAGGI SAUCES AND KETCHUPS, MAGGI HOT AND SWEET TOMATO CHILI SAUCE
RASNA PVT.LTD	RASNA NATIVE HAAT, RASNA FRUIT PLUS
PEPSOCO INDIA	TROPICANA JUICE
HALDIRAM'S FOOD INTERNATIONAL LTD.	HALDIRAM SNACKS
PAPERBOAT	JUICES

04.

GOVERNMENT INTERVENTIONS FOR SUPPORTING F&V PROCESSING SECTOR

Government of India has taken up various initiatives to boost the F&V Processing Industry in India.

4.1 GOVERNMENT INITIATIVE

POLICY INITIATIVES:

- Exemption of processed food items from licensing under the Industries (Development and Regulation) Act, 1951.
- 100% Foreign Direct Investment (FDI) permitted through automatic route for the food processing sector subject to sectoral regulations.
- 100% Foreign Direct Investment under Government approval route, for trading, including through e-commerce, in respect of food products manufactured or produced in India.
- Lower GST for raw and processed products, with more than 71.7% of food products under various chapter heads/sub-heads covered in lower tax slabs of 0% & 5%.
- The government supports the sector through 100% exemption of Income Tax on profits and gains for new Food Processing Units for initial 5 assessment years.
- Provision of profit-linked tax holiday under Section 80 IB and investment-linked deduction under Section 35 AD of Income Tax Act, 1961.
- Classification of loans to food & agro-based processing units and Cold Chain under agriculture activities for Priority Sector Lending.
- Cold Chain and Food Parks covered under the Harmonised Master List of Infra structure Sub-sectors.
- Setting up of a Special Fund of ₹2000 crore in National Bank for Agriculture and Rural Development (NABARD) to provide affordable credit for designated Food Parks and agro-processing units

DEVELOPMENTAL INITIATIVES:

Creating modern infrastructure for supporting the growth of the food processing sector through the implementation of the Schemes of Mega Food Parks, Integrated Cold Chain and Value Addition Infrastructure, Agro Processing Cluster and Backward & Forward Linkages, and setting up/modernization of PM Kisan Sampada Yojana (PMKSY).

4.2 GOVERNMENT SCHEMES

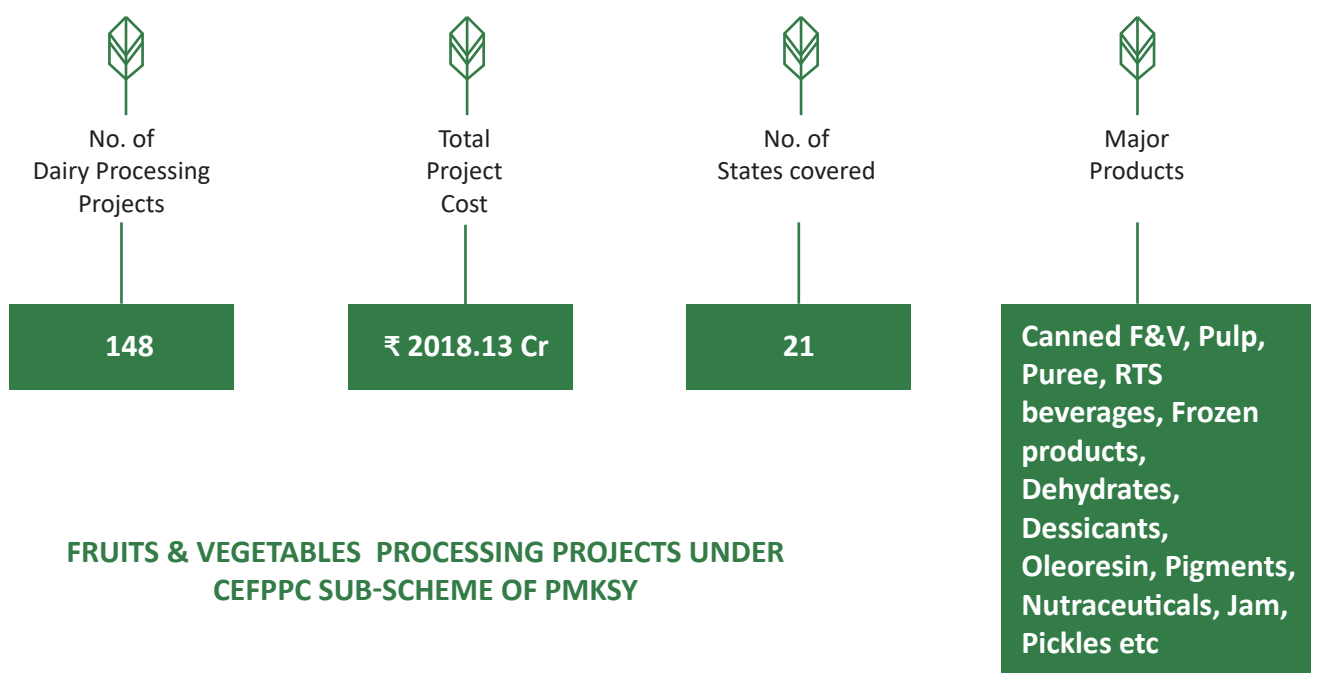
THERE ARE SEVERAL SCHEMES AND INITIATIVES TAKEN BY THE GOVERNMENT OF INDIA FOR THE PROCESSING OF FRUITS AND VEGETABLES. SOME OF THEM ARE:

A. PRADHAN MANTRI KISAN SAMPADA YOJANA (PMKSY):

PMKSY is a comprehensive scheme implemented by MoFPI which aims to create modern infrastructure with efficient supply chain management from farm gate to retail outlet. The key objectives of PMKSY are:

- Creation of modern infrastructure for food processing mega food parks/ clusters and individual units
- To create effective backward and forward linkages - linking farmers, processors and markets
- To create robust supply chain infrastructure for perishables

Under PMKSY, the sub-scheme titled Creation/Expansion of Food Processing and Preservation Capacities (CEFPPC) is being implemented. The progress of CEFPPC scheme in dairy processing sector is listed below.



B. PM FORMALIZATION OF MICRO FOOD PROCESSING ENTERPRISES (PMFME):

The PMFME is a centrally sponsored scheme with an outlay of INR 10,000 Cr to be implemented over a period of five years from 2020-21 to 2024-25. The scheme provides financial, technical and business support for existing micro food processing enterprises. As of 2023, a total of 8330 F&V processing units got support from the scheme to the tune of INR 526 Cr across the country¹².

C. PRODUCT LINKED INCENTIVES FOR FOOD PROCESSING INDUSTRIES (PLIFPI):

Government of India approved Production Linked Incentive Scheme for Food Processing Industry including processed fruits & vegetables. The aim of the scheme is to create global processing champions from India by improving competitive strength of Indian companies vis-à-vis their global counterparts in terms of output, value addition, linkages etc. The scheme has an outlay of INR 10,900 Cr to be implemented over a six-year period from 2021-22 to 2026-27.

Under the PLI scheme, fruits and vegetables processing plants with a cumulative annual capacity of over 5,72,447 tons is being set up across 18 states in India.

D. MISSION FOR INTEGRATED DEVELOPMENT OF HORTICULTURE (MIDH):

This scheme aims to promote holistic growth of the horticulture sector, including fruits and vegetables. It provides support for the development of infrastructure, research and development, marketing, and post-harvest management..

E. TECHNOLOGY MISSION FOR INTEGRATED DEVELOPMENT OF HORTICULTURE IN THE NORTH-EASTERN REGION, SIKKIM AND JAMMU & KASHMIR:

This scheme aims to promote the development of the horticulture sector, including fruits and vegetables, in the North-Eastern region, Sikkim, and Jammu & Kashmir. It provides support for the development of infrastructure, research and development, and marketing.

F. NATIONAL HORTICULTURE MISSION (NHM):

Launched in 2005, the NHM aims to promote the holistic growth of the horticulture sector, including the development of post-harvest management, processing, and marketing infrastructure.

G. OPERATION GREENS:

Launched in 2018, this scheme aims to promote the processing of tomatoes, onions, and potatoes (TOP crops) by providing financial assistance for setting up processing facilities and cold storages.

¹² PMFME Scheme Division, MoFPI

05. GOVERNANCE AND REGULATORY LANDSCAPE

The regulatory framework for the fruits and vegetables processing industry in India includes a set of rules and regulations imposed by the Ministry of Food Processing Industries (MOFPI), Agricultural and Processed Food Products Export Development Authority (APEDA), Food Safety and Standards Authority of India (FSSAI), Bureau of Indian Standards (BIS), and Agriculture Produce (Grading & Marking) Act (AGMARK). A comprehensive account of these regulatory bodies is provided below.

5.1 MINISTRY OF FOOD PROCESSING INDUSTRIES

The Ministry of Food Processing Industries, is a government ministry in India that was established in 1988 with the aim of developing and regulating the food processing industry in the country. MOFPI has two main areas of responsibility: policy support and development activities. It plays an important role in stimulating investment for food processing industry, offering guidance and assistance to the industry, and fostering an environment that is favorable to its growth. MOFPI's primary objectives are:

- Formulation and implementation of policies and plans for the food processing industry
- Promoting investments in the food processing sector
- Providing technical and financial assistance for the establishment of food processing industries
- Conducting research and development activities to promote food processing technology
- Providing training and capacity building to stakeholders in the food processing industry
- Promoting food safety and quality through the implementation of food safety standards and regulations
- Enhancing exports of processed food products from India
- Creating a favorable environment for the growth of the food processing industry in India.

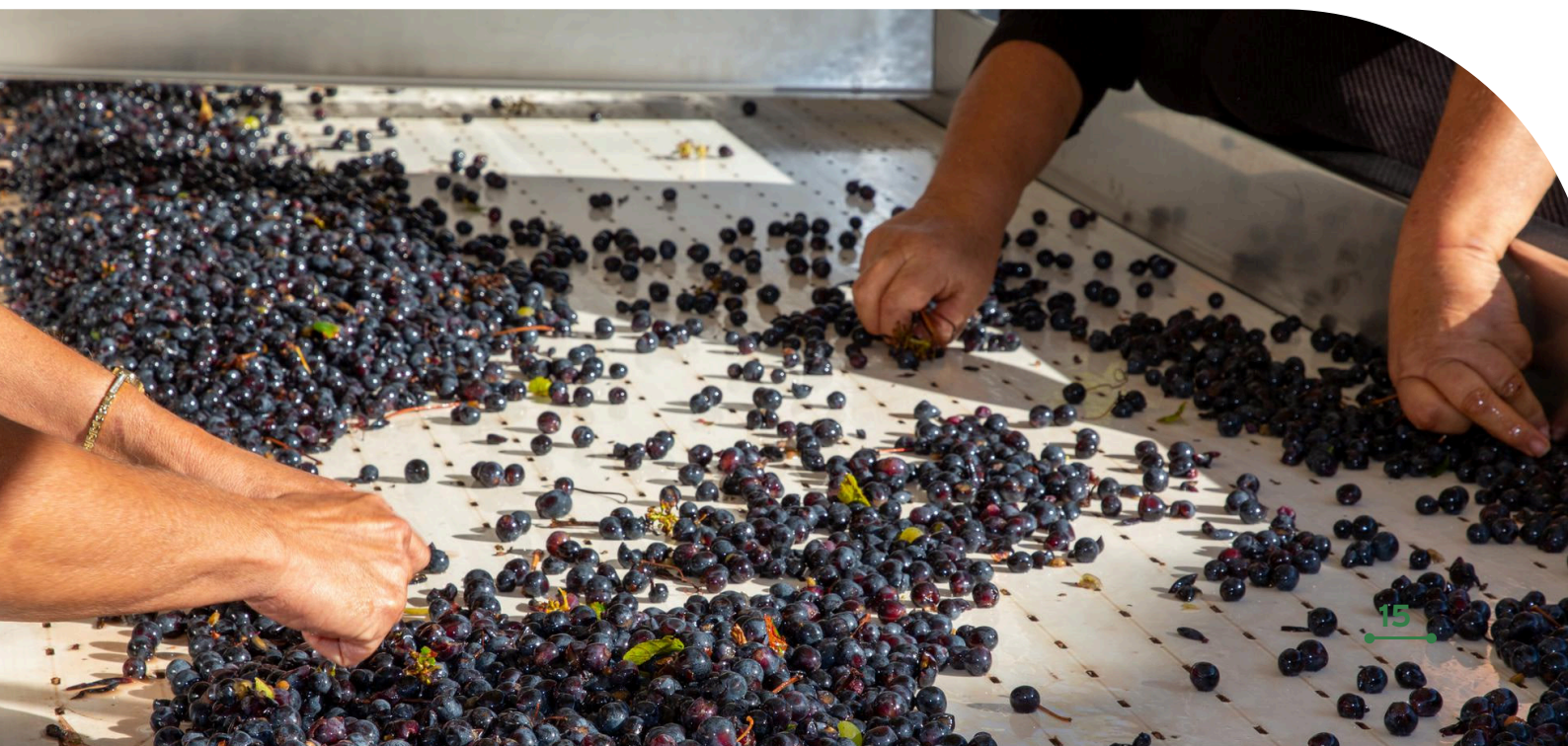
- MOFPI is also responsible for implementing various government schemes and initiatives related to the food processing sector, such as the Pradhan Mantri Kisan sampada Yojana (PMKSY) and the Scheme for Integrated Cold Chain and Value Addition Infrastructure.

5.2 APEDA

APEDA, the Agricultural and Processed Food Products Export Development Authority, is an apex organization of the Indian government's Ministry of Commerce and Industry that was formed in 1985 under the APEDA Act. APEDA has been instrumental in promoting and facilitating the export of processed fruits and vegetables from India to various countries around the world

Some of its primary responsibilities include:

- To promote the export of agricultural and processed food products from India.
- To develop and finance specific projects for the promotion of exports
- To provide assistance to exporters in the development of packaging, marketing and quality control of products.
- To undertake training and education programmes in the field of marketing, packaging and quality control.
- To collect and disseminate information related to exports of agricultural and processed food products
- To register exporters and to regulate the export of scheduled products



5.3 BUREAU OF INDIAN STANDARDS ACT, 1986

The Bureau of Indian Standards (BIS) was created through the enactment of the Bureau of Indian Standards Act in 1986 and serves as a national organization responsible for setting standards. The BIS standardization and certification scheme covers processed fruits and vegetables in India, establishing the criteria for their quality, safety, and labeling. To ensure conformity with the relevant standards, the BIS also conducts routine inspections and tests on processed fruits and vegetables.

Some of the Key Functions are as follows :

- It develops national standards for agriculture, food, and processed foods.
- It provides third-party certification for processed foods to ensure compliance with Indian standards.
- It enforces standards through a network of laboratories and inspection offices.
- It promotes the use of quality standards to enhance the competitiveness of Indian products.
- It sets safety standards and certification requirements to ensure consumer protection for processed foods.

Bureau of Indian Standard has set various quality standards for processed fruits and vegetables to ensure their safety, quality, and reliability. These standards include:

- BIS 803: This standard specifies the requirements for canned fruits and vegetables, including their sensory, chemical, and microbiological properties.
- BIS 1050: This standard specifies the requirements for dehydrated vegetables and their packaging, including their moisture content, microbiological properties, and labeling.
- BIS 1164: This standard specifies the requirements for fruit juices and their concentrates, including their sensory, chemical, and microbiological properties.
- BIS 1996: This standard specifies the requirements for tomato ketchup and sauce, including their sensory, chemical, and microbiological properties.
- BIS 1195: This standard specifies the requirements for pickles and chutneys, including their sensory, chemical, and microbiological properties.

5.4 FOOD SAFETY AND STANDARDS AUTHORITY OF INDIA

Food Safety and Standards Authority of India, which is a statutory body was established under the Food Safety and Standards Act, 2006. It was created to ensure food safety and hygiene in the country by regulating and supervising the manufacture, storage, distribution, sale, and import of food products.

Some of the key functions of FSSAI under the Food Safety & Standards Act are:

- Laying down standards for food products and regulating their manufacture, storage, distribution, sale, and import to ensure their safety and quality.
- Licensing and registration of food businesses, including food processing and packaging units, storage, transport, and distribution.
- Conducting inspections, surveillance, and enforcement activities to ensure compliance with food safety standards and taking action against non-compliant entities.
- Promoting consumer awareness about food safety and nutrition through education and information dissemination.
- Conducting research, risk assessment, and generating scientific data related to food safety.
- Providing training and capacity-building programs for stakeholders involved in the food industry.
- Collaborating with international organizations and governments to promote food safety and trade in safe and quality food products.



Some of the key regulations to ensure the safety and quality of processed fruits and vegetables in India are listed in table below.

REGULATION	PURPOSE	REQUIREMENTS/ GUIDELINES
Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011	Sets standards for processed fruits and vegetables	Limits for contaminants and additives
Food Safety and Standards (Packaging and Labelling) Regulations, 2011	Specifies labelling requirements	Name of the product, list of ingredients, nutritional information, date of manufacture and expiry
Food Safety and Standards (Food Recall Procedure) Regulations, 2017	Guidelines for recall of processed fruits and vegetables	Safety concerns or non-compliance
Food Safety and Standards (Import) Regulations, 2017	Guidelines for import of processed fruits and vegetables	Limits for contaminants and additives
Food Safety and Standards (Licensing and Registration of Food Businesses) Regulations, 2011	Licensing and registration requirements for food processing businesses involved in fruits and vegetables	Registration and licensing requirements
Food Safety and Standards (Food Products Standards and Food Additives) Amendment Regulations, 2020	Revised standards for various food products including fruits and vegetables	Limits for pesticide residues in fruits and vegetables.



5.5 AGRICULTURAL MARKETING INFORMATION AND REGULATION

Agricultural Marketing Information and Regulation Department (AGMARK) is a certification mark used in India to certify the quality of agricultural and processed food products. It was introduced by the Government of India in 1937 to provide quality control and grading standards for agricultural products.

Some of the key functions of AGMARK include:

- To certify the quality of agricultural and processed food products based on predetermined quality standards.
- To promote standardized grading of agricultural and processed food products to ensure quality and reliability.
- To ensure fair practices in the trade of agricultural and processed food products by monitoring compliance with quality standards and preventing fraud.
- To provide consumer protection by ensuring that certified products meet established quality standards and are safe for consumption.

5.6 EXPORT INSPECTION COUNCIL

The Export Inspection Council (EIC) was set up by the Government of India under Section 3 of The Export (Quality Control and Inspection) Act, 1963 (22 of 1963). The EIC is the official export –certification body of India which ensures quality and safety of products exported from India. Some of the key functions of EIC include:

- Notify commodities which will be subjected to quality control and / or inspection prior to export
- Establish standards of quality for such notified commodities
- Specify the type of quality control and / or inspection to be applied to such commodities

However, the regulatory checks through EIC are voluntary and are not covered in the EIC Act 1963.

06. R&D AND SKILL DEVELOPMENT ECOSYSTEM FOR F&V PROCESSING

R&D and availability of skilled workforce is at the core of a competitive dairy processing sector. India hosts numerous technical institutes, universities, centres of excellence etc to support the dairy processing industry in adopting latest processing technologies, promote IPR registrations for products as well as process, ensure skill development etc. Some of the key institutions forming the backbone of R&D ecosystem in India are listed in table.



INSTITUTIONS	HIGHLIGHTS
<p>Indian Council of Agricultural Research (ICAR)</p>	<ul style="list-style-type: none"> • Premier research organization under the Ministry of Agriculture and Farmers' Welfare, Government of India, that conducts research and development in the field of agriculture. • ICAR has several institutes and centers dedicated to food processing research and development. • The Central Food Technological Research Institute (CFTRI) and the Central Institute of Post-Harvest Engineering and Technology (CIPHET) are two such institutes under ICAR. • These institutes focus on developing technologies and processes for post-harvest handling, processing, packaging, preservation, and value addition of fruits, vegetables, and other agricultural commodities.
<p>Central Food Technological Research Institute (CFTRI)</p>	<ul style="list-style-type: none"> • National-level research institute under the Council of Scientific and Industrial Research (CSIR). • specializes in food science and technology research, including fruit and vegetable processing.
<p>National Institute of Food Technology Entrepreneurship & Management (NIFTEM)</p>	<ul style="list-style-type: none"> • Research institute that focuses on research and education in the area of food science and technology, including fruit and vegetable processing
<p>Indian Institute of Horticultural Research (IIHR)</p>	<ul style="list-style-type: none"> • Research institute that conducts research on horticultural crops, including fruits and vegetables, and develops technologies for their processing.
<p>Defence Food Research Laboratory (DFRL)</p>	<ul style="list-style-type: none"> • Research laboratory of the Defence Research and Development Organisation (DRDO) that conducts research on food science and technology, including processing of fruits and vegetables.
<p>National Horticulture Board (NHB)</p>	<ul style="list-style-type: none"> • An autonomous organization under the Ministry of Agriculture and Farmers' Welfare that promotes and develops the horticulture sector, including fruits and vegetables processing.
<p>Other Technical Institutions</p>	<ul style="list-style-type: none"> • Indian Institute of Food Processing Technology (IIFPT): Specializes in food processing technology research and education, including fruit and vegetable processing. • National Research Centre for Citrus (NRCC): Specializes in citrus research, including processing of citrus fruits. • Central Institute of Post-Harvest Engineering and Technology (CIPHET): Focuses on post-harvest technology research, including fruit and vegetable processing. • Tamil Nadu Agricultural University (TNAU): Conducts research on agriculture and allied subjects, including fruit and vegetable processing. • University of Agricultural Sciences, Bangalore (UASB): Conducts research on agriculture and allied subjects, including fruit and vegetable processing.

07.

FRUITS & VEGETABLES PROCESSING: HIGH POTENTIAL OPPORTUNITIES

The global trends in F&V processing and overview of it in India discussed in earlier sections, analysed parallelly brings into light immense opportunities the sector beholds. Increased demand projections both in domestic and global markets, impacts processing sector positively.

7.1 PROCESSING TECHNOLOGY & MACHINERY

Opportunities in fortification of processed fruits and vegetables, probiotics in fresh-cut produce etc provides opportunity to promote innovative processing technology as well as machinery, including cold storage and preserving equipment throughout the supply chain. Similarly, modern technologies like AI and blockchain can be utilised to ensure better traceability systems from farm to fork, facilitating exports of quality products.

7.2 ACTIVE, INTELLIGENT AND SUSTAINABLE PACKAGING SOLUTIONS

By adopting sustainable packaging solutions, the processed fruits and vegetables industry can reduce its carbon footprint and appeal to environmentally conscious consumers, thereby increasing demand for their products. Examples of sustainable packaging solutions include using paper-based or plant-based packaging

7.3 PRODUCT INNOVATION AND HIGH POTENTIAL PRODUCTS

There are several high potential processed fruits and vegetables products for the Indian domestic market and export market. The way people consume processed food can differ significantly depending on various factors such as geographic location, cultural background, and individual preferences.

7.3.1

EXPANSION OF DOMESTIC MARKET:

Due to influential factors such as a growth in disposable income, heightened health consciousness, and a preference for convenience, the demand for processed products is expected to increase in the upcoming years. Consumer preferences and trends can be influenced by a variety of factors. However, there are some potential trends that may emerge:

- **Health and wellness:** As more and more consumers become health conscious, there may be an increased demand for processed fruits and vegetables that are low in sugar, salt and fat, and high in nutrients.
- **Convenience:** With busy lifestyles, consumers may continue to demand convenient and ready-to-eat processed fruits and vegetables, such as pre-cut, pre-packaged salads and fruit cups.
- **Ethnic and regional flavors:** Indians are known for their diverse cuisines, and there may be a demand for processed fruits and vegetables that cater to regional and ethnic tastes, such as pickled vegetables, chutneys and achaars.

7.3.2

FOR EXPORT MARKETS

As the awareness about health and wellness increases globally, there is a rising demand for processed fruits and vegetables that are not only healthy but also convenient and easy to use. The following trends are likely to influence the future demand for processed fruits and vegetables in foreign markets:

- **Organic and natural products:** Consumers are becoming more conscious of the negative effects of pesticides and chemicals on their health and the environment, leading to an increasing demand for organic and natural products that are free from harmful chemicals.
- **Plant-based products:** With the growing trend towards plant-based diets, there is a surge in demand for processed fruits and vegetables that can replace meat and dairy products.
- **Functional foods:** Consumers are searching for processed fruits and vegetables that offer additional health benefits beyond basic nutrition. This includes products that are fortified with vitamins, minerals, and other beneficial ingredients.
- **Convenient and on-the-go options:** With busy lifestyles and the need for quick and easy meal options, there is a growing demand for processed fruits and vegetables that are convenient and can be consumed on-the-go.
- **Sustainable packaging:** As consumers become more aware of the negative impact of plastic on the environment, there is a rising demand for processed fruits and vegetables that are packaged in sustainable and eco-friendly packaging.

CONCLUSION

The Indian fruits and vegetables processing sector has enormous growth and development potential. India has a strong foundation in the fruits and vegetables market due to its abundant agricultural resources and diverse production. The government's actions and assistance have been critical in fostering the expansion of the processing industry.

The Indian government has actively encouraged investment, provided infrastructure assistance, and facilitated market access for processed fruits and vegetables through initiatives such as the Ministry of Food Processing Industries (MOFPI) and the construction of food parks. These approaches have increased value addition, reduced post-harvest losses, and created rural job possibilities.

The governance and regulatory environment, led by organisations such as the Food Safety and Standards Authority of India (FSSAI) and the Agricultural and Processed Food Products Export Development Authority (APEDA), maintains the quality and safety of processed fruits and vegetables. This regulatory structure fosters customer trust both domestically and globally, and it supports the export of high-quality products.

To realise the full potential of the Indian fruits and vegetables processing business, ongoing government backing, investments in technology and infrastructure, and a focus on product diversity are required. Strengthening the cold chain infrastructure, enhancing processing processes, and encouraging R&D can increase the value addition and shelf life of processed products, allowing them to meet the expectations of a changing consumer landscape. Furthermore, by encouraging sustainable and organic farming practises, as well as measures for food traceability and sustainability certifications, Indian processed fruits and vegetables can be positioned as a preferred alternative in global markets.

The Indian fruits and vegetables processing market may reach its full potential by leveraging government involvement, fostering a favourable regulatory framework, and embracing innovation. The sector has the potential to significantly contribute to food security, create jobs, increase farmer incomes, and establish India as a global leader in processed fruits and vegetables.

Finally, the Indian fruits and vegetables processing business is ready for expansion, fuelled by government assistance, regulatory governance, and forward-thinking tactics. India can harness the full potential of its fruits via persistent efforts and collaborations between the government, industry stakeholders, and farmers.

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