MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

Crisil Intelligence

Assessment of Demand-Supply Gaps in Plants & Machinery for Food Processing Sector in India

July 2025

by S&P Global

MINISTRY OF FOOD PROCESSING INDUSTRIES
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Crisil Intelligence

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Acknowledgement

We are immensely grateful for being awarded this assignment by the Ministry of Food Processing Industries, Government of India. As we have reached the successful completion of this prestigious assignment, we wish to convey our gratitude to several stakeholders without whom we would not have had this moment.

Firstly, we would like to thank Shri Sandip Ravindra Kote, Director, Ministry of Food Processing Industries, and Ms. Anu Verma, Deputy Director, Ministry of Food Processing Industries, for their timely suggestions, expert guidance, and unwavering support throughout the duration of this assessment.

Along with them, we would also like to thank the farmers and traders who shared a slice of their lives with us by letting us in on their thoughts, concerns, challenges, and suggestions. We are especially indebted to them for the cooperation and support they extended to our team.

Lastly, we would like to convey our gratitude to our colleagues from other teams for providing their necessary support in the execution of this assignment.

Foreword

It is my pleasure to introduce this report, on demand supply scenario in food processing equipment sector, which studies the capabilities of the domestic market and availability of food processing equipment to domestic food processing players.

The food processing industry is a vital component of our country's economy, providing employment opportunities, increasing farmers' incomes, and contributing to the nation's food security. The government has been committed to supporting the growth of this sector, and I am delighted to say that our efforts have yielded positive results.

Through initiatives such as the Production Linked Incentive Scheme for Food Processing Industry (PLISFPI) and the PM Formalisation of Micro food processing Enterprises (PMFME) scheme, we have been able to provide support to micro, small, and medium enterprise (MSMEs) in the food processing sector, enabling them to upgrade their technology, improve their productivity, and expand their market reach.

Our focus on strengthening the food processing sector is not only aimed at promoting economic growth but also at ensuring that our farmers receive a fair price for their produce and that our consumers have access to safe, nutritious, and affordable food. We have made significant progress in reducing production costs, improving supply chain management, and enhancing market linkages, which has led to increased affordability and availability of processed food products for the masses.

As we move forward, we recognize that we need to evaluate the current technological and equipment capabilities in the domestic market to meet the ambitious growth of food processing sector production output. We are committed to working with all stakeholders to develop the entire food processing ecosystem and bring India in the forefront of food processing production capabilities.

I am confident that this report will provide valuable insights into the progress we have made and the challenges we still face. I hope that it will serve as a useful resource for policymakers, industry stakeholders, and all those who are interested in the development of the food processing sector in India.

Shri A.P. Das Joshi

Secretary

Ministry of Food Processing Industries (MoFPI)

Preface

Food processing sector is one of the largest employment providers in the organized manufacturing sector with 12.41% employment in the total registered/organized sector as per the report of Annual Survey of Industries (ASI), 2022-23. There are large number of incorporated entities in food processing sector providing employment opportunities and as per the latest National Sample Survey (NSS 73rd, Round 2015-16), there were 2.459 million food processing enterprises in the unregistered segment, making up over 98% of all units. The large and medium enterprises, forming 2% of the units, contribute to 60-65% of the production value. Overall, the sector contributes to 7.66% of total manufacturing sector gross value added (GVA) and has seen robust growth of 10-11% in the last decade.

India is the second largest producer of agricultural products and is largely self-sufficient from food security side. Overall agriculture exports stood at Rs. 4.2 lakh crore in fiscal 2025 and imports stood at Rs. 3.1 lakh crore. The share of processed food exports in agri-food exports increased substantially from 13.7% in 2014-15 to 23.4% in 2023-24.

The industry on an average spends 0.5 to 1.5% of its revenue towards capital expenditure with large entities spending on an average 5-8% of its revenue on capital expenditure during the period of expansion. The Indian food processing sector is largely unorganized and spends little on technological advancement processing capabilities and is marked with limited capacities. To compete in the exports market and increase the share of processed food, India's food processing sector needs to invest in efficient and advanced processing capabilities. With this agenda, the availability of food processing equipment in the domestic market becomes increasingly important, if we are to capture the food trade.

This study assesses the demand-supply gaps in the food processing plants and machinery sector in India, providing an overview of the domestic equipment manufacturing landscape and identifying suitable policy interventions to support the food processing sector and develop domestic capabilities for machinery manufacturing.

Currently the global food equipment companies with a domestic presence dominate the India landscape, catering to various segments such as dairy, beverages, and meat processing. Indian equipment manufacturers must compete with established brands from Germany, Japan, and the US with limitations in volumes and scale of operations.

The study aims to identify the gaps in the food processing plants and machinery sector and address the key challenges faced by the sector with assessment of any suitable policy interventions. The study focuses on understanding the current landscape of the processing machinery used in various categories of food products, their dependency on imports, challenges faced by machinery manufacturers, traders and food processing players, and the common infrastructure and machinery used at food parks. It also touches upon the challenges faced by farmers with respect to processing plants and machinery.

India's food processing sector is at a pivotal stage, with growing demand for high-quality, efficient, and scalable solutions. However, persistent gaps in the availability of cost-effective and domestically produced machinery can hinder sectoral growth. This study seeks to highlight these gaps and provide actionable insights to enhance the competitiveness of India's food processing machinery manufacturing ecosystem.

This report aims to provide valuable insights and recommendations for the development of the food processing industry in India, highlighting the need for a collaborative approach involving industry participants, research institutes, and regulatory bodies. By adopting a holistic approach and addressing the challenges and limitations faced by industry, we can ensure the growth and development of the food processing sector, while maintaining the highest standards of safety, quality, and hygiene.

India needs to develop manufacturing capabilities in equipment and components segment, if the food processing sector aims to outperform and capture high share in global trade. Domestic production capabilities will ensure access to high efficiency machinery even to small units present in the sector.

Crisil has adopted a holistic approach, backed by our deep sector expertise, extensive internal database and exhaustive primary and secondary research. We have mapped out the current environment, looked at key data sources, identified the machinery used in different food processing segments and food processing machinery clusters across various states and union territories.

The findings are based on data and input collected between August 2024 and May 2025. The report is structured to first present the landscape and key challenges, followed by an assessment of demand-supply gaps, stakeholder perspectives and potential policy interventions. We acknowledge the valuable contributions of industry participants, government bodies, field experts whose inputs significantly enriched this study.

The report has been prepared by the Consumer Consulting Team – Crisil Intelligence, comprising sector specialists with deep expertise in the food processing industry. The team has a proven track record of delivering strategic insights and policy advisory to public and private sector stakeholders. The insights presented in this report are drawn from a combination of rigorous research, data analysis, and first-hand stakeholder engagements conducted by authors.

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List of abbreviations

Abbreviation	Full form
AFNOR	Association Française de Normalisation
ANSI	American National Standards Institute
APCs	Agro-processing clusters
APEDA	Agricultural and Processed Food Products Export Development Authority
ASI	Annual Survey of Industries
ASTM	American Society for Testing and Materials
BEAG	Bakery Equipment Assessment Group
BFL	Backward-forward linkages
BIS	Bureau of Indian Standards
CEFPPC	Creation / expansion of food processing and preservation capacities
CGMPs	Current good manufacturing practices
CIP	Clean-in-place
DIN	Deutsches Institut für Normung
DSIR	Department of Scientific and Industrial Research
EHEDG	European Hygienic Engineering and Design Group
EU	European Union
FAO	Food and Agriculture Organization
FCMs	Food Contact Materials
FDA	Food & Drug Administration's
FDI	Foreign direct investment
FFA	Free fatty acid
FTLs	food testing laboratories
GDP	Gross domestic product
GST	Goods and Services Tax
GVA	Gross value added
ICUMSA	International Commission for Uniform Methods for Sugar Analysis
IQF	Individual quick-freezing
MFPs	Mega food parks
MNCs	Multinational corporations
MoFPI	Ministry of Food Processing Industries
MSMEs	Micro, small, and medium enterprise
NPD	New product development
NSF	National Sanitation Foundation
NSS	National Sample Survey
OG	Operation Greens
PHE	Plate heat exchanger
PLC	Programmable Logic Controller
PLI	Production Linked Incentive
PLISFPI	Production Linked Incentive Scheme for Food Processing Industry
PMFME	Pradhan Mantri Formalisation of Micro Food Processing Enterprises
PMKSY	Pradhan Mantri Kisan Sampada Yojana
RTE	Ready-to-eat
SCADA	Supervisory Control and Data Acquisition
SMEs	Small and medium enterprises
SS	Stainless steel
UNI	Ente Nazionale Italiano di Unificazione
US	United States
VFDs	Variable frequency drives

Executive summary

India is the second-largest producer of food globally. In terms of categories, India ranks first in milk production, spice production, pulses and bovine production. It ranks second in terms of horticulture crops, fish and aquaculture, paddy, to name a few. The food processing sector has also emerged as an important segment of the Indian economy in terms of its contribution to gross domestic product (GDP), employment and investment. The sector constituted as much as 7.66% and 8.45% of the gross value added (GVA) in the manufacturing and agriculture sectors, respectively, in fiscal 2023.

A wide variety of machinery is needed to support diverse food processing operations, including conveying, sieving, pulping, grading, sorting, washing, peeling, mixing, grinding, cooking, pulverising, juicing, frying, etc. These machines form the backbone of India's food processing infrastructure. Food processing can be broadly categorized into three categories: primary processing, secondary processing and tertiary processing. Primary processing involves the initial processing of raw agricultural products to make them suitable for consumption or further processing. These include cleaning, grading, sorting, milling, juice extraction, etc. Examples include grains, pulses, juices, purees and spices. Secondary processing involves transforming primary processed products into more value-added products. It includes canning, bottling, freezing, extraction, refining, etc. Examples include canned fruits and vegetables, frozen meats, seafood, bread, refined oil, etc. Tertiary processing involves creating highly value-added products from secondary processed products. These include formulation and blending, texturisation, flavouring and seasoning and ready-to-eat products. Examples include chips, namkeens, energy bars, instant noodles, instant soups, frozen meals, etc.

Global companies with domestic presence dominate the landscape in terms of food processing machinery in India. It caters to various segments such as dairy, beverages, meat processing, packaging, and automation. Food processing machinery companies are spread across key industrial hubs, ensuring efficient supply chain management and access to raw material. Several of the leading global process equipment manufacturers have a presence in India. These players cater to demand for machinery in India as well as other countries in the Asian subcontinent. Indian equipment manufacturers can meet domestic demand but lack volumes and scale to compete with established brands from Germany, Japan, and the US.

In terms of imports of food processing machinery, China dominated Indian imports due to their price points. As of fiscal 2024, the share of China in the overall food processing machinery and parts imports stood at 40.8%, followed by Germany (8.0%), Italy (7.4%), the Netherlands (7.4%) and Turkey (4.8%) during the same period. Machinery for primary processing of vegetables and bread grain milling are major imports from China. Further, an analysis of 52 eight-digit HS codes reveals that importing from China is the most cost effective. China reported low price-to-volume ratio for 31 of these HS codes, outpacing other top suppliers, including Germany, Italy, the Netherlands, and Turkey, indicating lower import costs as against other countries. Machines which are more technically advanced are imported from European nations such as Germany, Italy, Netherlands and Turkey. These include machinery for processing confectionery, chocolates, dairy, bakery, macaroni, dairy, flour etc.

India imports nearly Rs. 7,147 crores of plants and machinery as of fiscal 2024, with large entities contributing to 55-60% of these imports. After analysing the demand-supply situation of the food processing equipment in the country, it is estimated that import dependency for the food processing equipment ranges from 14.0-18.0% of the overall demand, with certain segments such as meat, beverages bakery and oleoresins having a higher reliance on imports. Multinational corporations (MNCs) with significant global presence are the ones predominantly importing plants and machinery for their food processing facilities. Large entities import 40% of their equipment demand, whereas medium-scale entities import on average 12-15% of their equipment demand. Majority of the process equipment demand is also catered by fabricators.

Large players prefer imported machinery for their advanced technology and high efficiency output. Other key reasons why global companies import machinery include:

State-of-the-art, advanced technology and precision-driven process machinery from established global companies

Unavailability of large production capacity and high-speed machinery domestically

Existing relations and tie-ups with international process consultants and equipment players

Compatibility and interoperability with existing systems

Imported machinery also often complies with international standards, which are essential for exporting beverages to other countries

Imported machinery often comes with advanced food safety and hygiene features, such as easy cleaning systems, which reduces the risk of contamination and ensures compliance with international food safety standards

Most food processing plants in the country have over 50% automation, and this percentage is increasing, indicating the growing need for food processing machinery.

Some of the factors impacting domestic food processing equipment manufactures include working capital shortage, technology gaps, lack of R&D gaps, non-uniform implementation of government schemes and quality & precision of domestic manufactured machines is believed to not have the same level as imported machinery.

Key focus should be on strengthening regulatory standards in food processing equipment industry in India. India has a limited number of equipment-specific standards compared to the extensive range covered by NSF/ANSI in the US and CEN EN standards in Europe. The existing BIS standards seem to just focus on primary processing equipments such as potato graders, seed processing equipment, sugarcane crushers etc. There is a lack of comprehensive and updated standards for a wider variety of modern food processing equipment used in sectors like bakery, dairy, meat processing, and beverage production. These standards should address the unique safety and hygiene requirements of each type of equipment (e.g., mixers, ovens, conveyors, filling machines).

The PLI scheme is poised to drive significant growth in India’s manufacturing sector over the next few years, particularly in capital-intensive segments. The scheme has made significant strides in attracting investments, generating employment and increasing exports in 14 key sectors, including electronics, textiles, medical devices, automobiles, food processing etc. The scheme which aims to drive industrial capex of Rs 2.6-2.8 lakh crore during the scheme period, is projected to contribute ~5% capex in key sectors. The incentives totaling Rs 1.8-1.9 lakh crore are expected to generate incremental revenue of Rs 30 lakh crore. Launched in March 2020, the scheme has attracted investments of Rs 1.61 lakh crore till December 2024, highlighting the promising nature of the scheme. A similar PLI scheme for food processing machinery and parts of machinery can help attract larger investments and contribute to the growth of the sector. Additionally, it can create new job opportunities in the manufacturing sector. The scheme, would also help Indian food processing companies to access modern and efficient machinery, improving their productivity and competitiveness in the global market.

To guide the industry better, it is essential to strengthen regulatory standards in the food processing equipment industry in India. The existing standards are limited, and there is a need for comprehensive and updated standards that address the unique safety and hygiene requirements of modern food processing equipment. Additionally, developing detailed material standards, equipment-specific standards, and incorporating comprehensive hygienic design principles can help improve the quality and precision of domestic manufactured machines Other regulatory standards recommendations include developing detailed material standards and equipment specific standards and incorporating comprehensive hygienic design principles.

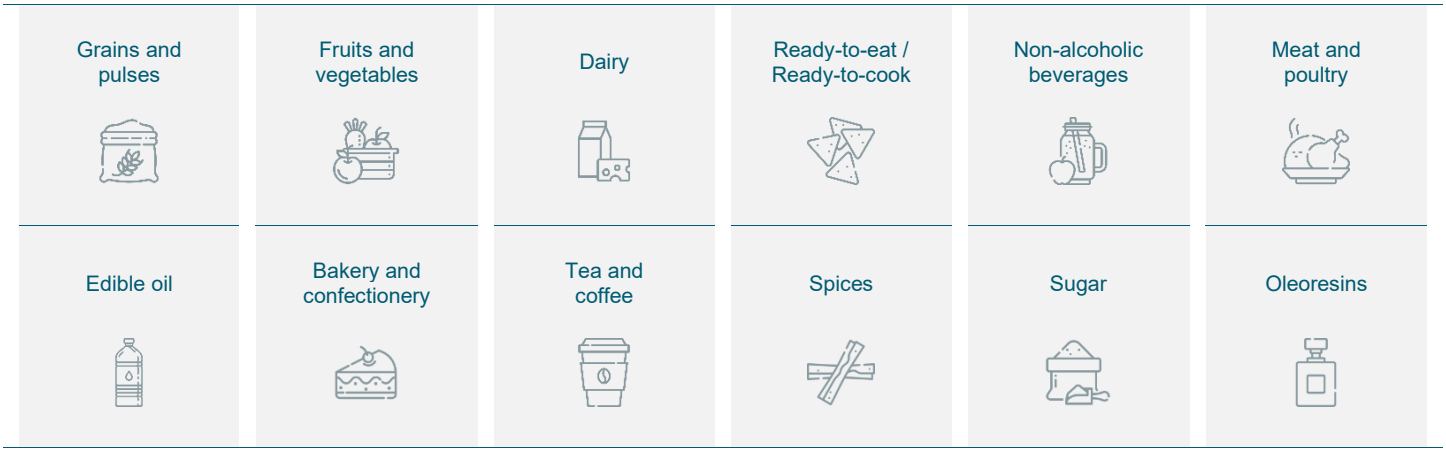
1. Overview of India’s food processing sector

1.1 Key segments of India’s food processing sector

India’s food processing sector is one of the largest in the world. It comprises of many parts, and hence, it may be analysed by dividing it into its major components based on a criterion.

Based on food category, India’s food processing sector may be divided into 12 major segments as displayed in the following chart.

Figure 1 Key segments of India's food processing sector based on food category



Each of the above segments plays a crucial role in India’s economy by contributing to India's gross domestic product (GDP), generating employment, and earning revenues through export. In fiscal 2023, India’s food processing sector constituted 7.66% and 8.45% of the gross value added (GVA) by India's manufacturing and agriculture sectors respectively.

1.2 Stature of India’s food processing sector at the global level

As per the Food and Agricultural Organization (FAO) of the United Nations, the top three countries with the highest gross production value of food between 2018 and 2022 were China, India, and the United States (US). However, it must be noted that China’s gross production value of food surpassed that of both India and the US combined every year over the period 2018 to 2022. More details are covered in the following table that lists the top ten countries based on gross production value of food.

Table 1 Top 10 countries by gross production value of food in USD billion, 2018 to 2022

Rank	Country	2018	2019	2020	2021	2022
1	China	1,191	1,531	1,566	1,514	1,620
2	India	405	426	411	501	505
3	US	334	333	356	411	457
4	Brazil	145	142	134	182	211
5	Iran	52	69	89	137	187
6	Russian Federation	76	83	83	97	118
7	Indonesia	91	83	90	92	101
8	Japan	101	102	107	104	88
9	France	71	67	71	84	73
10	Türkiye	54	59	58	57	72

Source: FAO, Crisil Intelligence

India ranks first in the production of pulses, onion and milk globally

By production volume, India ranks first in the production of pulses, milk, and spices. However, India ranks second in the production of wheat, paddy (rice), groundnut (excluding shelled), tea, tobacco, primary vegetables and fruits, and eggs, as China outranks India to emerge as the largest producer in each of these categories. Similarly, India ranks second in the production of sugarcane and jute, as Brazil and Bangladesh outrank India to emerge as the largest producers of sugarcane and jute respectively. The following table sheds light on how India's production volume compares with that of the world for agricultural products for which India ranks among the top two producers globally.

Table 2 Agricultural products for which India is among the top two producers in the world, 2020

Agricultural products	Production (million tonnes)		Production (%)	Top producers by volume	
	World	India	India / World	Rank 1	Rank 2
A Cereal crops					
Wheat	757.0	107.9	14.3	China	India
Rice (Paddy)	769.2	186.5	24.3	China	India
B Pulses	90.1	23.3	25.9	India	
C Oilseeds					
Groundnut (excluding shelled)	53.8	10.0	18.5	China	India
D Commercial crops					

Agricultural products	Production (million tonnes)		Production (%)	Top producers by volume	
	World	India	India / World	Rank 1	Rank 2
Sugarcane	1865.0	371.0	19.9	Brazil	India
Tea	27.2	5.5	20.2	China	India
Jute	3.5	1.7	48.4	Bangladesh	India
Tobacco unmanufactured	5.8	0.8	13.2	China	India
E Fruits and vegetables					
(Vegetables primary and melons	1138.7	135.3	11.9	China	India
Fruits primary (excluding melons)	899.6	107.0	11.9	China	India
Potatoes	371.1	48.6	13.1	China	India
Onion (dry)	104.6	26.1	25.0	India	
F Dairy products					
Milk total	914.5	210.2	23.0	India	
Eggs (primary) total	93.3	6.7	7.2	China	India

Source: Department of Agriculture & Farmers Welfare, Crisil Intelligence

In addition to the agricultural products listed in the above table, there are a few more agricultural products for which India's production volume is noteworthy in the global context. The following table highlights how India's production volume compares with that of the world for these few agricultural products.

Table 3 Agricultural products for which India is among the top ten producers in the world, 2020

Agricultural Products	Production (million tonnes)		Production (%)	Top producers	
	World	India	India / World	Producers ahead of India	India's rank
Total cereals	3,066.0	342.1	11.4	China, US	3
Rapeseed	25.2	2.5	10.0	Canada, Germany, China	4
Green coffee	10.8	0.3	3.0	Brazil, Vietnam, Colombia, Indonesia, Ethiopia, Honduras,Uganda, Peru	9
Meat	137.0	4.5	3.3	China, US, Brazil, Russia	5

Source: Department of Agriculture & Farmers Welfare, Crisil Intelligence

As the data above indicates, India's food processing sector holds a prominent position at the global level which emphasizes its crucial role in global food supply chains.

1.3 Enterprises in India's food processing sector

India's food processing sector is dominated by **small unincorporated enterprises, estimated to be ~2.3 million in number, constituting almost 98% of all enterprises**. Medium and large sized incorporated enterprises make up only about 2% of all enterprises, but their production volume forms 60 to 65% of the sector's total production volume. The following table lists the number of incorporated and unincorporated enterprises in every state.

Table 4 State-wise number and share of incorporated and unincorporated enterprises in India's food processing sector

State / UT		Registered enterprises		Unincorporated enterprises	
		Number*	Percentage	Number**	Percentage
1	Uttar Pradesh	2,407	5.6%	2,76,611	12.1%
2	West Bengal	2,230	5.2%	1,85,532	8.1%
3	Maharashtra	2,820	6.6%	2,78,371	12.2%
4	Tamil Nadu	4,996	11.7%	1,83,102	8.0%
5	Andhra Pradesh	5,427	12.7%	1,09,889	4.8%
6	Bihar	953	2.2%	89,778	3.9%
7	Karnataka	2,405	5.6%	1,55,757	6.8%
8	Jharkhand	266	0.6%	58,813	2.6%
9	Madhya Pradesh	1,096	2.6%	1,27,198	5.6%
10	Rajasthan	980	2.3%	92,907	4.1%
11	Gujarat	2,585	6.0%	99,864	4.4%
12	Telangana	3,702	8.7%	77,714	3.4%
13	Odisha	1,356	3.2%	1,65,135	7.2%
14	Kerala	1,725	4.0%	1,03,257	4.5%
15	Assam	1,750	4.1%	56,725	2.5%
16	Punjab	3,457	8.1%	37,669	1.6%
17	Jammu and Kashmir	184	0.4%	NA	NA
18	Chhattisgarh	2,225	5.2%	29,224	1.3%
19	Haryana	1,008	2.4%	34,950	1.5%
20	Himachal Pradesh	162	0.4%	27,555	1.2%
21	Uttarakhand	374	0.9%	19,028	0.8%
22	Delhi	151	0.4%	16,482	0.7%
23	Tripura	131	0.3%	6,501	0.3%
24	Manipur	38	0.1%	7,285	0.3%
25	Nagaland	17	0.0%	3,421	0.1%

	State / UT	Registered enterprises		Unincorporated enterprises	
		Number*	Percentage	Number**	Percentage
26	Puducherry	68	0.2%	2,030	0.1%
27	Meghalaya	30	0.1%	5,490	0.2%
28	Goa	96	0.2%	1,390	0.1%
29	Mizoram	29	0.1%	104	0.0%
30	Andaman and Nicobar Islands	6	0.0%	NA	NA
31	Chandigarh	19	0.0%	NA	NA
32	Dadra & Nagar Haveli	33	0.1%	NA	NA
33	Arunachal Pradesh	51	0.1%	3,360	0.1%
34	Daman and Diu	NA	NA	NA	NA
35	Lakshadweep	-	0.0%	501	0.0%
36	Sikkim	18	0.0%	45	0.0%
37	Ladakh	8	0.0%	127	0.0%
	Total	**42,801**	**100%**	**22,89,057**	**100%**

**Number of registered units as per Annual Survey of Industries 2022-23*

***Number of unincorporated enterprises manufacturing food and beverages as per ASUSE FY23-24*

Source: Ministry of Food Processing Industries (MoFPI), Crisil Intelligence

1.4 Government initiatives aimed at boosting India's food processing sector

The following key government initiatives and schemes are aimed at bolstering the infrastructure for India’s food processing sector.

Production Linked Incentive (PLI) scheme

The PLI scheme was announced in the Union Budget 2021-22, with a capital outlay of Rs 1,97,000 crores for a period of five years starting from fiscal 2021. The PLI Scheme for Food Processing Industry (PLISFPI) was approved by the Cabinet on March 31, 2021, with an outlay of Rs 10,900 crore, to be implemented between fiscal 2022 and fiscal 2027. This scheme consists of three components:

- incentivising manufacturing in four segments of food products (ready-to-cook/ ready-to-eat foods; processed fruits and vegetables; marine products; and mozzarella cheese)
- promoting innovative / organic products of small and medium enterprises (SMEs)
- incentivising branding and marketing of Indian brands in the global market for their promotion abroad

In addition, a PLI scheme for promoting millet-based products was launched in fiscal 2023 with an outlay of Rs 8,000 crores. As on 31 March 2025, a total of 170 applications from 132 companies have been approved under the PLI scheme, an investment of Rs 8,910 crores has been made against the target of Rs 7,722 crores, and employment has been generated for 3.4 lakh people.

Pradhan Mantri Kisan Sampada Yojana (PMKSY)

PMKSY, an umbrella scheme, has been under implementation by the Ministry of Food Processing Industries (MoFPI) since fiscal 2018. This scheme has made substantial contribution in strengthening the country's infrastructure for food processing and preservation. As

per the latest publicly available data, 1,646 projects have been approved under various component schemes of PMKSY. On reaching the operational stage, these projects are estimated to benefit about 5.1 million farmers and generate direct or indirect employment for more than 0.74 million people. The following table mentions the project cost under various component schemes of PMKSY as of 31 March 2025.

Table 5 Project cost under component schemes of PMKSY

	Sub-scheme	Project Cost in INR crores
1	Mega food parks*	4,660
2	Creation of infrastructure for agro-processing clusters (APCs)	2,294
3	Creation / expansion of food processing and preservation capacities (CEFPPC)	8,443
4	Integrated cold chain and value addition infrastructure	11,466
5	Setting up / upgradation of food testing laboratories (FTLs)	1,177
6	Backward-forward linkages (BFL)*	693
7	Human resources and institutions – research & development	97
8	Human resources and institutions – skill	19
9	Operation greens – long term interventions (OG)	2,103

**Scheme component discontinued*
Source: Budget documents, MoFPI, Sansad, Crisil Intelligence

Pradhan Mantri Formalisation of Micro food processing Enterprises (PMFME)

The PMFME scheme was launched by the government to address the challenges faced by participants in the unorganised segment of India's food processing sector. This scheme supports micro-enterprises by focusing on several aspects such as technology, machinery, financial aid, branding, marketing, and food safety.

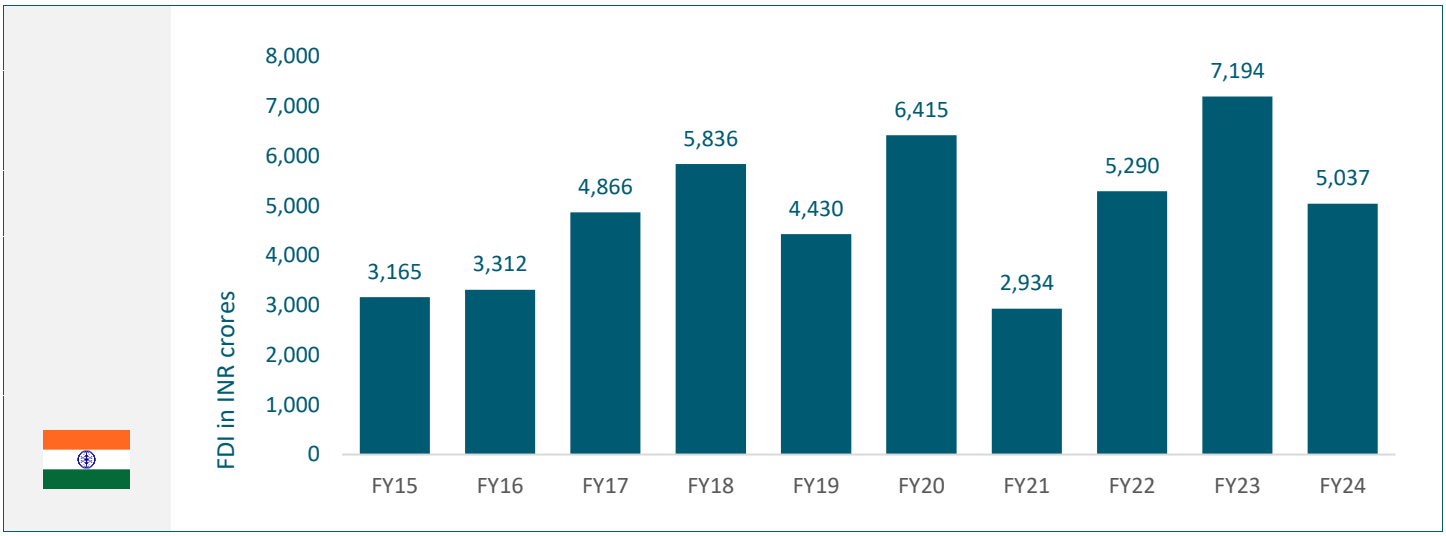
As part of the Atmanirbhar Bharat Abhiyan, this scheme has been operational for five years with an outlay of Rs 10,000 crores. As of March 2025, Rs 2,793 crores had been released under this scheme, resulting in the generation of direct / indirect employment for over 7 lakh people.

1.5 FDI inflows into India's food processing sector

FDI (foreign direct investment) inflows into India's food processing sector have varied significantly over the years. In the aftermath of Covid-19 pandemic, FDI inflows declined to Rs 2,934 crores in fiscal 2021. FDI inflows grew in FY22 and FY23, rising to their highest recorded value of Rs 7,194 crores (equivalent to $895.34 million) which declined to Rs 5,290 crore ($608.31 million) in fiscal 2024.

The following chart maps the FDI inflows into India's food processing sector over FY 2015 - 2024. The trend captured in the following chart reflects fluctuations caused by changing global economic conditions and investment policies.

Figure 2 FDI inflow into India's food processing sector in INR crores, FY15-24



Source: Department for Promotion of Industry and Internal Trade, Crisil Intelligence

2. Machinery used in key segments and food infrastructure parks in India

Food processing sector is supported by a wide variety of machines. one of the largest in the world. This is because diverse operations are carried out to process food such as sieving, pulping, grading, sorting, washing, peeling, mixing, grinding, cooking, pulverising, juicing, and frying.

2.1 Primary, secondary, and tertiary processing

Food processing operations can be broadly classified into three categories: primary processing, secondary processing, and tertiary processing.

Primary processing refers to operations that convert raw agricultural products into forms that are either suitable for consumption or further processing. These operations are carried out produce products such as grains, pulses, juices, purees and spices. Typical operations under primary processing are cleaning, grading, sorting, milling, and juice extraction.

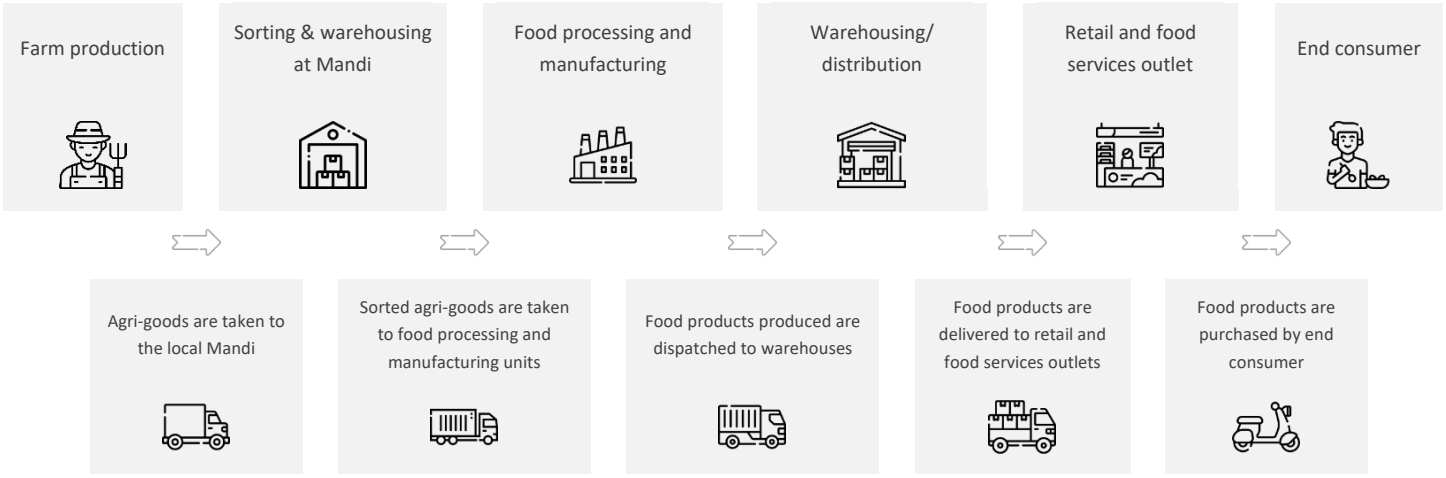
Secondary processing refers to operations that convert the output of primary processing into forms that are more valuable. Examples of these value-added forms include canned fruits and vegetables, frozen meats, seafood, bread, refined oil, etc. Typical operations under secondary processing are canning, bottling, freezing, extraction, and refining.

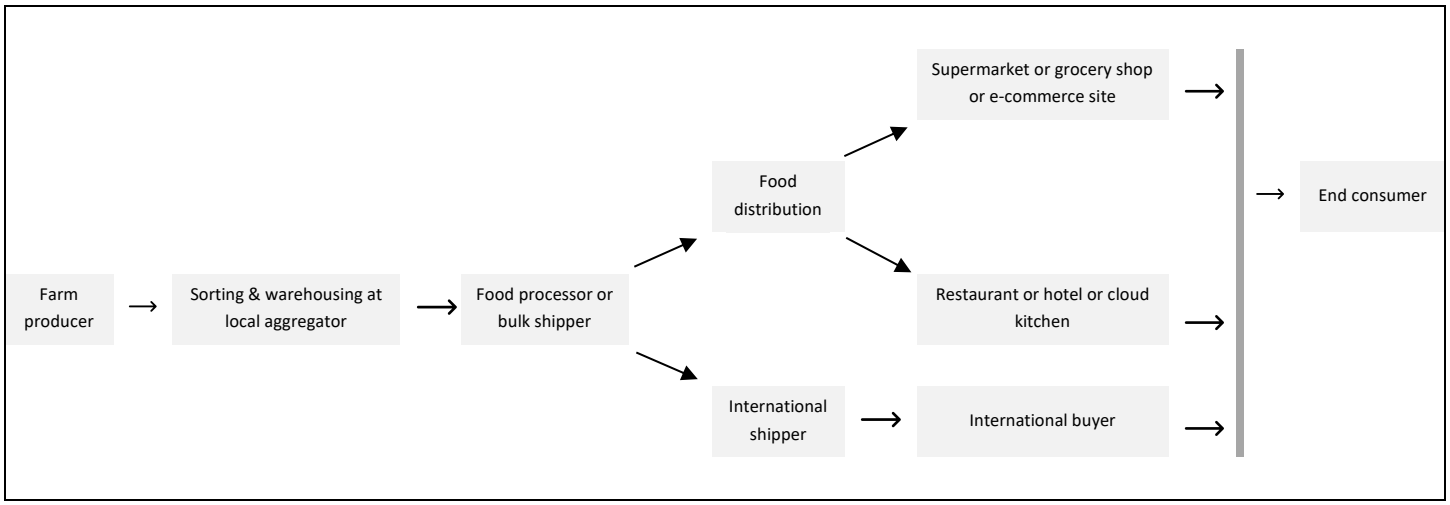
Tertiary processing refers to operations that convert the output of secondary processing into high value-added products. Examples of these products include chips, namkeens, energy bars, instant noodles, instant soups, frozen meals, etc. Typical operations under tertiary processing are formulation, blending, texturisation, flavouring, and seasoning.

2.2 Value chain of India's food processing industry

India's food processing industry is supported by several different entities. Each of these entities plays a crucial role in the value chain. The following chart highlights the major entities of India's food processing industry and the roles they play along the value chain.

Figure 3 Value chain of India's food processing industry





Source: Crisil Intelligence

Machines form the backbone of India's food processing industry. Several types of machines are used by different entities for carrying out various food processing operations. The following chart lists some of the key pieces of machinery and equipment used across the value chain of India's food processing industry. However, it must be noted that the following chart mentions some of the most used food processing machinery and equipment at each stage of the value chain. The actual machinery or equipment used for a specific operation depends on several factors such as the food product being processed, the scale of production, the skill level of the person(s) operating the machinery or equipment, etc.

Figure 4 Key machinery / equipment used across the value chain of India's food processing industry

Farm level	Collection centres	Food processing units	Food distribution & transport	Restaurants
▪ Harvesting machinery ▪ Machines for cleaning / washing ▪ Machine for sorting	▪ Machines for cleaning / washing such as soak tanks, washers ▪ Sorting and grading machines ▪ Machines for testing ▪ Packaging machines	▪ Peeling/ cutting/ pureeing machines ▪ Cooking/ blending/ frying machines ▪ De-oiling/ straining machines ▪ Packaging machines	▪ Cold storage warehouses consisting of freezers, coolers, atmosphere control machinery ▪ Silos for non-perishables ▪ Warehouse management systems for inventory management, tracking, etc. ▪ Temperature controlled vehicles or reefer trucks, tankers ▪ Conveyors, forklifts ▪ Wrapping machines, barcode scanning machines	▪ Machines for washing and cutting ▪ Mixers, food processors, blenders ▪ Grills, ovens, fryers ▪ Beverage dispensers, coffee machines, etc.
Primary processing	Primary + secondary processing	Tertiary processing		

Source: Crisil Intelligence

2.3 Category-wise plant & machinery

Grains and pulses

When comparing countries based on their production volumes, India emerges as the largest producer of pulses in the world, and the second largest producer of wheat and paddy.

India is a major producer of wheat, paddy, and pulses in the global context. In fiscal 2024, India's production of wheat was estimated to be about 113.292 million metric tonnes, while its production of paddy was estimated to be around 137.825 million MT. In the same fiscal, India's production of millet grains was recorded to be about 17.572 million MT. India is the largest producer of millets in the world with highly significant shares of global millet production across several varieties - kodo millet (100%), little millet (100%), barnyard (99.9%), finger millet (53.3%), and pearl millet (44.5%). In 2022, the share of India's millet production out of the world's total production of millets stood at around 20%.

Given India's prominence in production of grains and pulses, it is critical that India's producers have access to machinery and equipment essential for processing grains and pulses. Hence, in the following table, the different operations involved in the processing of pulses are outlined along with the key equipment needed for each operation.

Table 6 Processes involved, and key equipment used in processing pulses

Process	Description	Key equipment
Cleaning	Raw grains undergo a multi-stage cleaning process, involving destoning, sieving, and aspirator cleaning, to remove impurities. This process eliminates stones, finer impurities and dust.	Destoner, sieve, cleaner with aspirator
Sorting and grading	Raw pulses are passed through a grader, to separate grains into different fractions based on size.	Graders, optical sorters (size, weight, colour, shape)
Pitting	To loosen the husk, grains are passed through rollers resulting in cracking and scratching of their husk. This aids in the subsequent oil penetration process.	Carborundum / emery coated rollers
Oil treatment	Pitted pulses are treated with edible oil, such as linseed oil, for 12 hours to facilitate husk separation by allowing the oil to diffuse and loosen the husk from the kernel.	Batch mixer
Conditioning (alternate wetting and drying of oiled pulses)	The oiled pulses undergo a drying-wetting-drying cycle: first, they're dried in the sun or using a mechanical dryer; then, they're moistened with water while passing through a screw conveyor; finally, they're dried again to 10-12% moisture content, further loosening the husk for easy separation from the kernel.	Drying: mechanical dryer; Wetting: overhead tank, screw conveyor
De-husking	Conditioned pulses are passed through a roller and then the husk is removed using an aspirator, separating it from the grains.	Emery rollers, aspirator
Splitting	De-husked pulses are split and then separated into parts through sieving; this results in faster cooking and more evenly cooked grains.	Pulse splitter
Polishing	Water/oil is applied to split grains to impart shine to each grain.	Polisher
Packaging	Polished dal is weighed and filled into bags. These are then sealed, to keep out moisture and retain product quality.	Packaging machine
Testing	To ensure that the moisture content is optimum, a sample of dal is tested for its moisture content.	Grain moisture analyser

Source: Crisil Intelligence

Machinery used for processing grains and pulses is largely supplied by domestic players

Processing of grains and pulses involves primary processing operations such as cleaning, sorting, de-husking, and polishing. Of these, cleaning and grading / sorting are the most important operations as they are key to ensuring the quality and safety of the final product. Since grains and pulses mainly require primary processing, most of the machinery requirements are fulfilled by domestic players. All MSMEs use locally produced machinery, while a few large companies use some imported equipment such as optical sorters which offer

more precision in sorting and grading grains and pulses. Machinery for processing grains and pulses account for 5-10% of imported machinery, demonstrating India's low reliance on imported machinery for grains and pulses.

Industry insights

One of the key challenges faced by local manufacturers of machinery for grains and pulses is the management of demand during the peak of harvesting season. Since most of the demand for machinery comes during the harvesting season, some machinery manufacturers are compelled to refuse orders.

> *There is lack of innovation in the industry. Most of the Indian manufacturers are using the design of MNCs to make machinery in India without considering the requirements of the local processors. Due to this, about 5% of grains are lost during processing.*
>
> Machinery manufacturing player, Uttar Pradesh

> *Imported sorting machinery is much more technologically advanced than domestic machinery, which gives desired output. Hence, I opted for the imported one.*
>
> Grain processing player, Maharashtra

Fruits and vegetables

India's climate is apt for the cultivating a wide variety of fruits and vegetables. Leveraging this, India's food producers have propelled India to emerge as the world's second largest producer of primary fruits and vegetables.

As per the National Horticulture Database (second advance estimates) published by the National Horticulture Board, India produced 112.6 million MT of fruits and 204.9 million MT of vegetables in fiscal 2024.

Processing vegetables majorly involves freezing and packaging operations to protect the nutrient content of vegetables and to increase their shelf life. For most vegetables and some fruits, individual quick freezing is carried out wherein individual pieces of vegetables, such as peas, carrots and broccoli, are rapidly frozen to a temperature of -30°C to -40°C. This process helps in preserving the nutrients, texture and flavours. For some vegetables, this process also involves a retorting operation, which sterilizes the vegetables to increase their shelf life under ambient temperature conditions.

The following table covers the different processes involved in producing frozen peas along with the key equipment needed for each process.

Table 7 Processes involved, and key equipment used in producing frozen peas

Process	Description	Key equipment
De-podding	Pea grains are separated from the pods and sent for further processing.	Peas de-powder
Winnowing	To ensure that only pea grains undergo further processing, whole pods that are not de-podded from the grains are separated.	Pea winnower
Washing	Pea grains are washed in water, to remove dirt from their surface.	Vegetable washer
Blanching	Washed pea grains are heated in boiling water, to kill all enzymic activity in the pea grains.	Vegetable blancher
Cooling	Blanched peas are cooled to 10-15 degree Celsius, to make cooling in freezer easier.	Vegetable cooler
Dewatering	Moisture from grain surface is removed, so that no ice is formed on the pea grains during freezing.	Dewatering conveyor
Freezing	Peas are frozen using individual quick freezer, so that they do not lump together.	Individual quick freezer
Storage	Frozen peas are stored in cold chambers where the temperature is maintained at -18 degree Celsius before sending to packing.	Chilling equipment
Packaging	Frozen peas are weighed and filled into bags. These are then sealed, to keep out moisture and ensure product quality.	Packaging machine
Testing	A sample of frozen peas is thawed and boiled in water for 5 minutes to detect adulteration with Malachite Green, an organic dye used to enhance colour; if the water turns green, it indicates adulteration.	Boiling vessel

Source: Crisil Intelligence

Dehydration systems and precision cutting systems are largely imported

In terms of import dependency, dehydration systems and automation systems are largely imported. These imported machineries offer operational efficiency compared with Indian counterparts. There are three types of dehydration systems used in fruits and vegetables processing—normal hot air dryers, which India can produce, heat pump dryers, majorly produced in China, and freeze dryers, which are also largely imported. Indian companies lack the technical know-how of complex technologies, hence cannot produce the later types of two dryers. Additionally, automation products and parts are largely imported for fruit and vegetable processing plants, along with advanced blades for precision cutting. Import dependency in fruits and vegetable category is estimated to be on a moderate side with 15-25% share in total equipment consumption.

Industry insights

Fruits are typically a seasonal produce and involve less processing in the vegetable segment. Therefore, the capacity utilisation of machines in fruits and vegetables category is low.

> *In Gulf food exhibition Dubai, China, Turkey and European countries had their own pavilion; India did not. With the support of MOFPI, we can showcase our products at the global level to export more.*

Fruit & vegetable equipment manufacturer, Gujarat

> *CGS-I Scheme (CGTMSE): The scheme provides guaranteed cover for sanctioning of collateral free loans to entrepreneurs by banks, but it is difficult to avail.*

Vegetable processing player, Andhra Pradesh

Dairy

India's milk production constitutes 25% of the global milk supply. Given that, India's milk production surpasses that of all the other countries in the world.

Over the past decade, India's milk production grew at a CAGR of 5%. This growth is apparent in the production volume recorded over the years, which shows milk production rising from 187.3 million MT in 2018-19 to 239.3 million MT in 2023-24.

Under dairy processing, the most important process is that of pasteurization. This process involves heating raw dairy products to a high temperature within a short period of time, followed by rapid cooling of the same. When conducted correctly, this process extends the shelf life of the pasteurized product by killing the pathogenic bacteria present in it.

The following table lays out the details of how pasteurized milk is produced in India's dairy sector.

Table 8 Processes involved, and key equipment used in producing pasteurized milk

Process	Description	Key equipment
Chilling	To prevent bacterial growth, raw milk is cooled to a temperature of 2° C to 5° C and stored in a milk vat.	Milk vat
Separation	Raw milk is separated into cream and skim milk, to facilitate standardization.	Cream separator

Process	Description	Key equipment
Standardisation	To ensure consistent quality, cream is added back to the skim milk according to the type of milk being produced.	Standardisation machine which uses dosing units
Homogenisation	To ensure uniform diffusion of milk fat in the standardised milk, large fat globules are broken down into tiny droplets.	Milk homogenizer
Pasteurisation	To kill harmful bacteria, the homogenised milk is heated to 72° C for at least 16 seconds and then cooled down to ~30° C.	Vat pasteurizer
Packaging	Pasteurised milk is packed using a packaging machine. This keeps out moisture and ensures product quality.	Packaging machine
Testing	To assess the milk quality, a milk sample is mixed with a dye solution to measure microbial load; the time taken for the blue colour to disappear indicates the level of bacterial contamination.	Methylene blue thiocyanate solution, test tube, incubator

Source: Crisil Intelligence

Import dependency in the dairy sector is low, a few large players import technically advanced products

Processing equipment for pasteurisation, homogenisation and packaging are imported. Moreover, separator technology is still not largely available and imported from Tetra Pak and GEA. In packaging, aseptic filling and packaging machinery are also imported, although some equipment players offer aseptic filling machinery. Though available domestically, a few large players prefer the imported aseptic filling machinery due to the volume they can handle with precision and accuracy. Other types of machinery imported in this category include cheese processing machinery and yogurt incubators. Typically, MSMEs and smaller players do not use imported machinery for dairy processing. Import dependency of the dairy processing sector is estimated to range between 5-15%.

Industry insights

- Maintenance of advanced machinery poses a challenge at times.
- There is a lack of automated machines for sweets making industry in India.

> *On my next fund raise, I will dedicate a part of the fund for R&D to develop better machinery to make traditional Indian sweets.*
>
> Frozen sweets manufacturer, Maharashtra

> *Due to lack of standardised feeding, hygiene, and handling, there is variability in milk fat, microbial load, etc. which makes processing difficult.*
>
> Milk products manufacturer, Andhra Pradesh

Ready-to-eat / ready-to-cook

In India's food processing sector, this is the fastest growing segment on account of several factors including increasing urbanization, rising per capita income, and growing preference for convenience.

In the past few years, the ready-to-eat / ready-to-cook segment has grown at double-digit CAGR in India primarily driven by rising domestic consumption. Given that, it must be noted that besides keeping up with surging domestic demand, India's food processing sector emerged as a significant exporter of French fries in fiscal 2024, with total exports of 135,877 tonnes.

On the processing front, the ready-to-eat / ready-to-cook segment includes several different types of products. So, the machinery and equipment used in this segment encompass a wide range.

The following table delves into the specifics of how potato chips are produced on a commercial scale. Among the processes listed, blanching is used in the production of several other ready-to-products as well. In producing potato chips, blanching involves briefly submerging sliced potatoes in hot water or steam to remove excess starch.

Table 9 Processes involved, and key equipment used in producing potato chips

Process	Description	Key equipment
Washing	Potatoes are washed to remove any adhering soil, debris or field material.	Potato washing machine
Peeling	To ensure that chips look uniform, washed potatoes are peeled in a rotating drum, which has rough surfaces to remove the skin.	Potato peeling machine
Slicing	Peeled potatoes are cut into very thin slices to achieve the desired shape of potato chips.	Potato slicing machine
Blanching	Potato slices are blanched to avoid any change in colour.	Potato blanching machine
Dewatering	Potato slices are de-watered using vibration or air-blowing machines to remove surface moisture, preventing them from sticking together.	Dewatering machine
Frying	To reduce moisture content to less than 2%, potato slices are fried in a fryer.	Fryer

Process	Description	Key equipment
De-oiling	Fried chips are agitated in a de-oiling machine to remove extra oil from their surface.	De-oiling machine
Sorting	Chips are inspected using an optical sorting machine to ensure their consistency.	Optical sorting machine
Flavouring	Chips are seasoned in a rotating drum to evenly distribute salt and other flavouring agents.	Flavouring machine
Packaging	Chips are weighed and sealed into bags with nitrogen gas to keep off the moisture and ensures quality.	Packaging machine
Testing	Chips are tested with a texture analyser to measure their crispiness and hardness.	Texture analyser

Source: Crisil Intelligence

Level of import dependency is high for players producing large volumes of food

Automation products such as servo motors, servo drives, motors and pumps are largely imported in this category. Retort machines are also largely imported. Retorting is a process used to sterilise packaged food products, extending their shelf life without refrigeration while preserving their taste, texture and nutritional value. Though there are a few manufacturers who have started manufacturing retort machines in India, there is a requirement of using imported machinery by clients in the western countries. Other key machinery imported in this category include large batch fryers, seasoning equipment, with precise application mechanisms. A few players import filling and packaging machinery for their ability to efficiently and hygienically pack ready-to-eat (RTE) products, such as soups, sauces, and snacks. Additionally, the level of food processing is higher in European countries, which is why these countries come with more advanced machinery. Foreign consultants of large multinational manufacturers prefer the use of imported machinery due to their experience and precision and technical advancements of these machines. About 20-30% of equipment in the RTC / RTE category is estimated to be imported.

Industry insights

- The delivery time for imported machinery is low as the machines are ready to deliver, while Indian machines are made to order, which takes longer time to deliver, resulting in loss of business to imported suppliers in the highly competitive RTE/RTC segment.
- Skilled labour costs and raw material costs are very high.

> *We don't have the right technology and know-how to make automation products in India.*

RTE / RTC equipment manufacturer, Maharashtra

> *There is lack of skilled technicians for imported and advanced machinery. Maintenance of imported machinery becomes challenging at times.*

RTE food processing player, Delhi

Non-alcoholic beverages

The non-alcoholic beverage is set to grow rapidly, driven by factors such as rising health consciousness, urbanisation, and rising disposable income.

The market for non-alcoholic beverages is expected to see significant expansion in areas, such as healthy drinks, plant-based beverages, organic drinks, and sports drinks. This presents a highly optimistic outlook for the industry. Novel products, such as dairy alternatives and plant-based protein drinks, including almond milk and soy-based preparations, have gained worldwide popularity, particularly in high-income economies. Additionally, there is a rising demand for functional fortified beverages, naturally healthy drinks, and organic certified products, fuelling the sector's growth further. Manufacturers are also introducing innovative flavours and packaging to cater to diverse consumer preferences. The Indian government is actively promoting the non-alcoholic beverage sector through various initiatives, including the revival of traditional Indian drinks. For example, the Agricultural and Processed Food Products Export Development Authority (APEDA) under the Ministry of Commerce & Industry has launched a global campaign to rebrand and relaunch the classic Indian Goli Soda, now known as Goli Pop Soda. This nostalgic beverage, which was once a staple in Indian households, is experiencing a significant resurgence in the global market, driven by its innovative makeover and strategic expansion into international markets.

The production of non-alcoholic beverages involves several processing complexities. One of the main challenges is ensuring the quality and consistency of the raw materials, such as fruits, vegetables, and grains, which can vary in terms of flavour, texture, and nutritional content. Additionally, the processing steps, including sorting, washing, peeling, and juicing, require careful control to prevent contamination and spoilage. Further, the use of preservatives, sweeteners, and flavour enhancers must be carefully managed to meet regulatory requirements and consumer preferences. Overall, the production of non-alcoholic beverages requires a delicate balance of quality control, processing precision, and regulatory compliance to produce a safe and appealing final product.

Table 10 Processes involved, and key equipment used in producing fruit juice

Process	Description	Key equipment
Washing	Fresh, refrigerated, or frozen produce is washed to remove dirt and pesticides from its surface.	Washing machine
Sorting	Washed fruits or vegetables are fed into a sorting machine to remove damaged or spoiled items.	Sorting machine
Peeling	Fruits or vegetables are peeled using a peeling machine.	Peeling machine

Process	Description	Key equipment
Cutting	Peeled fruits or vegetables are cut into smaller pieces for juice extraction.	Multifunction vegetable chopper
Extraction	To extract juice, cut fruits or vegetables are pressed, crushed, or ground.	Juice extractors, such as belt presses, screw presses, and rack and cloth presses
Straining or filtration or clarification	Extracted juice is passed through non-corrodible metallic screens, to remove suspended solids, pectic substances and proteins.	Non-corrodible metallic screens
Pasteurising	To kill potentially harmful microorganisms, filtered juice is heated to a specific temperature for a certain period.	Pasteuriser
Blending	For consistency, different batches of pasteurised juice are blended.	Mixer
Addition of preservatives and/or additives	Preservatives and additives are added to the juice to enhance its flavour, colour and texture and to improve its shelf life.	Mixer
Packaging	To keep out moisture and ensure product quality, the juice is packed using a packaging machine.	Aseptic packaging using tetrapak, and flexible packaging machines
Testing	A juice sample is analysed with a refractometer to measure its °Brix value, estimating sugar content and other soluble solids in the juice.	Refractometer

Source: Crisil Intelligence

Import dependency of machines in the beverage category is high between 25-35%

There is a mid-to-high level of import dependency in the non-alcoholic beverage category, given the high volume and technical advancement required for processing. It is estimated that 25-35% of processing machinery in this category are imported. Automation products such as drives, programmable logic controllers, reverse osmosis membranes are imported as these are not available in India. Packaging machineries also imported in this category. Teta Pak packaging machinery and flexible packaging filling machines are imported. Additionally, high-speed bottling systems, canning systems, carbonation machines and advanced filtration machines used by large players are imported. Carbonation and mixing machines are imported for their ability to efficiently and consistently carbonate and mix beverages. A few other machineries imported in this category include advanced distillation systems and molecular sieve systems.

Industry insights

> *There are a lot of opportunities especially in the African market. However, there should be a single point of clearance for all exports as this becomes challenging.*
>
> Beverages' machinery manufacturer, Gujarat

> *Government should facilitate tie-ups with foreign manufacturers so that technology transfer of complex machinery can take place in some way. This will help domestic manufacturing of advanced machinery.*
>
> Beverages' machinery manufacturer, Gujarat

Meat processing

India ranks second in egg production as per the Food and Agriculture Organisation Corporate Statistical Database production data 2021.

According to the Food and Agriculture Organisation Corporate Statistical Database production data 2021, India ranks fifth in meat production in the world. Egg production in the country has increased from 78,480 million in 2014-15 to 138,380 million in FY23 and clocked a CAGR of 7.35% over the past nine years. The per capita availability of eggs was at 101 eggs per annum in 2022-23 compared with 62 eggs in 2014-15. Meat production in the country has increased from 6.69 million tonnes in 2014-15 to 9.77 million tonnes in 2022-23.

Chilling is one of the most critical steps in the meat processing chain that involves rapid cooling of the meat to a temperature that inhibits the growth of microorganisms, such as bacteria, yeast, and mold, which can cause spoilage and foodborne illness.

Table 11 Processes involved, and key equipment used in producing sausages

Process	Description	Key equipment
Cutting and deboning	Meat or poultry is cut and deboned to prepare it for grinding.	Meat cutting machine, deboning machine

Process	Description	Key equipment
Grinding	Meat or poultry is ground into a mince for mixing with non-meat ingredients.	Grinder
Mixing or blending	Ground raw meat or poultry components, water, spices, seasonings, and flavourings are transferred to a mixer or blender for uniform distribution of all ingredients.	Mixer or blender
Shaping or linking	The meat mixture is stuffed into sausage casings using a filling machine to contain the ingredients.	Sausage filling machine
Packaging	Sausages are packed using a packaging machine to keep out moisture and ensure product quality.	Packaging machine
Testing	A sample of the fresh sausage is sealed and tested for water activity to determine its moisture level, a key indicator of microbial growth potential.	Hygrometer

Source: Crisil Intelligence

In terms of import dependency, the sector is heavily reliant on imported machinery, especially for slaughtering, deboning, cutting, and packaging. Other key machinery imported by Indian players include sausage stuffing and casing machinery. The sector relies on imported machinery due to the limited availability of advanced domestic machinery that meets the standards of imported machinery designed to produce high-quality products with minimal waste and better texture, which is essential for meeting customer expectations. Imported machinery often comes with advanced food safety and hygiene features, such as easy cleaning systems, which reduces the risk of contamination and ensures compliance with international food safety standards. Slaughtering machines are imported for their ability to humanely and efficiently slaughter animals, which reduces stress and improves meat quality.

Industry insights

Indian manufacturers lack technical expertise to make complex machines like the imported ones.

> *We are following ISO 9001:2008. But the standards set for the Indian equipment are old and redundant. They require amendments.*
>
> Meat equipment manufacturer, Uttar Pradesh

> *We need some handholding and guidance in developing machines from a design standpoint and from the standpoint of good manufacturing practices and parts procurement.*
>
> Meat equipment manufacturer, Uttar Pradesh

Edible oil

India is the fourth largest oilseeds producer in the world. Major oilseeds plants include soybean, groundnut, mustard and sesame. Domestic output in the country often falls short of demand, which leads to high imports.

India has 20.8% of the total area under cultivation globally, accounting for 10% of global production. India produces groundnut, soybean, sunflower, sesamum, niger seed, mustard and safflower oilseeds.

Oil pressing, also known as oil extraction, is one of the most critical processes, which involves extracting oil from oilseeds, nuts or other oil-bearing materials using mechanical pressure or other methods. The goal of oil pressing is to separate the oil from the solid material.

Table 12 Processes involved, and key equipment used in producing edible oil

Process	Description	Key equipment
Cleaning	Oil seeds are cleaned with destoners, magnetic separators, and aspirators to remove stones, metal contaminants, and lightweight impurities, ensuring processing machines remain free of debris.	Destoner, magnetic separator, aspirator
Drying	Cleaned oil seeds are dried in grain dryers to reduce the moisture content and minimise degradation during storage.	Grain dryers
Dehulling or shelling or decorticating	Dried oil seeds are dehulled to remove abrasive hulls/shells, reducing wear on downstream processing machines.	Dehuller
Crushing	Dehulled oil seeds are crushed to meet the size requirement for flaking.	Oil seed crushing machine
Flaking	Small pieces of dehulled oil seeds are pressed to form thin flakes for faster cooking.	Flaking machine
Cooking or tempering	Oil seed flakes are heated at elevated temperatures to denature proteins and deactivate enzymes that split fats.	Cooker
Extruding or puffing	Cooked flakes are heated at high pressure for a short time and then released under atmospheric pressure to improve the oil extractability.	Extruder

Process	Description	Key equipment
Pressing	Oil seed flakes are separated into raw oil and oil seed meal.	Oil press machine or oil extraction machine or expeller
Degumming	Raw oil is treated in a degumming machine to remove the gums.	Degumming machine
Neutralisation	Fatty acids are removed when degummed oil is treated with a neutralising agent in a neutralizer.	Neutraliser
Bleaching	Degummed oil is mixed with bleaching earth in a bleacher to absorb colour pigments, then removed to produce bleached oil.	Bleacher
Deodorising	Bleached oil is subjected to steam distillation under high temperature and vacuum to evaporate all odour substances.	Deodoriser
Dewaxing or winterization	Deodorised oil is chilled in a crystalliser to crystallise the waxes present in the oil; the crystals are then removed from the oil.	Crystalliser
Packaging	Oil is packed using a packaging machine to keep out moisture and ensure product quality.	Packaging machine
Testing	A free fatty acid (FFA) test strip is used to determine the oil's FFA content by colour change, ensuring it meets quality standards and avoiding deterioration of quality.	FFA test strip

Source: Crisil Intelligence

India's edible oil processing industry was traditionally reliant on imported machinery, however, in recent times, adoption of Indian made machinery has increased. Oil press machines, which are more advanced, are now being offered by Indian manufacturers. In addition, technologies such as cold press and automation are being offered in Indian machines, thereby reducing the reliance on imported machinery. India has a wide range of oil extraction machines available, catering to various needs and industries.

Some common types of oil machines available in India are cold press oil machines, screw press oil machines, hydraulic oil press machines, oil expeller machines, and mini oil mills automatic oil machines. Certain oil pressing machines for products such as coconut are still being imported. Imported oil pressing machines come with more advanced technology, such as hydraulic or screw processing, which can provide higher oil extraction efficiency and better-quality output. Imported oil pressing machines often comply with international standards, such as ISO or CE, which are essential for exporting edible oil to other countries. Imported oil pressing machines also have higher capacity, which enables Indian edible oil processors to process larger quantities of oilseeds and meet growing demand. Some large players still import machinery such as oil pressing machines and oil filtration machines.

Industry insights

> *Machines for coconut oil processing are still largely imported by players in our country.*
>
> Coconut oil processing player, Tamil Nadu

> *Multiple middlemen increase costs and reduce quality.*
>
> Soybean oil processing player, Uttar Pradesh

Bakery and confectionery

The Indian bakery market, which includes biscuits, confectionery, cakes and pastries, is estimated to have reached Rs 1.17 – 1.20 lakh crore in fiscal 2024.

In India, biscuits dominate the bakery market with an estimated ~55% share in fiscal 2024, followed by chocolates (20%) and sugar-based confectionery (14%).

Baking is one of the most critical processes in biscuit making (as shown in the example below) and in the overall bakery industry. Baking gives biscuits their characteristic texture and structure, including crispiness, crunchiness, and chewiness, and helps to develop their flavour, colour and appearance.

Table 13 Processes involved, and key equipment used in producing biscuits

Process	Description	Key equipment
Mixing and kneading	All ingredients, including wheat flour, sugar, leavening agents, skimmed milk powder, and malt extract, along with fats, are fed into a mixer where they are mixed properly to prepare the dough.	Mixer
Moulding	Dough is processed through a biscuit moulding machine with three key components—rollers, cutters, and laminators. First, the dough is fed through the rollers to flatten it, making it easier to cut. Next, the dough sheets are hardened and layered by the laminator. Finally, the laminated sheets are passed through the cutter, which precision cuts them into the desired shape, giving biscuits their distinctive form.	Biscuit moulding machine
Baking	Moulded biscuits are transferred to the oven via a conveyer belt in batches where they are baked, causing the leavening agents to create gas which makes the biscuits rise and become crispy.	Oven
Cooling	Baked biscuits are passed on to cooling conveyors for natural cooling.	Cooling conveyor
Packaging	Cooled biscuits are stacked and fed into the packaging machine for packaging to avoid moisture and ensure product quality.	Packaging machine
Testing	A sample of biscuits is treated with controlled forces to quantify its texture properties, measuring its crispiness, hardness, and chewiness of the biscuits.	Texture analyser

Source: Crisil Intelligence

Larger players are dependent on imported machinery for advanced processes such as mixing, baking, filling and optical sorting, while smaller players use domestic machinery. For instance, imported ovens come with advanced technology, such as automatic temperature control and steam injection, which might not be readily available in domestic counterparts. Imported mixers and blenders can mix at high speeds and come with more precision control systems. In the long run, imported equipment can be more cost-effective, even though the upfront cost is much higher, due to higher productivity and efficiency. About 30-35% of the machine requirements are estimated to be fulfilled through imports in this category given the high demand for these products and the large volumes these imported machinery can handle.

Industry insights

> *Multi-purpose machinery lines are employed for producing diverse biscuit types, which provide operational flexibility and reduced downtime.*
>
> Biscuit manufacturing player, West Bengal

> *Preferred suppliers are from Germany, Italy, and Switzerland due to their expertise in biscuit manufacturing equipment. Companies like Bosch and GEA have been used to source machinery.*
>
> Biscuit manufacturing player, West Bengal

Tea and coffee

India is the second largest producer of tea globally based on Tea Board of India (Government of India) article published in March 2023.

Indian tea is among the finest in the world because of the significant investments made in tea processing units, the wide product range and innovations to keep pace with changing demands. Indian tea also holds several geographical indication tags, for instance Darjeeling tea.

India is the seventh largest producer of coffee in the world. As per the post-blossom estimate of Coffee Board of India, the country's coffee production reached 374,200 tonnes during coffee year 2023-24 (October 2023-September 2024). Karnataka, Kerala and Tamil Nadu dominate the country's coffee production, accounting for approximately 96% of the output in this period, with Karnataka alone contributing 71%.

Table 14 Processes involved, and key equipment used in producing tea

Process	Description	Key equipment
Plucking	Tea leaves are plucked from the top of the plant for processing within a few hours to prevent fermentation.	Tea plucking machine
Withering	The leaves are laid out on bamboo mats or tarps, or rotated in a withering machine, to reduce the moisture content.	Tea withering machine
Rolling, maceration or bruising	Withered tea leaves are rolled, twisted and crushed to break down their cell walls and initiate oxidation.	Rolling machine or rotor vane
Firing	The leaves are briefly heated to a high temperature to denature enzymes and halt oxidation, preventing browning.	Tea leaf roasting machine
Sorting	The leaves are separated into batches based on their size, because different-sized leaves brew at different speeds.	Tea sorting machine
Packaging	Tea leaves are filled into bags which are then sealed to keep out moisture and ensure product quality.	Packaging machine
Testing	A sample of is tested for its concentration of theaflavins as they are responsible for the astringency of the tea.	Spectrophotometer

Source: Crisil Intelligence

Table 15 Processes involved, and key equipment used in producing coffee

Process	Description	Key equipment
Harvesting	Coffee cherries can be harvested using two methods: strip picking, which involves removing all cherries from a branch and then sorting out unripe (green) and overripe (very dark) ones; or selective picking, which involves hand-picking only the ripe, deep red cherries.	Coffee harvesting machine
Parchment coffee bean extraction	Parchment coffee beans can be extracted in two ways: ▪ Dry method: Cherries are sun-dried on beds, regularly raked and turned to ensure even drying, and covered at night to prevent moisture absorption. This process takes several weeks, until the outer layer turns black and brittle, transforming the cherries into parchment coffee beans. ▪ Wet method: Cherries are pulped to remove their outer skin, then fermented in water and enzymes to dissolve the mucilage. The beans are then washed and dried in the sun or a dryer till the moisture content is reduced to 11%, resulting in parchment coffee beans.	▪ Dry method: drying beds ▪ Wet method: pulping machine, fermentation tank, washing machine, drying table or dryer
Hulling	Dried parchment coffee beans are hulled to remove the parchment layer.	Hulling machine
Polishing	Any silver skin that remains on after hulling is removed to produce polished beans, which are considered superior to unpolished ones.	Coffee polisher

Process	Description	Key equipment
Grading and sorting	Polished coffee beans are sorted and graded according to size, colour and weight. This process separates high-quality beans from defective or low-quality ones, ensuring that only the finest beans are processed and packaged together.	Sieves, coffee bean colour sorting machine, gravity separator
Roasting	The beans are roasted to the required level and then immediately cooled to produce aromatic brown beans.	Roasting machine
Grinding	The roasted beans are ground into the desired size.	Coffee grinding machine
Packaging	Ground coffee is weighed and usually packed in airtight bags or sealed containers to avoid moisture and ensure product quality.	Packaging machine
Testing	A small amount of coffee is brewed and cooled to room temperature to measure its pH level, which indicates if the coffee tastes sour or bland.	pH meter

Source: Crisil Intelligence

The tea and coffee processing industries are not heavily reliant on imported machinery, though some advanced and auxiliary equipment, such as moisture analysers, de-stoners for sorting and quality control equipment, are imported. Imported moisture analysers are equipped with advanced technology such as infrared and microwave sensors, which provide faster and accurate measurement. Imported de-stoners often come with advanced separation technology, such as air jets and more efficient vibrating screens, and have higher processing capacities. Larger players also import sophisticated packaging machinery. For larger players, import dependency is 20-30%, while smaller players do not import machinery for tea and coffee processing.

Industry insights

> *There is good demand from neighbouring countries like Nepal. We are looking forward to availing ourselves of this opportunity.*
>
> Tea processing machinery manufacturer, Gujarat

> *Export grade tea products often require more precise sorting and blending systems to maintain consistency in flavor and aroma. As a result, bigger players import machinery for their processes.*
>
> Tea processing machinery manufacturer, Gujarat

Spices

India is the largest producer. Consumer and exporter of spices in the world. Growth in the industry is driven by strong domestic demand and growing international markets for natural flavouring and health-based ingredients.

In fiscal 2024, the country's spice production reached 11.8 million MT, with garlic being the topmost produced spice, trailed closely by chilli and ginger. Among states, Madhya Pradesh (31%) was largest producer of spices in fiscal 2024, followed by Gujarat and Andhra Pradesh.

Mixing and grinding are crucial processes in spice processing. Mixing ensures that the spices are uniformly blended, which is essential for achieving consistent flavour and aroma. It also helps break down lumps or agglomerates, ensuring that the spices are evenly distributed and homogeneous. Grinding reduces the particle size of the spices, which increases their surface area and allows for better extraction of flavour and aroma compounds.

Table 16 Processes involved, and key equipment used in producing blended spice

Process	Description	Key equipment
Cleaning	Whole raw spices are processed using several cleaning machines to remove large contaminants.	Destoners, magnetic separators, air blowers
Washing	Spices are washed using weak alkaline cleaning solutions and/or neutralising agents to remove small contaminants.	Spice washing machine
Drying	The spices are dried either in the sun or in a spice dryer.	Spice dryers, such as tray, rotary or fluidised bed dryers
Roasting	The dried spices are roasted to intensify their flavour and aroma.	Drum, infrared or hot air roasters, among others
Sorting and grading	The roasted spices are sorted and graded by size, colour and density. The result is a collection of uniform-looking spices.	Sieving machines, optical sorters and density separators
Grinding	The spices are crushed into powder.	Spice grinders
Sieving	The finely ground spices are run through sieves or screens to achieve a uniform particle size in the spice powder.	Sieves/ screens

Process	Description	Key equipment
Mixing or blending	Spice powders are mixed to produce a custom blend.	Mixer
Packaging	The blended spice powder is weighed and filled into bags, which are sealed to keep out moisture and ensure product quality.	Packaging machine
Testing	A sample of the spice blend is taken in a crucible, weighed and then heated in a muffle furnace until all the organic matter in the spice blend is burned. The residue or ash is then weighed.	Crucible, muffle furnace

Source: Crisil Intelligence

Very few large players import machinery for advanced processes such as grinding and mixing. Overall, import dependency is very low in the sector at less than 10%.

Sugar

India is the largest consumer and second largest producer of sugar in the world. India's sugar industry plays a pivotal role in the rural economy supporting over 50 million sugarcane farmers & their dependents and numerous ancillary industries.

Sugarcane production in India has increased 40% from 352 million MT in fiscal 2014 to 491 million MT in fiscal 2024. India has a share of about 15% in global sugar consumption and 20% in global production but import and export of the commodity is regulated by government.

In sugar processing, crystallisation is one of the most critical processes as it determines the quality of the sugar, including its purity, colour and texture. Crystallisation affects the yield as well, as it determines how much sugar can be recovered from the sugar solution.

Table 17 Processes involved, and key equipment used in producing sugar

Process	Description	Key equipment
Cleaning	Sugar cane is spread on agitating conveyors that pass through strong jets of water and combing drums to remove debris.	Conveyor

Process	Description	Key equipment
Cutting	The cleaned sugar cane is cut into small pieces.	Cane knife
Shredding	The pieces are shredded to expose the sucrose-containing plant cells in the cane.	Swing-hammer type shredder
Diffusion	The shredded cane is washed with hot water, causing it to disintegrate into juice and bagasse (fibrous residue).	Cane diffuser
Clarification	The extracted cane juice is blended with milk of lime and heated in a clarifier, causing it to separate into two distinct layers. The clear juice rises to the top, while a precipitate, known as 'mud', settles at the bottom. The mud is removed, filtered and processed to recover the sucrose it contains.	Clarifier
Evaporation	The clarified juice is passed through a series of multiple effect evaporators that remove about two-thirds of the water content through vacuum evaporation, forming a syrup (35% water).	Evaporator
Crystallisation	The syrup is concentrated to saturation in vacuum pans, into which tiny sugar crystals known as seeds are introduced. The sucrose molecules in the syrup begin to crystallise onto these seeds, forming a dense mixture called massecuite, which consists of sugar crystals suspended in syrup. The massecuite is transferred to large crystallisers, where it is slowly stirred and cooled, allowing the crystallisation process to continue.	Single-stage vacuum pans, cooling crystallizers
Centrifuging	The crystallised massecuite is placed into centrifuges, which separates it into raw sugar crystals and a liquid, called molasses. The raw sugar crystals are retained and the molasses pass through the lining of the centrifuge basket, which is stored in large tanks.	Centrifugal machine
Drying	The raw sugar crystals are dried and granulated by passing through heated air to obtain dry crystals of brown sugar.	Sugar granulator
Grading	The dry sugar crystals are sorted by size through vibrating screens and placed in storage bins.	Screen
Packaging	The sugar is weighed and packed to keep out moisture and ensure product quality.	Packaging machine
Testing	A sample of the sugar is analysed to establish its International Commission for Uniform Methods for Sugar Analysis (ICUMSA) rating, which determines its purity based on colour.	Colorimeter or photometer

Source: Crisil Intelligence

Since the industry is quite developed in the country, machinery for sugar processing is also largely produced domestically. Most large players also procure machinery domestically, while all small and mid-sized players use only domestic machinery. Equipment and

machinery that is sometimes imported by large players includes centrifugal machines, sugar refining machines, crystallisers and evaporators.

Oleoresins

Oleoresins are natural extracts that combine the essential oils and resinous components of spices or herbs. They capture the full flavour, aroma, and colour of the raw spice in a concentrated form.

Oleoresins are used as flavourings, colourings and fragrances in a variety of industries, including food, beverages, pharmaceuticals and cosmetics. India is a key producer of oleoresins given its leading position in the world in spice production. Spice oleoresins produced in India include:

- **Paprika oleoresin:** India is the largest producer of paprika oleoresin, which is used as a colouring agent in food products
- **Chilli oleoresin:** India is also a major producer of chilli oleoresin, which is used as a flavouring agent in food products
- **Turmeric oleoresin:** India produces a significant quantity of turmeric oleoresin, which is used as a colouring and flavouring agent in food products
- **Ginger oleoresin:** India is also a major producer of ginger oleoresin, which is used as a flavouring agent in food products and beverages

The process of extracting the solvent from spices is complex and technically advanced, which is why more than 50% of machines used by large players are imported. Extractors, spray dryers and distillation machinery are the key equipment imported in this category.

- Extractors are imported for their ability to efficiently extract oleoresins from spices, herbs and other plant materials
- Spray dryers are imported for their ability to efficiently dry oleoresins and produce high-quality powders
- Distillation machinery is imported for its ability to efficiently separate and purify oleoresins, which is essential to ensure high quality

Table 18 Processes involved, and key equipment used in producing oleoresin

Process	Description	Key equipment
Cleaning	Whole spices are cleaned to remove debris, metal and other contaminants.	Destoner, gravity separator, sieve metal detectors

Process	Description	Key equipment
Drying	The cleaned spice is dried artificially to reduce its moisture content to 8-10% to prevent fungal growth and toxin production in the spice.	Convection dryers
Grinding	The dried spice is ground to prepare it for distillation.	Grinding mill
Distillation	The ground spice is placed in a distillation apparatus through which steam is passed. The essential oils in the spice are vapourised and passed through a condenser to cool them to a liquid state. The liquid mixture of water and essential oils settles in such a way that the essential oils accumulate on the water surface and are then collected along with the de-oiled cake.	Steam distillation apparatus
Extraction	The de-oiled cake from distillation is treated with an appropriate solvent to extract non-volatile resins.	Percolator
Blending	The non-volatile resins and the volatile essential oils are blended and homogenised to obtain a smooth oleoresin.	Mixer
Packaging	The oleoresin is weighed and packed to keep out moisture and ensure product quality.	Packaging machine

Source: Crisil Intelligence

Industry insight

> *The food industry, including operators within food parks and independent entities, faces significant working capital constraints. Banks typically require 100% collateral to provide working capital, and if they provide collateral-free loans, the interest rates can soar above 15%.*
>
> Equipment manufacturer, Gujarat

> *Banks tend to disregard small working capital requests.*
>
> Equipment manufacturer, Gujarat

2.4 Processing infrastructure at food parks shows low to medium reliance on imported machinery

Mega food parks (MFPs) and food parks in India are designed to provide comprehensive infrastructure for the food processing industry, enabling efficient and cost-effective production, processing and packaging of products.

Crisil's survey of food parks across the country indicated that ~20% food parks rely on imports for over 20% of the machinery for common processing infrastructure, while the rest (~80%) import ~0-10% of the machinery.

Table 19 Core processing infrastructure and the average installed capacity in a food park

Product line or facility	Average installed capacity at a food park
Individual quick-freezing (IQF) lines	IQF lines for fruits and vegetables with capacities of up to 1,200 kg/hour
Tetra Pak juice units and flexible packaging juice units	15,000 pieces per hour of 200 ml each
Dairy unit raw milk processing, pouching	More than one lakh litres
Packhouses	Capacity of 10 metric tonnes per hour consisting of stages such as washing, sorting, drying, waxing and grading
Spice processing line	15 metric tonnes per day with cleaning and grading equipment, separators, grinders, driers, pulverisers and packaging machinery

Source: Food park websites, Crisil Intelligence

Table 20 Cold chain infrastructure at food parks

1	Ripening chambers	These are airtight rooms with insulation, temperature control systems, air circulation systems, humidity control systems and ethylene gas injection systems
2	Cold and blast freezers	These refer to frozen storage (-18 to -20 degrees Celsius) and cold storage (0 to 8 degrees Celsius)
3	Individual quick-freezing lines	These comprise fluidisers, boilers, cooling coils, low temperature belts, high pressure fans, air pressure controls and air compressors

Source: Food park websites, Crisil Intelligence

Table 21 Other common facilities at food parks

1	Plotted areas and sheds	These are pre-sanctioned industrial plots with access to water, sewer and power supply lines. Investors can use all common facilities at nominal charges.
2	Basic enabling infrastructure	This includes road network, electric substation and distribution, street lighting, common effluent treatment plant, stormwater drainage system, water supply system, solid waste management system, weighbridge, boundary walls, security and IT enabling systems.
3	Core processing infrastructure	This includes dry warehouses, steel silos, cold and frozen stores, dairy and juice processing lines, fruits and vegetables quick freezing lines, testing labs, boilers, reefer vans, and food testing laboratories.

4	Non-core infrastructure	This includes conference halls, office space, meeting rooms, canteen, dormitories, primary health centre, creche, and parking area.

Source: Food Park websites, Crisil Intelligence

2.5 Import dependency varies across food categories

The reliance on imported machinery ranges from as low as 0-10% for sugar to as high as above 50% for meat and oleoresins, with most categories falling between 10-35%. The meat processing sector is the most reliant on imported machinery. Bakery and confectionary, beverages, and ready-to-eat/ready-to-cook products also have a significant dependence on foreign equipment, with import dependencies ranging from 20-35%. In contrast, sectors like tea and coffee, spices and sugar have relatively lower import dependencies, indicating a greater degree of self-sufficiency in these areas. Within the categories, large players prefer imported machinery compared with small or MSME players. The table below summarises the import dependency of the different categories in the food processing industry.

Table 22 Category-wise import dependency

Category	Large players	Small players	Overall import dependency for the category
Grains and pulses	🟡	🟢	10-20%
Fruits and vegetables	🟡	🟡	15-25%
Dairy	🟢	🟢	5-15%
Ready-to-eat/ ready-to-cook	🟡	🟢	20-30%
Beverages	🔴	🟡	25-35%
Meat	🔴	🔴	Heavily reliant on imported machinery, especially for slaughtering, deboning, cutting and packaging
Edible oil	🔴	🟡	25-30%
Tea and coffee	🟡	🟢	5-15%
Spices	🟡	🟢	5-10%
Bakery and confectionary	🔴	🟢	30-35%
Sugar	🟢	🟢	0-10%
Oleoresins	🔴	🟡	More than 50% for large players as the process of extraction is complex and technically advanced
Cold chain	🟡	🟡	15-25%, for cooling components and refrigeration units
Common infrastructure facilities	🟢	🟢	5-10% for refrigeration
Testing lab equipment	🟡	🟡	15-20% for deep freezers, ultrasonic baths and vacuum desiccators, GMO testing, DNA sequencing and heavy metals analysis

Note: Red colour denotes high import dependency above 50%, orange denotes medium import dependency between 15-50%, green denotes low import dependency below 15%. Small players are those with revenue of less than Rs 100 crore, with the rest classified as large players.

Source: Crisil Intelligence

2.6 Challenges faced by farmers in using simple machinery

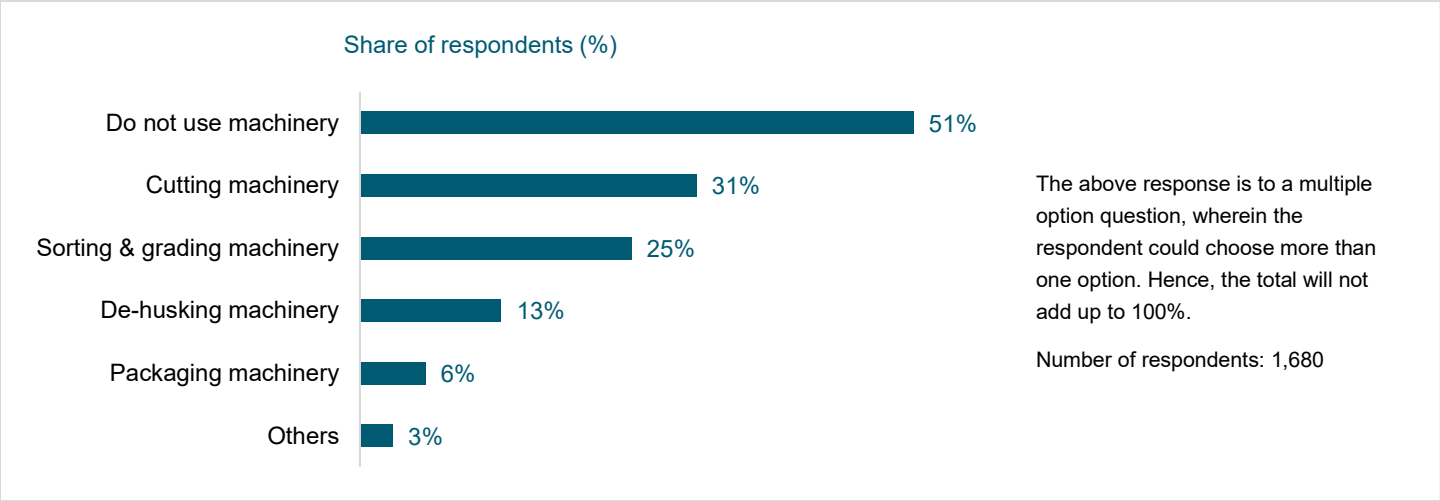
Crisil Intelligence surveyed 1,680 farmers evenly spread across 26 states, including Uttar Pradesh, Punjab, Kerala, Manipur, Arunachal Pradesh, Rajasthan, Karnataka, Gujarat, Haryana, Madhya Pradesh, Tamil Nadu, Telangana and Maharashtra. Among the respondents, 34% are small farmers (less than four hectares of land), 41% are medium farmers (four to 10 hectares) and the remaining 25% are large farmers with more than 10 hectares of land.

The survey aimed to understand the type of machinery used by the farmers, the procurement process and challenges faced.

Cutting machinery used widely, but adoption of post-harvesting machinery low

In post-harvesting operations, cutting machinery is the most widely used equipment, followed by sorting and grading machinery, and de-husking machinery. However, more than half of the farmers surveyed do not utilise any machinery for post-harvesting purposes.

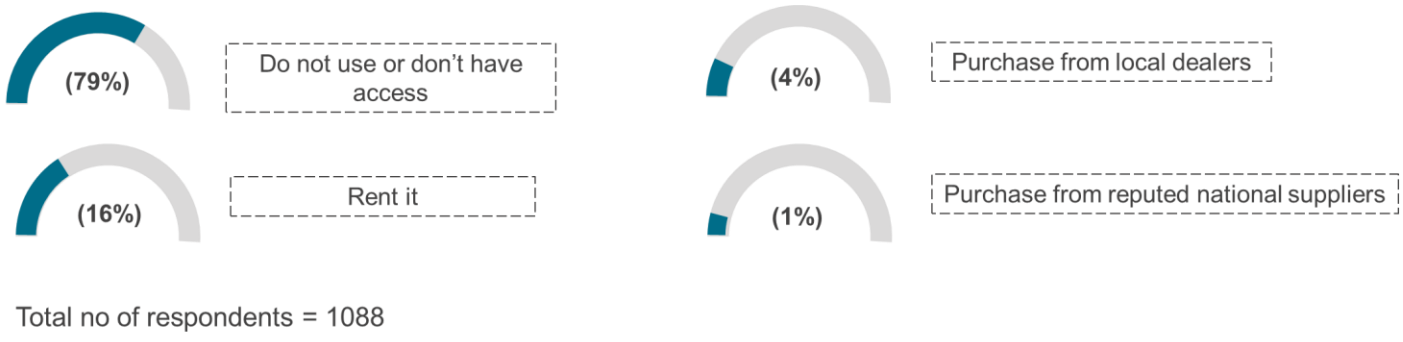
Figure 5 Type of machinery used by farmers



Source: Crisil Intelligence

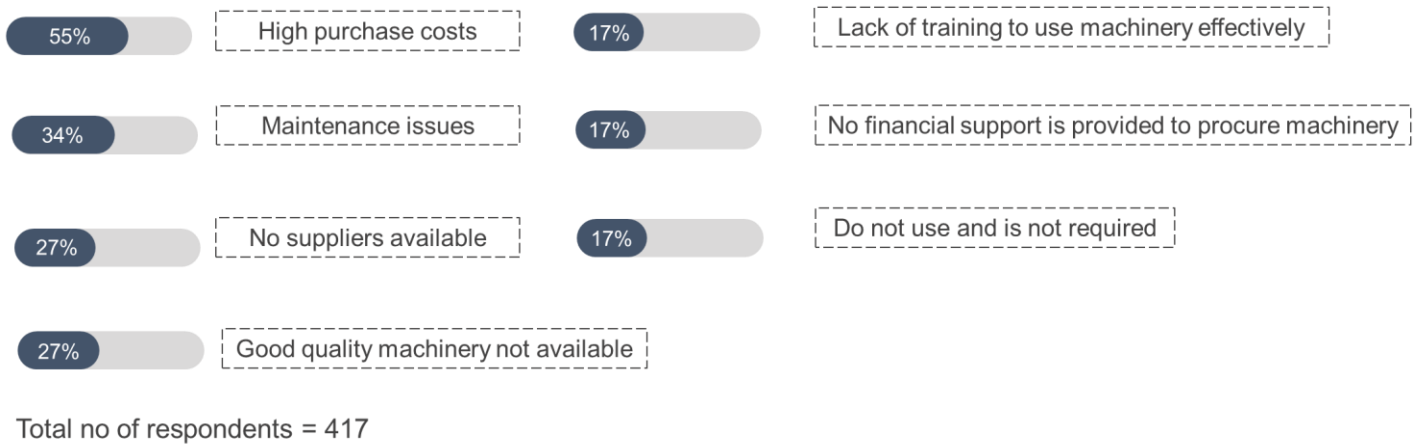
When it comes to acquiring post-harvesting machinery, renting is the preferred method for most farmers, followed by purchasing from local dealers and buying from well-established national suppliers. Nevertheless, bulk of the farmers either do not have access to such machinery or choose not to use it.

Figure 6 Renting is the preferred method for procuring equipment



Source: Crisil Intelligence

Figure 7 Challenges faced by farmers in procuring machinery



Note: The above response is to a multiple option question, wherein the respondent could choose more than one option. Hence, the total will not add up to 100%. Source: Crisil Intelligence

3. Overview of procurement sources and manufacturing base of P&M in the country

3.1 Domestic manufacturing landscape

Global companies with domestic presence dominate the landscape

India's food processing machinery sector is diverse and strategically positioned. It caters to various segments such as dairy, beverages, meat processing, packaging, and automation. Food processing machinery companies are spread across key industrial hubs, ensuring efficient supply chain management and access to raw material. Several of the leading global process equipment manufacturers such as Alfa Laval, Buhler, GEA group, Tetra Pak have a presence in India. These players cater to demand for machinery in India as well as other countries in the Asian subcontinent.

Indian equipment manufacturers can meet domestic demand but lack volumes and scale to compete with established brands from Germany, Japan, and the US. Specialised technology and tools, such as high-tensile cutting blade, are imported as these are not manufactured in India. MNCs have also invested in research and development (R&D) to develop the requisite expertise and technology. New product development takes time, which impacts the capabilities of the domestic equipment manufacturers to compete with the global companies.

One of the most significant barriers India faces in the global market is the perception about its products. India's manufacturing sector has traditionally been linked with low-cost production, which has often been synonymous with compromised quality. To effectively compete with renowned brands from countries like Germany, Japan, and the US, India needs to revamp its image and prioritize quality.

Below is a detailed tabular representation of the top food processing machinery companies in India, covering their location, specialisation, capacity, and unique offerings:

Table 23 Top food processing machinery companies in India

Company	Location	Product list	FY24 revenue (Rs crore)	Add-on details
1 Alfa Laval India Pvt Ltd	Pune, Maharashtra	Heat exchangers, separators, pumps, and fluid handling systems	1,687.3 (CY22)	Global presence, ISO-certified, energy-efficient solutions
2 Buhler India Pvt Ltd	Bengaluru, Karnataka	Grain milling, pasta production, and chocolate processing	858.5	Swiss technology, energy-efficient systems
3 GEA Group India	Vadodara, Gujarat	Dairy, beverage and food processing equipment	573.5	Focus on sustainability, automation, and turnkey solutions
4 Heat and Control	Chennai, Tamil Nadu	Snack food processing, frying, seasoning and packaging system	386.4	Global leader in snack food processing, innovative solutions

Company	Location	Product list	FY24 revenue (Rs crore)	Add-on details
5 Tetra Pak India Pvt Ltd	Pune, Maharashtra	Packaging and processing solutions for liquid food	437.5	Aseptic packaging, ecofriendly designs
6 Krones India Pvt Ltd	Secunderabad, Telangana	Processing machinery beverages, dairy products, confectionary	201.8 (CY22)	Provides turnkey solutions for the liquid consumer products industry
7 Sidel India Pvt Ltd	Gurugram, Haryana	Beverage packaging and processing solution	258.1	Global leader in beverage packaging, ecofriendly design
8 Fowler Westrup (India) Pvt Ltd	Malur, Karnataka	Grain and seed processing machinery	260.8	Advanced seed and grain processing solutions
9 Nichrome India Ltd	Pune, Maharashtra	Packaging machines for food, dairy, and beverages	122.0	Innovative packaging solutions, ISO-certified
10 Kanchan Metals Pvt Ltd	Greater Noida, Uttar Pradesh	Food processing confectionery, sweets and packaging machinery	162.6	High-quality stainless steel fabrication affordable pricing with hygiene designs
11 Danfoss Industries Pvt Ltd	Gurugram, Haryana	Refrigeration, heating, and cooling systems for food processing	2,569.8	Energy-efficient solutions, leading provider of climate and energy technologies
12 Bajaj Processpack Ltd	Noida, Uttar Pradesh	Packaging and processing machinery for food	232.8	High-quality, ISO-certified, turnkey solutions
13 IDMC Ltd	Anand, Gujarat	Dairy equipment, milk handling and packaging systems	751.0	Pioneer in dairy machinery, trusted by Amul and other major dairy brands
14 Windsor India Ltd	Ahmedabad, Gujarat	Bakery, confectionary, and snack processing machinery	354.0	Advanced automation, high-quality machinery
15 SSP Pvt Ltd	Mumbai, Maharashtra	Dairy, fruit and vegetable processing equipment	206.9	High-quality stainless-steel machinery
16 Goma Engineering Pvt Ltd	Mumbai, Maharashtra	Dairy, beverage, and pharmaceutical processing machinery	148.8	High-quality, ISO-certified
17 T&I Global Ltd	Kolkata, West Bengal	Tea processing machinery	183.5	India's leading tea machinery manufacturer
18 Bry-Air India Ltd	Gurugram, Haryana	Conveyors and material handling systems for food processing	349.5 (CY23)	Specialises in moisture control solutions
19 JBT CorpIndia	Mumbai, Maharashtra	Food processing and packaging solutions	36.6	Advanced automation, global presence
20 Meatek Food Machineries Pvt Ltd	Pune, Maharashtra	Meat processing, frozen food equipment, slaughterhouse machinery	10.7	Specialises in meat and poultry processing
21 Sona Machinery	New Delhi	Agro-processing equipment, focusing on rice milling and grain processing	97	Turnkey solution provider for rice mills and grain-based distilleries, including engineering, erection, and commissioning services

Company	Location	Product list	FY24 revenue (Rs crore)	Add-on details
22 Chem Process Systems	Sanand, Gujarat.	Dairy, food and pharmaceutical processing machinery, distilleries	238.3	Specialises in power plant equipment, vacuum systems and related components
23 Neologic Engineers	Pune, Maharashtra	Food processing machinery	185	Specialises in complete processing lines for various applications, including dairy products like butter and ghee, milk pasteurisation, ice cream production
24 SATAKE INDIA (Japan)	Delhi	Grain processing equipment	112.1	Specialises in colour sorters, laboratory equipment and plant automation solutions
25 VSA Machines	Hyderabad, Telangana	Biscuit making machinery	1.3	N/A
26 Shreeja Health Care Products	Surat, Gujarat	Oil extraction machinery, including oil maker machines, commercial oil presses, mini oil ghani machine and filter press machines	20	Specialises in both small, business-oriented machines and larger, commercial-scale oil extraction equipment
27 Vishwakarma Industries	Delhi	Agricultural machinery	0.05 (FY21)	Known for needle looms, plastic scrap dryers and recycling machines, and certain types of agricultural machinery such as chaff cutters and threshers
28 Suri Engineers	Hyderabad, Telangana	Rice processing equipment	110.2	Supplies machinery for rice mills, including pre-cleaning, separation, fine cleaning and polishing equipment
29 Middleby Corp	Bengaluru, Karnataka	Food processing and packaging equipment	164.7	Also produces equipment for industrial baking, thermal processing, slicing and loading
30 Noida Fabcon Machines	Greater Noida, Uttar Pradesh	Food processing equipment, conveyor systems and snack making machines	36.5	N/A
31 Allround Vegetable Processing	Ambala, Haryana	Vegetable processing equipment	68.6	Specialises in post-harvest handling and storage solutions, particularly for root vegetables such as carrots, potatoes and onions
32 New Era Machines	Sahnewal, Punjab	Biscuit production lines and baking systems	37.9	Also known for its expertise in three-roll pre-sheeters
33 Gee Gee Foods and Packaging Co.	New Delhi,	Food processing equipment	0.2	Specialises in high-performing and superior-designed equipment
34 SPX Flow Inc.	Pune, Maharashtra	Food and beverage processing	545.9	Manufactures a range of industrial machinery, including mixers, pumps, valves, homogenisers, and heat exchangers, as well as specialised equipment such as ultra-high-temperature systems and spray dryers

Company	Location	Product list	FY24 revenue (Rs crore)	Add-on details
35 Multivac India Pvt Ltd	Alwar, Rajasthan	Packaging machinery	114.5	Product portfolio also includes packaging materials and automation solutions

Note: Revenues for FY24, unless mentioned otherwise.
Source: Ministry of Corporate Affairs, Crisil Intelligence

South and west dominate the equipment manufacturing landscape

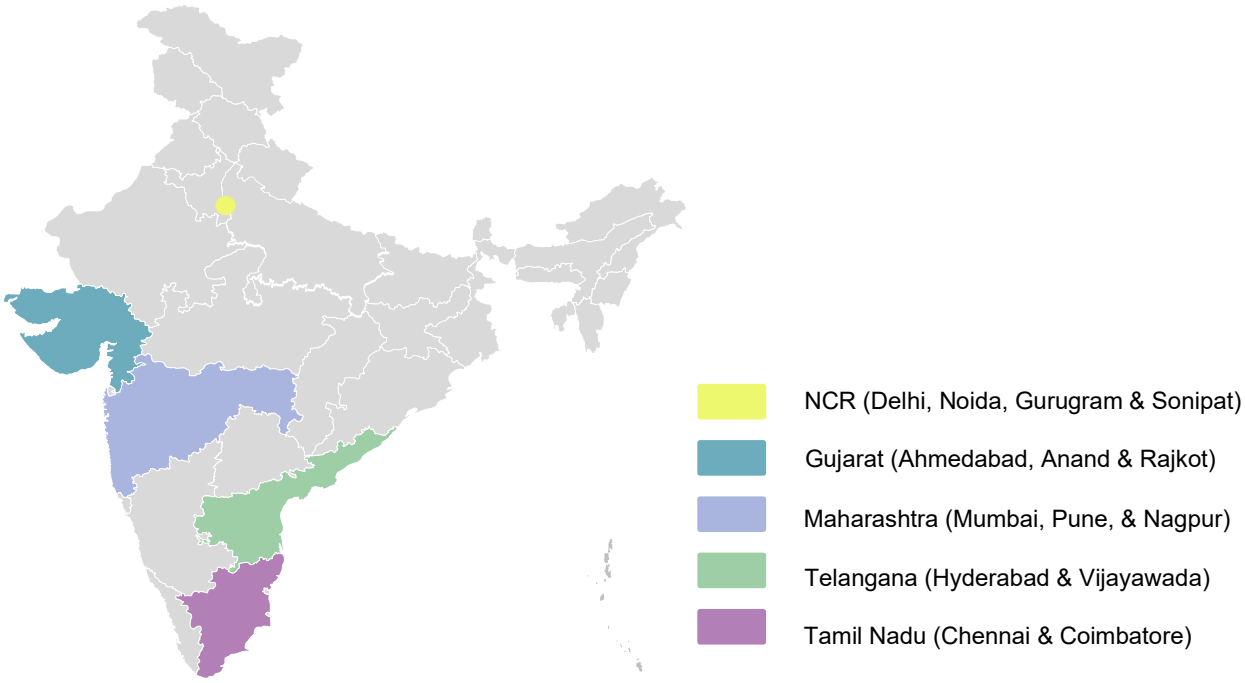
India's food processing machinery sector is spread across key industrial hubs, ensuring optimised logistics, supply chain efficiency and market accessibility. The sector's presence is geographically diversified, with hubs in the west, north, south, east, and central regions, catering to various segments such as dairy, beverage, meat processing, snacks, packaging, and automation.

The western region, particularly Maharashtra and Gujarat, houses several food processing machinery manufacturers. Maharashtra's role is also supported by industrial zones and its concentration of food processing equipment production. Cities such as Mumbai, Pune, Nagpur and Ahmedabad are known for manufacturing capabilities, with a focus on dairy, beverage, and snack food machinery. These areas benefit from proximity to industrial parks, export-oriented ports, and infrastructure, supporting domestic and international business expansion. Companies in this region provide solutions for food production, including machinery with automation, energy management, and customised systems.

The southern region, with hubs in Bengaluru, Vijayawada, Chennai, Coimbatore and Hyderabad, contributes to grain milling, snack processing, and packaging machinery production. These areas incorporate technological advancements, IT ecosystems, and export-oriented facilities. Manufacturers in these regions develop systems with energy management, automation, and integrated solutions for the food processing industry. Bengaluru focuses on automated processing and large-scale manufacturing, addressing the demand for packaged foods.

Northern India includes a manufacturing belt for dairy, bulk food, and beverage processing machinery, with Delhi, Noida, Sonipat and Gurugram as key hubs. The region benefits from proximity to fast-moving consumer goods manufacturers, making it ideal for food packaging and beverage bottling solutions. Delhi serves as a distribution point for northern and north-western India. Noida is known for its manufacturing units, while Gurugram and Sonipat specialise in packaging solutions for the beverage and dairy industries. The integration of automation and comprehensive solutions allow these machinery companies to undertake large-scale operations.

Figure 8 Presence of food processing companies in India



Source: Crisil Intelligence

The eastern region, including West Bengal, plays a role in specialised machinery production for sectors such as tea processing and packaging. This area's proximity to tea-growing regions allows companies to provide machinery to the tea estates. The tea industry is a key segment, with machinery designed for bulk processing and handling production cycles.

Central India, with Nagpur and Indore as hubs, serves as a centre for conveyor systems and automation solutions. The location enables connectivity to other states and facilitates nationwide distribution. Companies in this region focus on material handling systems, including conveyor systems, washing lines and assembly solutions for the food processing industry. This location supports operational efficiency for businesses that supply across the country and helps manage transportation costs.

India's food processing machinery sector is defined by regional specialisations, where automation, energy management, and integrated solutions influence operations. The western and southern regions focus on automation and production lines, while the north and east deal with specific segments such as dairy, beverage, bulk food processing, and tea production. The location of these companies supports market reach, operational costs and the food processing industry's competitiveness.

These companies address India's domestic requirements, while positioning themselves in the global food processing machinery industry. Their presence across industrial hubs ensures adaptability, scalability, and an optimised supply chain, allowing them to meet the demand for machinery solutions in the food processing sector.

3.2 Source of food machinery imports

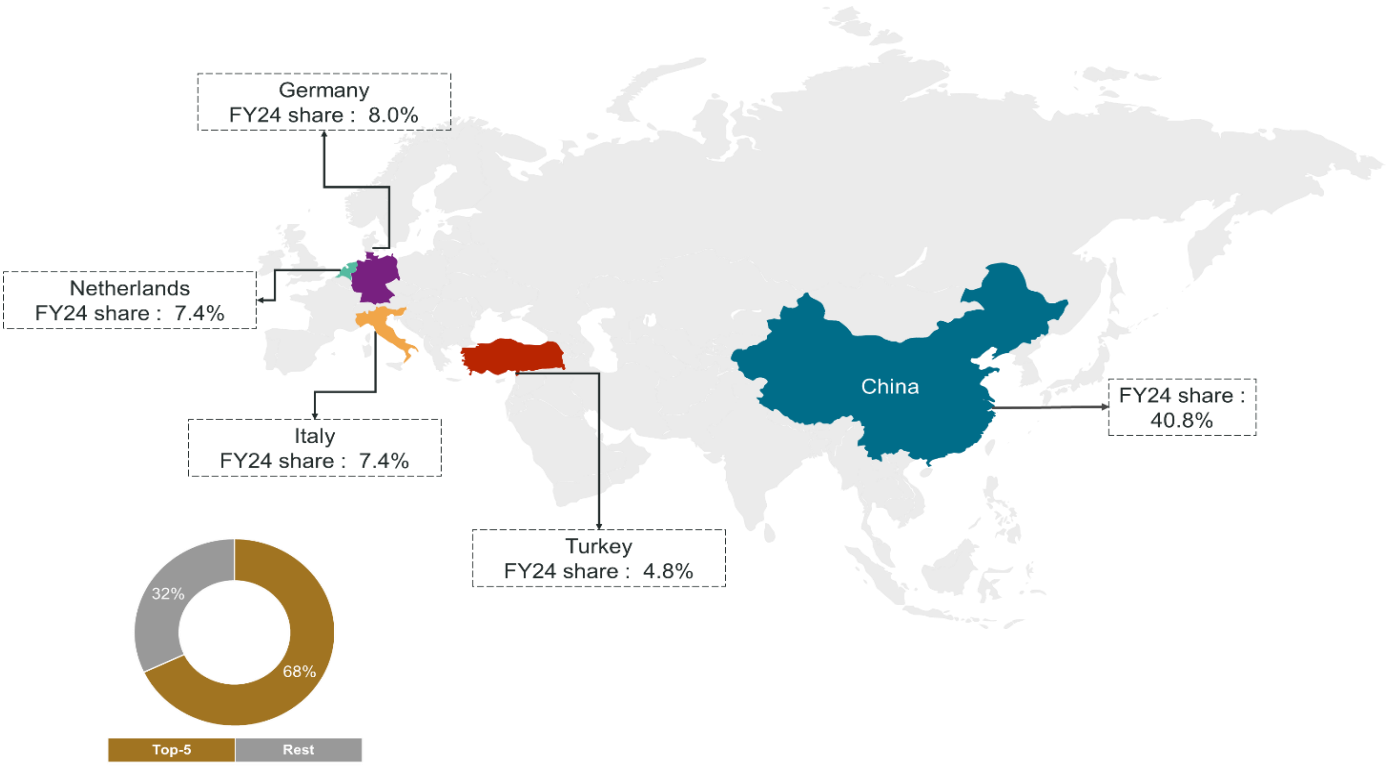
China dominates India's imports

Several factors influence the global market for food processing machinery. One of the primary elements is the identification of countries that are major suppliers of food processing machinery. Germany, Italy, the US, and Japan are known for their advanced technology and high-quality manufacturing capabilities in this sector. These countries not only dominate the production of food processing equipment but also play a crucial role in setting industry standards and innovations that drive the market.

Between FY19-FY24, China was the largest supplier of food processing machinery and parts to India. As of fiscal 2024, the share of China in the overall food processing machinery and parts imports stood at 40.8%, followed by Germany (8.0%), Italy (7.4%), the Netherlands (7.4%) and Turkey (4.8%) during the same period. Among the top five suppliers of food processing machinery and parts to India, the Netherlands and China have grown the fastest with a CAGR of 25.9% and 18.7%, respectively, between FY19-FY24.

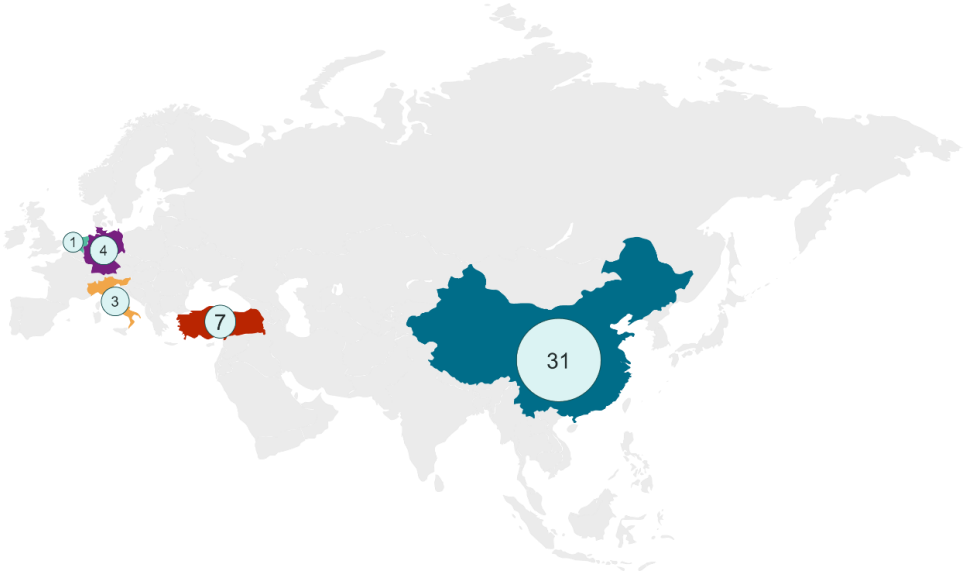
Further, an analysis of 52 eight-digit HS codes reveals that importing from China is the most cost effective. China reported low price-to-volume ratio for 31 of these HS codes, outpacing other top suppliers, including Germany, Italy, the Netherlands, and Turkey, indicating lower import costs as against other countries.

Figure 9 Top five countries contributing to India's food processing machinery and parts imports in fiscal 2024



Note: Top 5 countries include China, Germany, the Netherlands, Italy and Turkey. Others include Thailand, the US, Belgium, Denmark, the UK, Vietnam, Taiwan, Switzerland, Singapore, Spain, Sweden, Japan, France, Poland, Slovenia, South Korea.
Source: Ministry of Commerce, Crisil Intelligence

Figure 10 Analysis of cost-effective imports from top five supplying countries



The value inside the circle represents the number of HS codes for which imports from the specific country are more cost-effective compared with the other top five nations

Source: Ministry of Commerce, Crisil Intelligence

Figure 11 Machinery for primary processing of vegetables and bread grain milling are major imports from China

Country	China
Rank (FY24)*	1
Growth (FY19-24)	18.7% CAGR
Top 5 machinery imports, are used for/in	1. Primary processing of vegetables (28.8%) 2. Milling of bread grain (13.5%) 3. Processing of rice (5.1%) 4. Preparing animal feed (4.8%) 5. Manufacturing confectionery, cocoa, or chocolate products (4.1%) 6. Others^ (43.7%)

** Rank is based on the country's percentage contribution to India's total import value during the specified period*

^ Others include machinery used in bakery, flour mill, preparation of fruits, nuts/vegetables, manufacturing of macaroni/similar items, poultry incubators and brooders, manufacture of wine, cider, fruit juices/similar beverages, sugar manufacturing, milking, preparation of meat/poultry, dairy, brewery among others along with parts of machinery

Source: Ministry of Commerce, Crisil Intelligence

Table 24 Key success factors which have enabled China's food processing machinery sector to be globally competitive

Success factor		Description
	Well established food processing industry	Based on China statistical yearbook of 2023, China has 39,543 enterprises above designated size under food processing (processing of food from agricultural products, manufacture of foods, manufacture of liquor, beverages and refined tea). These enterprises cumulatively generated revenue of $1,266.4 billion and a profit of $92.7 billion. The country is the world's largest producer and consumer of food thereby providing the machinery sector with a large consumption base
	Government support	China's favorable government policies support the sector in numerous ways. Some of these key initiatives include: - **Industrial policy such as Made in China 2025 which prioritizes technological upgrading, smart manufacturing in high technology sectors including food processing machinery** - **Targeted support for industrial parks** offering improved management, planning, standardization, subsidies and incentives - **14th Five-Year Plan (2021-2025)** which emphasizes technological self-sufficiency, industrial upgrading. It has an aim for 70% domestic supply rate for smart manufacturing equipment and includes fiscal and monetary policies such as increased government spending, easier financing
	Existing large industrial base & infrastructure	China's advanced industrial base, large investments in infrastructure, and well-developed manufacturing ecosystem enable quick adoption of new machinery & technologies
	Product innovation and global competitiveness	Chinese manufacturers focus heavily on new product development, technological innovation with strong focus on automation, digital integration. This ensures higher productivity, efficiency helping them position higher and compete globally

Source: World Bank, Crisil Intelligence

Figure 12 Germany's exports to India predominantly comprise machinery to produce confectionery, cocoa and chocolate products

Country	Germany
Rank (FY24)*	2
Growth (FY19-24)	7.6% CAGR
Top 5 machinery imports, are used for/in	1. Manufacturing confectionery, cocoa, or chocolate products (33.4%) 2. Dairy (9.2%) 3. Bakery (8.7%) 4. Primary processing of vegetables (3.1%) 5. Preparation of meat/poultry (2.9%) 6. Others^ (4.7%)

** Rank is based on the country's percentage contribution to India's total import value during the specified period*

^ Others include machinery used in Preparation of Fruits, nuts/vegetables, brewery machinery, bread grain milling, milking, flour mill, sugar manufacturing, manufacture of wine, cider, fruit juices/similar beverages, poultry incubators, manufacturing of macaroni/similar items and brooders, rice mill among others including parts of machinery

Source: Ministry of Commerce, Crisil Intelligence

Figure 13 Machinery to manufacture confectionery, cocoa, and chocolate products, macaroni/similar products and bakery items make up major share of imports from Italy

Country	Italy
Rank (FY24)*	3
Growth (FY19-24)	3.9% CAGR
Top 5 machinery imports, are used for/in	1. Manufacturing confectionery, cocoa, or chocolate products (17.9%) 2. Manufacturing of macaroni/similar products (9.5%) 3. Bakery (7.9%) 4. Diary (7.6%) 5. Preparation of fruits, nuts or vegetables (4.7%) 6. Others^ (52.4%)

** Rank is based on the country's percentage contribution to India's total import value during the specified period*

^ Others include machinery used in bread milling, Preparation of meat/poultry, manufacture of wine, cider, fruit juices/similar beverages, brewery machinery, milking, flour mill, sugar manufacturing, poultry incubators and brooders, rice mill among others including parts of machinery

Source: Ministry of Commerce, Crisil Intelligence

Figure 14 India's imports from the Netherlands mainly include primary food processing machinery and equipment for meat/poultry preparation

The Netherlands

Country	The Netherlands
Rank (FY24)*	4
Growth (FY19-24)	25.7% CAGR
Top 5 machinery imports, are used for/in	1. Primary processing of vegetables (44.8%) 2. Preparation of meat/poultry (19.6%) 3. Manufacturing confectionery, cocoa, or chocolate products (13.4%) 4. Poultry incubators and brooders (4.0%) 5. Bakery (3.9%) 6. Others (14.2%)

** Rank is based on the country's percentage contribution to India's total import value during the specified period*

^ Others include machinery used in bread milling, dairy, manufacture of wine, cider, fruit juices/similar beverages, brewery machinery, milking, flour mill, sugar manufacturing, manufacturing of macaroni/similar items, rice mill among others including parts of machinery

Source: Ministry of Commerce, Crisil Intelligence

Figure 15 Machinery to manufacture confectionery, cocoa or chocolate products and bread grain milling were major imports from Turkey during fiscal 2024

Turkey

Country	Turkey
Rank (FY24)*	5
Growth (FY19-24)	16.5% CAGR
Top 5 machinery imports, are used for/in	1. Manufacturing confectionery, cocoa, or chocolate products (39.9%) 2. Milling of bread grain (15.6%) 3. Flour processing (12.2%) 4. Processing of rice (5.3%) 5. Parts of milking machinery (4.1%) 6. Others^ (22.9%)

** Rank is based on the country's percentage contribution to India's total import value during the specified period*

^ Others include machinery used in primary processing of vegetables, preparation of meat/poultry, dairy, manufacture of wine, cider, fruit juices/similar beverages, brewery machinery, milking, sugar manufacturing, manufacturing of macaroni/similar items among others including parts of machinery

Source: Ministry of Commerce, Crisil Intelligence

Machinery used for primary processing of vegetables commands the highest share in Indian food processing equipment imports

Between FY19 and FY24, India's imports were dominated by machinery for primary processing of vegetables, which commanded the largest share in India’s food processing machinery imports. This was followed by machinery for confectionery, cocoa or chocolate production. In FY24, these two categories accounted for 18.6% and 13.4%, respectively, of the total imports. Rounding out the top five were machinery imports for the milling of bread grain, baking and processing of rice.

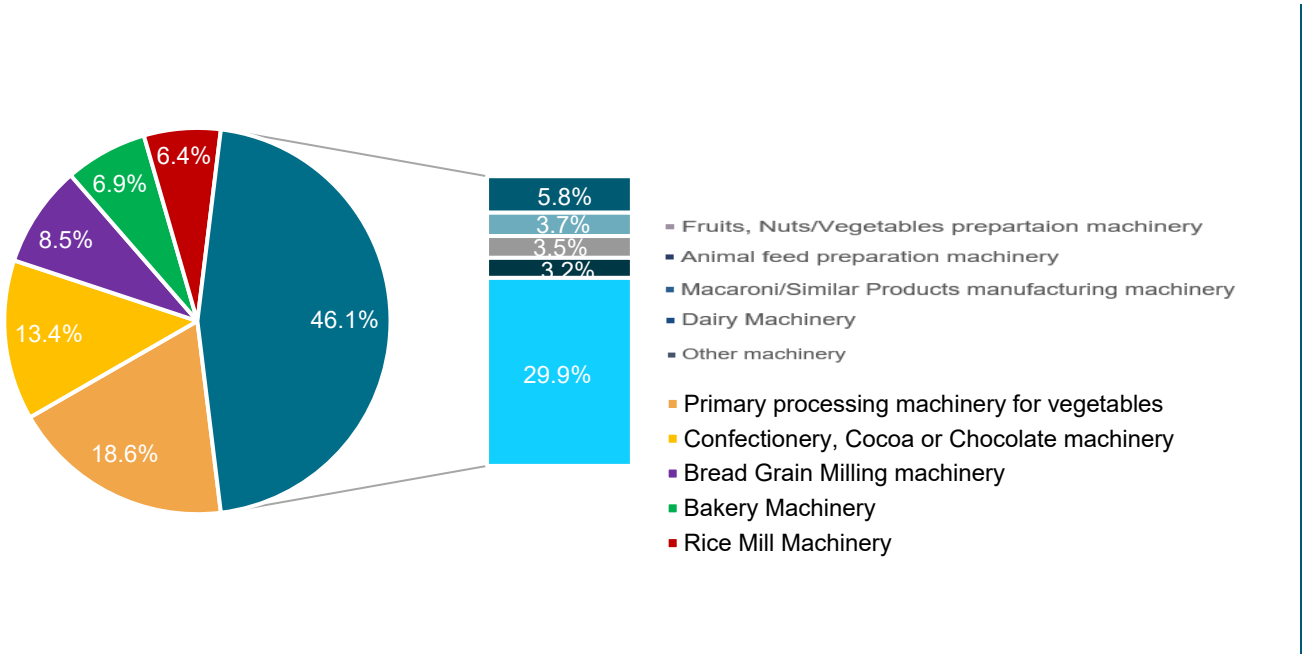
Further between 2019 and 2024, among the top five imports by India, machinery for milling of bread grain logged a CAGR of 33.7%. Machinery for confectionery, cocoa or chocolate followed closely, with a CAGR of 28.6%, while machinery for primary processing clocked a notable 22.2% CAGR.

China dominates machinery imports for primary processing of vegetables and bread grain milling, while Thailand leads in rice processing machinery imports

Among the top five food processing machinery imports by India, China is the leading supplier of vegetable processing and bread grain milling machinery, while Thailand accounts for most of the rice processing machinery imports. Major global plant & machinery players also have manufacturing presence in China (Refer Annexure for the list).

For machinery used in the production of confectionery, cocoa, chocolate products and bakery items, imports are diversified, with no single country commanding more than 50% share. Germany leads in imports of machinery for confectionery, cocoa, and chocolate production with a 23.3% share, while China dominates bakery machinery imports with 27.9%.

Figure 16 Share of top five equipment imported by India as of fiscal 2024

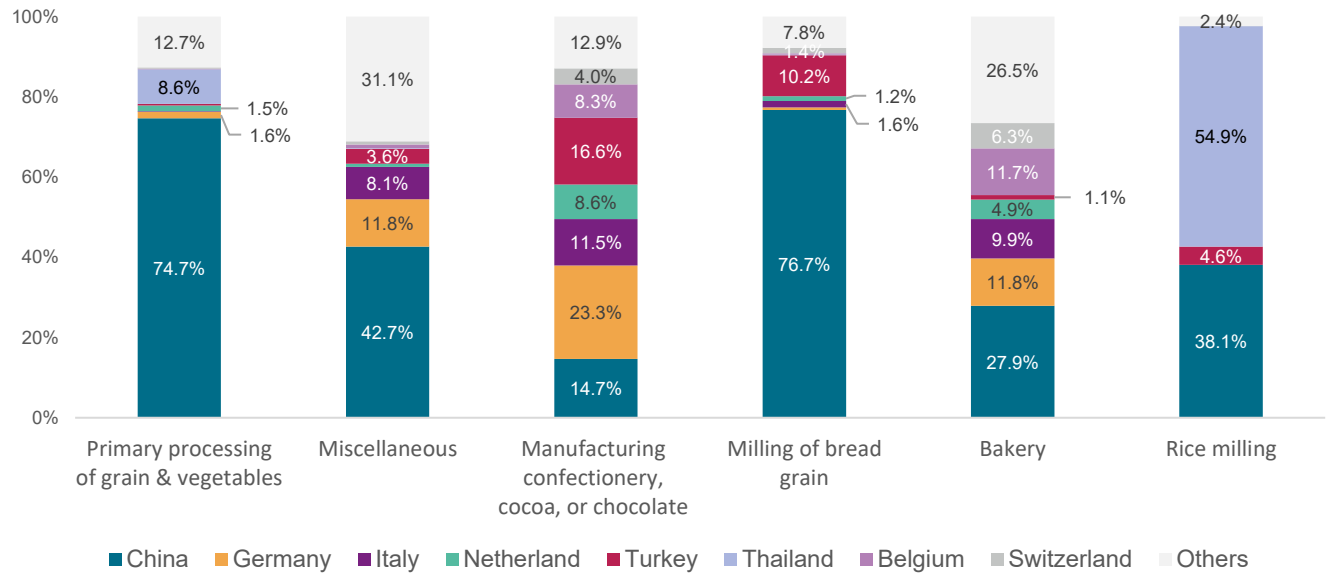


Other machinery includes machinery for preparation of meat/poultry, poultry-keeping machinery, flour mill machinery, auxiliary equipment for extrusion cooking plant, other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, horticultural, forestry, poultry-keeping or bee-keeping machinery, sugar manufacturing machinery excluding centrifuges, machinery for production of soya milk or other soya products (except soya oil), brewery machinery, among others

Kindly note that in the above analysis, only machinery imports have been analysed while parts of machinery have not been considered

Source: Ministry of Commerce, Crisil Intelligence

Figure 17 Country-wise analysis of top five machinery imports to India



Others include Japan, Hong Kong, Singapore, Taiwan, the UAE, Belgium, the US, the UK, Czech Republic, Vietnam, Slovenia, Denmark, Slovakia, South Korea

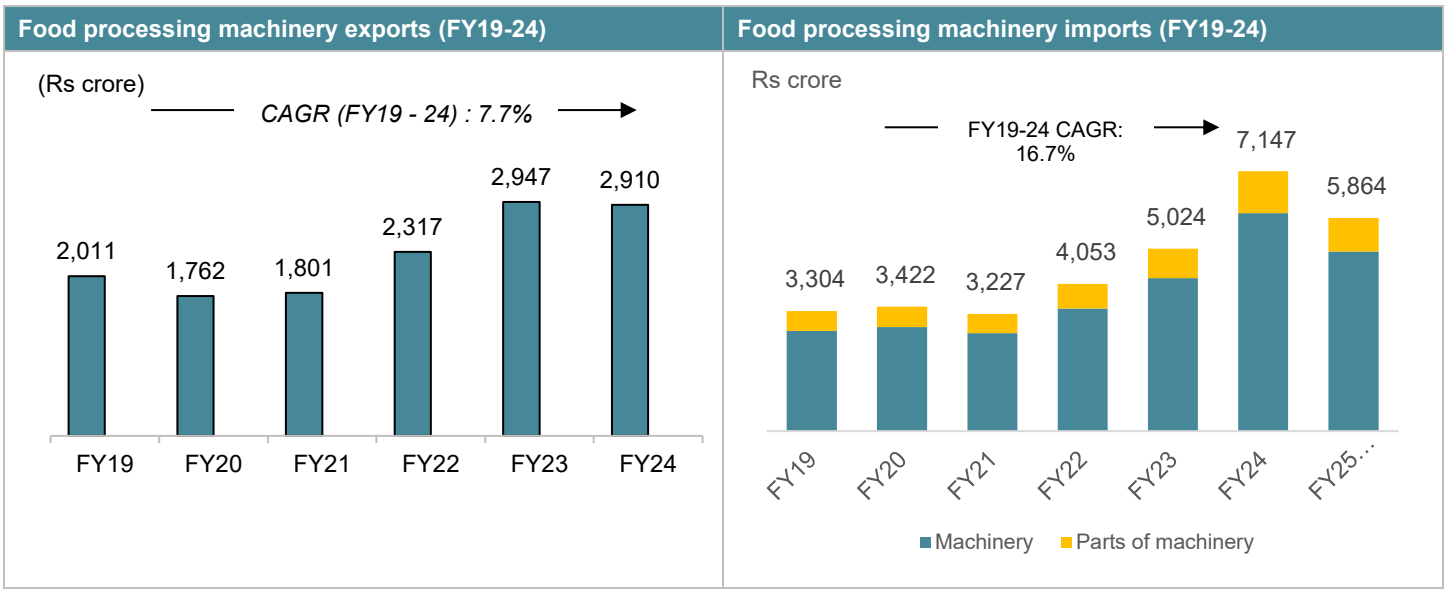
Source: Ministry of Commerce, Crisil Intelligence

4. Demand-supply (import export) scenario in the food machinery landscape

4.1 Food processing machinery exports from India logged a CAGR of 7.7% between FY19 and FY24

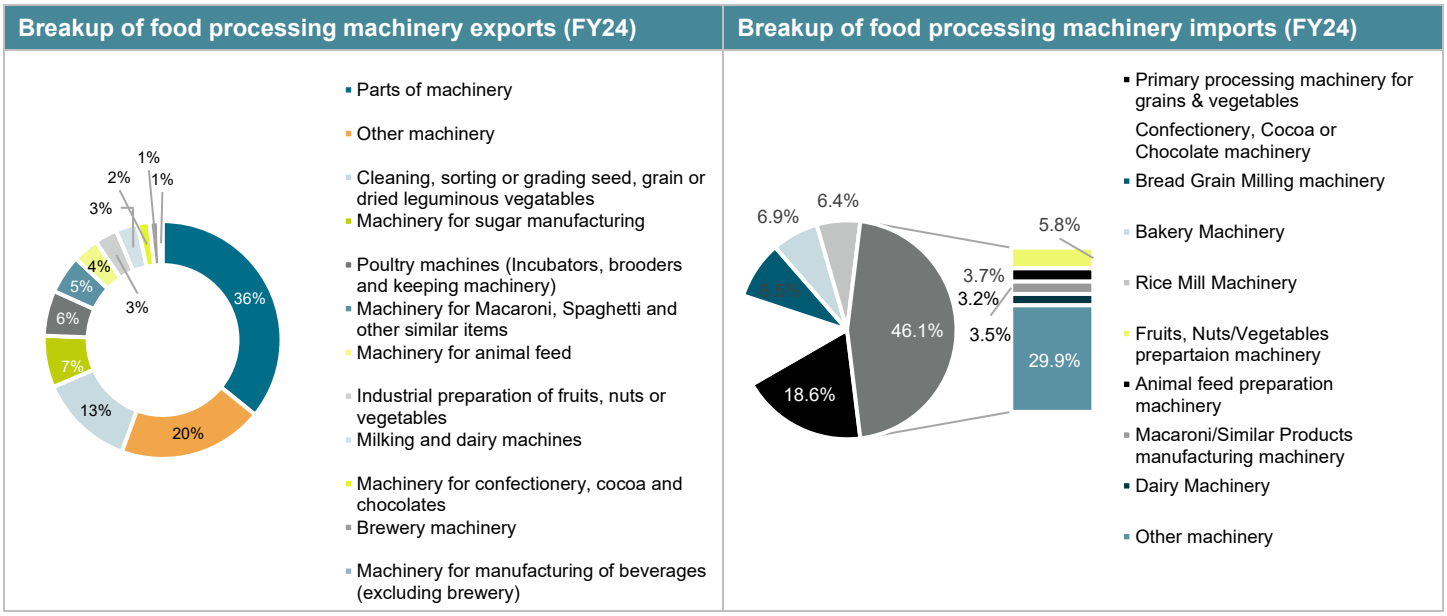
India food processing machinery exports clocked a CAGR of 7.7% between FY19 and FY24 mainly aided by rising global demand for processed and packaged foods, strong government push, including the Pradhan Mantri Kisan Sampada Yojana. Tax incentives also encourage the production of machinery that meets international standards. Machinery parts, cleaning and sorting machinery, and sugar manufacturing machinery dominated exports.

Figure 18 Food processing machinery exports and imports (FY19-24)



Note: HS codes used for analysis include: 8434, 8435, 8436, 8437, 8438; Source: Ministry of Commerce, Crisil Intelligence

Figure 19 Breakup of food processing machinery exports and imports (FY24)



Note: 6-digit HS codes used for analysis; Source: Ministry of Commerce, Crisil Intelligence

4.2 Kenya, Nigeria and Nepal are major export destinations for Indian food processing machinery

India exported food processing machinery worth Rs 340.8 crores to Kenya, as per the trade data for fiscal 2024. Nigeria, Nepal, Tanzania and Bangladesh were the other major destinations for Indian food processing machinery exports.

Table 25 Top five export destinations for Indian food processing machinery

Export destinations for India	FY24 export value of food products (Rs crores)	Key machinery exported
Kenya	340.8	Machinery for industrial production of F&B
Nigeria	225.7	Cleaning, sorting machines for seeds, grains, legumes etc
Nepal	206.2	Machinery for industrial production of F&B and cleaning, sorting machines for seeds, grains, legumes etc.
Tanzania	169.5	Machinery for industrial production of F&B; other agriculture, horticulture, bee-keeping machinery
Bangladesh	161.7	Machinery for industrial production of F&B and cleaning, sorting machines for seeds, grains, legumes etc.

Note: The countries considered is based on the top 10 export destinations for India in fiscal 2024, USD to INR conversion rate 1 USD = Rs 82 for FY24
Source: Ministry of Commerce, Crisil Intelligence

4.3 Food processing machinery and parts import dependency at 16.5-17.5% of the total demand

Demand for food processing equipment in India is estimated to have increased at 5-7% CAGR over the past decade, to Rs 30,000-35,000 crore in fiscal 2023, on the back of growing domestic demand for processed and packaged foods, particularly in urban areas, government initiatives such as Make in India, support provided through the Food Processing Fund and PMKSY, among others, as well as a growing population.

An analysis of supply of food processing equipment in the country estimates food processing equipment imports range between 16.5-17.5% of the overall demand, i.e. of total sales, imports stood at Rs 5,307 crore in fiscal 2023.

Table 26 Level of import dependency for food processing equipment in India

Sectors	FY24	Average decadal growth
Food processing – PFCE at current prices	Rs 54.4 lakh crore	10.0-11.0%
Food processing equipment – domestic demand	Rs 35,000-40,000 crore	5.0-7.0%
Food processing equipment - imports	Rs 7,000 crore (FY23 Rs 5,000 crore)	7.0-8.0%
Import dependency %	16.5 -17.5%	Rise in share to 16.5-17.5% (FY21-FY24) from 15-16% (FY15)

PFCE – private final consumption expenditure
Source: MoSPI, MoFPI, Crisil Intelligence

Note: *Crisil Intelligence has assessed capital expenditure of 1,000+ players in plant and machineries as a percentage of revenue to understand the investments and demand for plant & machinery. The data has been extrapolated to the industry level from the overall size of food processing sector in India and triangulated with reported trade data for plant and machinery imports, capital expenditure reported by food processing players in plant and machinery and share of plant and machinery player revenue. The import dependency is then calculated as trade imports by total industry size of plant and machinery players. The import dependency at sector level is verified by understanding import dependency by large, mid-size and small and unincorporated segments as well.*

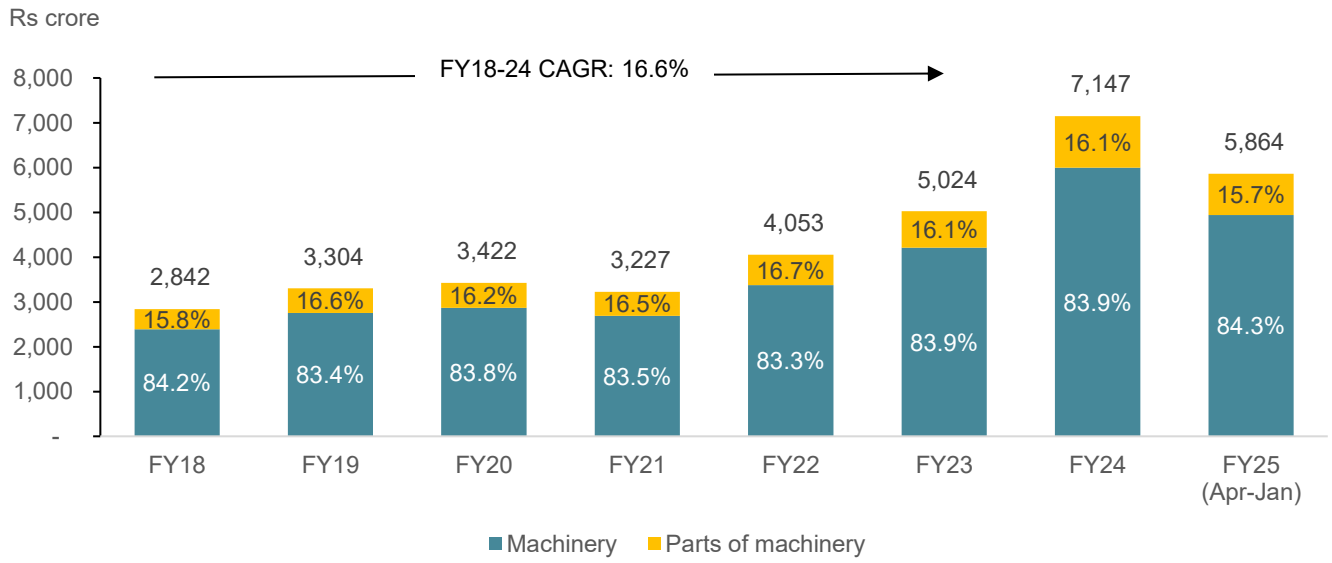
Rising capex accelerated import of food machinery and parts in the past five years

Import of food processing machinery and parts, which posted a 10.1% CAGR from FY14-FY24, surged 16.3% CAGR FY19-FY24, to Rs 5,990 crore. The acceleration was on the back of strong growth in output of the food processing sector.

Note*: Though machinery components such as bearings, pneumatic pumps, etc. are imported by equipment players, Crisil has considered only the food sector HS codes for analysis of imports. Notably, machinery accounted for a substantial 80-85% share of these food machinery imports over the period.*

A closer examination of the imports for fiscal 2024 reveals that machinery for manufacturing confectionery, cocoa or chocolate products and macaroni or similar products, producing dairy, for bread milling and bakery items, preparation of fruits, nuts or vegetables and samosas and *soan papdi*, as well as ice cream machine parts, hydro machines, and other food processing machinery, including brass brush, conveyor roller and GI earthing rods, were the main imports.

Figure 20 Import of food processing machinery and parts by India

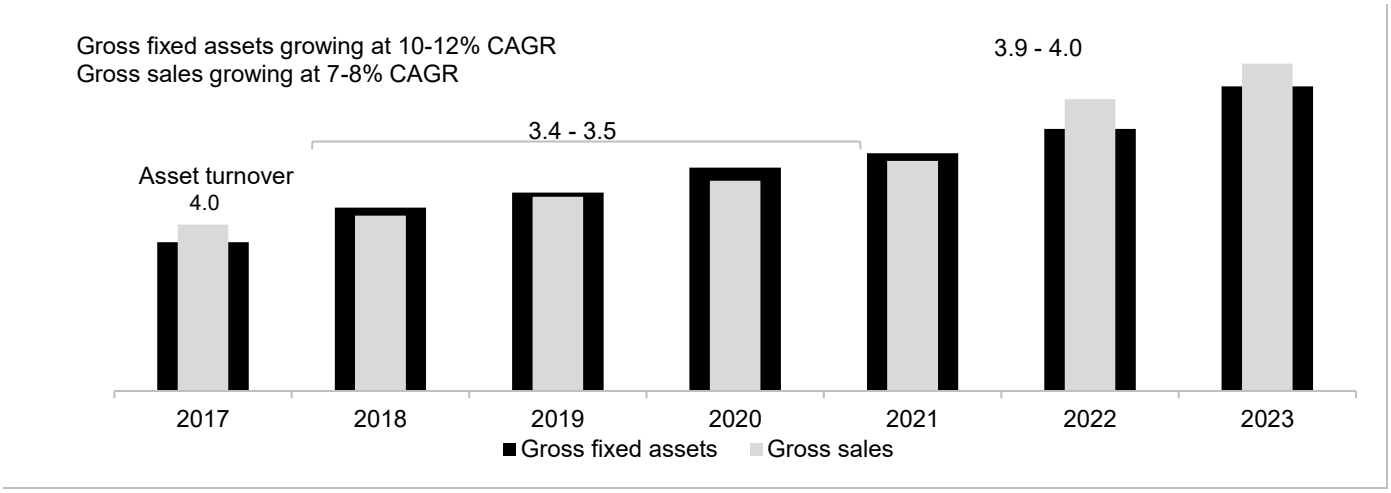


Source: Ministry of Commerce, Crisil Intelligence

Revenues of companies were affected between 2018 and 2021 due to demonetization, GST followed by Covid-19 pandemic

A comprehensive analysis of over 3,500 food processing companies by Crisil Intelligence reveals that while gross sales exhibited a steady growth rate of 7-8% CAGR between 2017 and 2023, the growth rate of gross fixed assets outpaced sales, expanding at a rate of 10-12% CAGR during the same period. However, the asset turnover ratio, which was 4.0 in 2017, experienced a significant decline between 2018 and 2021. This downturn can be attributed to the cumulative impact of demonetization, the implementation of the Goods and Services Tax (GST), and the COVID-19 pandemic, which occurred in 2020 and 2021. Nevertheless, as the pandemic's effects subsided and the government introduced supportive measures to boost manufacturing, including the Production-Linked Incentive (PLI) scheme, both gross fixed assets and sales witnessed an uptick from 2022 onwards, indicating a positive trend in the industry's growth trajectory.

Figure 21 Growth in gross assets and gross sales of food processing industry



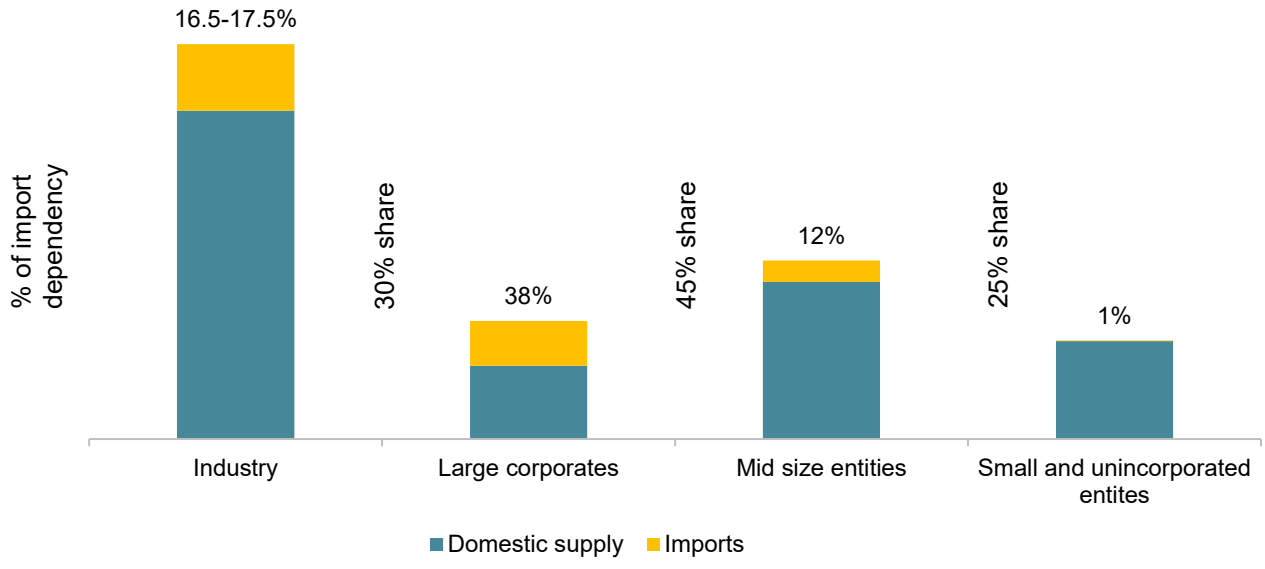
Source: Crisil analysis of 3,500+ companies in the food processing sector

Large food processing players have higher share of imported machinery

MNCs, with significant global presence predominantly import plant and machinery for their food processing facilities. Industry interactions highlighted that large food processing players also have a higher share of imported machinery as compared with mid-sized players or MSMEs. That said, of late, domestic equipment manufacturers have started providing some key plant and machinery to large MNCs.

Still, large enterprises accounted for over 5s0% of machinery imports over the years. And for some large players, the import share rises to as high as 50-60% of planned investment in plant and machinery, depending on the type of product and desired output.

Figure 22 Import of food processing machinery by large, mid- and small players



Source: Crisil Intelligence

Crisil Intelligence interacted with industry players to understand the reasons for the preference for imported machinery.

At the outset, the high share of imports by MNCs was largely attributed to the fact that their parent companies have established long-standing relationships with international process consultants and equipment manufacturers, hence facilitating the procurement of specialised equipment. Also, MNCs can leverage their global parent companies' networks and negotiate favourable terms, including competitive pricing, timely delivery and access to advanced technology. This enables them to acquire align with global standards and quality benchmarks as well. Further, large players prefer imported machinery for advanced technology and high efficiency output.

Also, specialised automated and advanced technology-driven machineries such high-speed precision cutting (e.g.: cutting of French fries), specialised grinding machines (e.g.: spices and soya grinding, etc.), automated baking / heating machinery, specialised confectionery machinery, meat processing machinery, optical sorter machinery are imported. Certain packaging machines such as retort packaging and high-speed filling machines are also imported.

Key reasons large players import plant and machinery

- State-of-the-art, advanced technology and precision-driven process machinery from established global companies
- Unavailability of large production capacity and high-speed machinery
- Existing relations and tie-ups with international process consultants and equipment players
- Compatibility and interoperability with existing systems
- Strong build and quality of imported machinery
- Imported machinery also often complies with international standards, such as ISO or CE, which are essential for exporting beverages to other countries
- Imported machinery often has comes with advanced food safety and hygiene features, such as easy cleaning systems, which reduces the risk of contamination and ensures compliance with international food safety standards

Key reasons mid-sized players import plants and machinery

- Advanced technology process machinery for specific operations such as meat processing, specialised grinding and cutting, etc, where suitable indigenous equipment is not available
- Cost efficiency, especially in the case of imports from China
- Imported machinery is often more energy-efficient, which reduces energy costs and may could increase improve the profitability for Indian processors

4.4 Factors driving the import of plant and machinery equipment

Figure 23 Factors driving the import of plant and machinery equipment

Top 3 reasons

- Advanced technology
- Better build quality
- Higher performance / efficiency / lower wastage

40-55% of respondents mentioned technology, build quality and performance efficiency as key factors for preferring imported machinery

Other reasons

- Better design
- Desired output quality
- Pricing
- Non-availability of suitable machines in domestic market
- Brand value / company reputation

Availability of competitively priced Chinese-made machinery was one of the factors driving demand for imported equipment

Source: Crisil Intelligence

Industry interactions also highlighted that food processing players purchase domestically made machinery for general machinery and process elements, such as mixers, conveyors, storage vessels, etc.

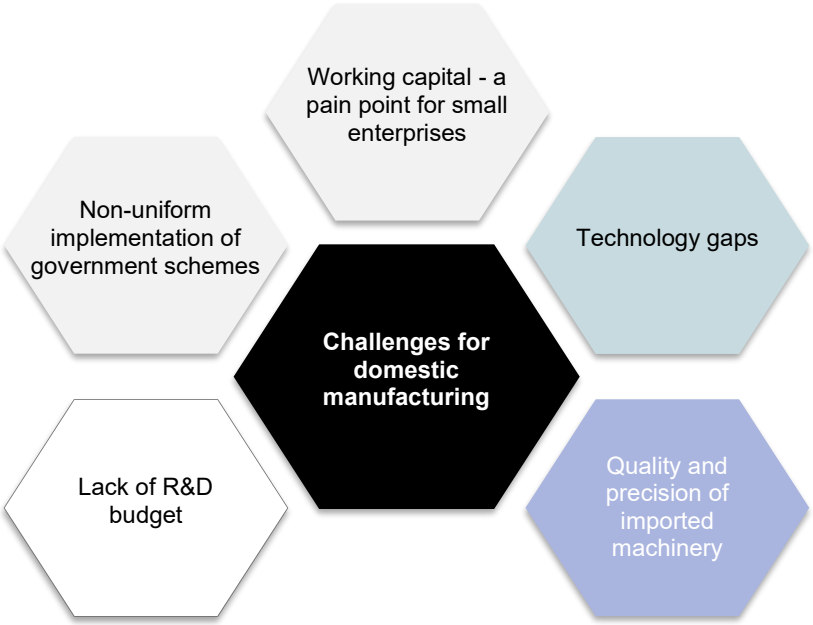
Pricing also plays a key role in the preference of domestic machinery. 65-70% of industry participants mentioned pricing as one of the factors for opting to procure from domestic equipment manufacturers. Another factor was customisation with regard to domestic manufacturers. Domestic equipment manufacturers largely provide made-to-order equipment, and, hence, are able to customise equipment to suit a client's process requirements.

However, domestic equipment manufacturers face considerable challenges to compete at the global level, owing to perceived low technology capabilities. They find it difficult to secure contracts from domestic customers as well.

Indian equipment manufacturers are believed to lack the expertise to build technologically high-end machinery; they are considered followers and not innovators. But Indian equipment manufacturers have proven their technology capabilities to build cutting-edge equipment, especially by collaborating with international firms. Stil, they have not been able to showcase and commercialise the products.

Hence, in terms of capacity utilisation, domestic mid- and large-sized food processing equipment players' utilisation ranges 70-80%, while smaller players made machines as per order, thereby indicating lower capacity utilisation.

Figure 24 Factors not conducive for domestic manufacturers



Source: Crisil Intelligence

- **Working capital:** Small food processing machinery companies often struggle to access credit from financial institutions, making it challenging to manage working capital requirement. 100% collateral is required to access working capital, and in many cases at very high interest rates
- **Technology gaps:** Indian food processing machinery often lacks advanced automation and control systems, which could reduce efficiency, productivity and product quality
- **Lack of R&D budgets:** Lack of R&D budget limits and hinders the industry's ability to innovate and compete with global players
- **Non-uniform implementation of government schemes:** Non-uniform implementation of government schemes poses challenges for Indian food processing machinery manufacturers including lack of standardization across states, inconsistent subsidies and incentives, complexity in the process to avail benefits under schemes.
- **Quality and precision:** Domestic-manufactured food processing machinery is believed not to have the same level of precision and accuracy as imported machinery, which could impact product quality and consistency

Global brands primarily responsible for setting up imported machinery

International food and beverage giants such as PepsiCo, Coca-Cola, Nestlé, Unilever and Danone have considerably influenced India's food processing industry. By sourcing imported machinery aligned with global manufacturing standards, these companies have set benchmarks for quality, innovation and efficiency.

PepsiCo: Transforming beverage and snack production

- PepsiCo has revolutionised snack and beverage manufacturing in India by importing specialised frying, seasoning and high-speed bottling machinery. Its facilities integrate energy-efficient systems and cutting-edge technologies for faster production and consistent product quality. This has catalysed the adoption of similar standards among local manufacturers

Coca-Cola: Revolutionising bottling technology

- Coca-Cola's advanced bottling plants employ imported machinery designed for carbonated beverage production. The integration of automated systems ensures precision, hygiene and sustainability

Nestlé India: Enhancing large-scale food processing

- Nestlé India has imported high-capacity machinery for milk processing, chocolate manufacturing and noodle production. This investment enables the company to meet consumer demand while maintaining international quality standards. The company's practices have spurred domestic producers to improve their capabilities

Unilever: Driving innovation in ready-to-eat foods

- Unilever has invested in European machinery for ice cream, frozen food and ready-to-eat meal production. Its automated systems reduce dependency on labour and ensure efficient, high-quality output. This has encouraged Indian manufacturers to explore automation in food processing

Danone: Setting standards in dairy processing

- Danone's facilities in India showcase imported equipment tailored for yogurt and other dairy product manufacturing. These state-of-the-art systems deliver precision and reliability, encouraging local players in the dairy sector to embrace similar advancements.

Mondelez International: Advancing confectionery and baking production

- Mondelez International has invested in high-speed automated lines for chocolate and biscuit production in India. The company utilises European-imported processing and packaging machinery to ensure consistency, quality and efficiency of its brands such as Cadbury Dairy Milk and Oreo. This has set a benchmark for India's confectionery sector and encouraged automation adoption among local manufacturers.

4.5 Global machinery impact: Elevating domestic food processing standards

The import of machinery has been a double-edged sword for India's domestic production base. On the one hand, it has significantly raised the bar for quality, productivity and technological advancement. However, it poses challenges for local manufacturers to compete on an equal footing. Understanding the impacts is crucial for shaping a balanced and sustainable food processing machinery ecosystem.

Positive impacts

- **Technology transfer:** Collaboration with global suppliers frequently facilitates the transfer of skill and technology to local manufacturers, which can significantly enhance their operational capabilities and competitiveness. When local manufacturers engage with international suppliers, they often gain access to advanced manufacturing techniques, innovative processes and cutting-edge technologies that may not be readily available within their regions
  - This partnership can take various forms, such as joint ventures, strategic alliances or even informal collaborations, all of which create opportunities for knowledge sharing and skill development. For instance, local manufacturers may receive training and support from global suppliers, enabling them to adopt best practices in production, quality control and supply chain management
  - Moreover, the exchange of expertise can lead to the development of new products and services tailored to local markets, fostering innovation and improving the overall quality of goods produced. As local manufacturers become more proficient in utilising these advanced technologies, they can enhance their productivity, reduce costs, and ultimately increase their market share both domestically and internationally.

- **Improved standards:** Importing superior machinery can significantly influence local manufacturers by prompting them to improve their production standards in several ways:
  - First, advanced machinery introduces cutting-edge technology that boosts efficiency and precision. Local manufacturers are likely to adopt these technologies to stay competitive, leading to improved product quality, reduced waste and faster production times
  - Second, superior machinery sets a benchmark for local manufacturers. Observing the capabilities of companies using advanced equipment can motivate local businesses to upgrade their own processes, driving innovation and encouraging investment in R&D
  - Additionally, importing high-quality machinery often includes training and support, empowering local workers to develop new skills and expertise. As employees become proficient, they can implement best practices and optimise workflows. Moreover, the influx of superior machinery can foster collaboration between local manufacturers and international firms, leading to partnerships that promote a culture of continuous improvement.

Negative impacts

- **Market displacement:** Rising imports, particularly from cost-effective suppliers such as China, pose significant challenges for local manufacturers. The influx of cheaper goods can increase competitive intensity, forcing local companies to lower prices. This pricing pressure can erode profit margin, making it difficult for domestic manufacturers to sustain their operations and invest in innovation or improvements
- **Stunted innovation:** Reliance on imports can significantly hinder local R&D spending for several reasons. Heavy dependence on foreign goods may discourage local companies from investing in their own R&D, as they may prefer to purchase readily available imports instead of developing their own solutions. This can lead to stagnation in local innovation. Also, focusing on imports diverts financial resources from local R&D efforts. Companies that spend heavily on foreign products may have less capital for research, creating a cycle that further entrenches reliance on imports and weakens domestic industries
  - Additionally, lack of R&D investment limits the growth of local talent and expertise. Without opportunities for development, skilled professionals may seek jobs abroad or in more innovative sectors, leading to a brain drain and a weakened R&D ecosystem
- **Trade agreement constraints:** Reduced tariffs from free trade agreements can significantly alter the competitive landscape for local products. Low or elimination of tariffs make imported goods more affordable, increasing consumer demand for these products and challenging local manufacturers, who may face higher production costs. This shift can lead to a decline in market share for domestic producers, resulting in reduced sales and revenue. Local businesses may be forced to cut costs, reduce their workforce or close. Additionally, the pressure to compete with cheaper imports may compel manufacturers to lower prices, eroding profit margin and potentially compromising on quality and innovation.

Table 27 Trade agreements

Country	Relevant trade/ tariff agreements	Key food machinery specialisation	Brands
China	▪ WTO MFN principle ▪ APTA	Customisable mid-range food processing systems	Hiwell Machinery, Amisy
Germany	▪ WTO MFN principle ▪ EU FTA at negotiation	Dairy processing, bakery solutions, snacking and beverage providers	Bosch, Bühler, GEA Group, Kronos AG
Italy	▪ WTO MFN principle ▪ EU FTA at negotiation	Pasta production, bakery equipment	Risco, Co.Mi. srl, Alimec
Japan	▪ India-Japan (CEPA)	High-speed slicing and packaging, seafood production lines	Hitec, Ishida, Mitsubishi Heavy Industries, Yamato
Netherlands Sweden Switzerland	▪ WTO MFN principle ▪ EU FTA at negotiation	Poultry processing, dairy processing, packaging	Tetra Pak, Marel, Meyn Food Processing, Bucher Industries, Alfa Naval
South Korea	▪ India-Korea (CEPA)	Grain and meat processing	Samyang, Dong Tang Food Machinery
Taiwan	▪ WTO MFN principle	Customisable mid-range food processing systems	CMC Corporation, King Pac, Anko Industrial Co
USA	▪ WTO MFN principle	Beverage and snack processing, aseptic technology	Heat and control, Middleby Corporation

APTA – Asia-Pacific Trade Agreement; WTO – World Trade Organization; MFN – most favoured nation; FTA – free trade agreement; CEPA – comprehensive economic partnership agreement

Source: Crisil Intelligence

5. Case studies - Technological advancement and pricing of imported P&M

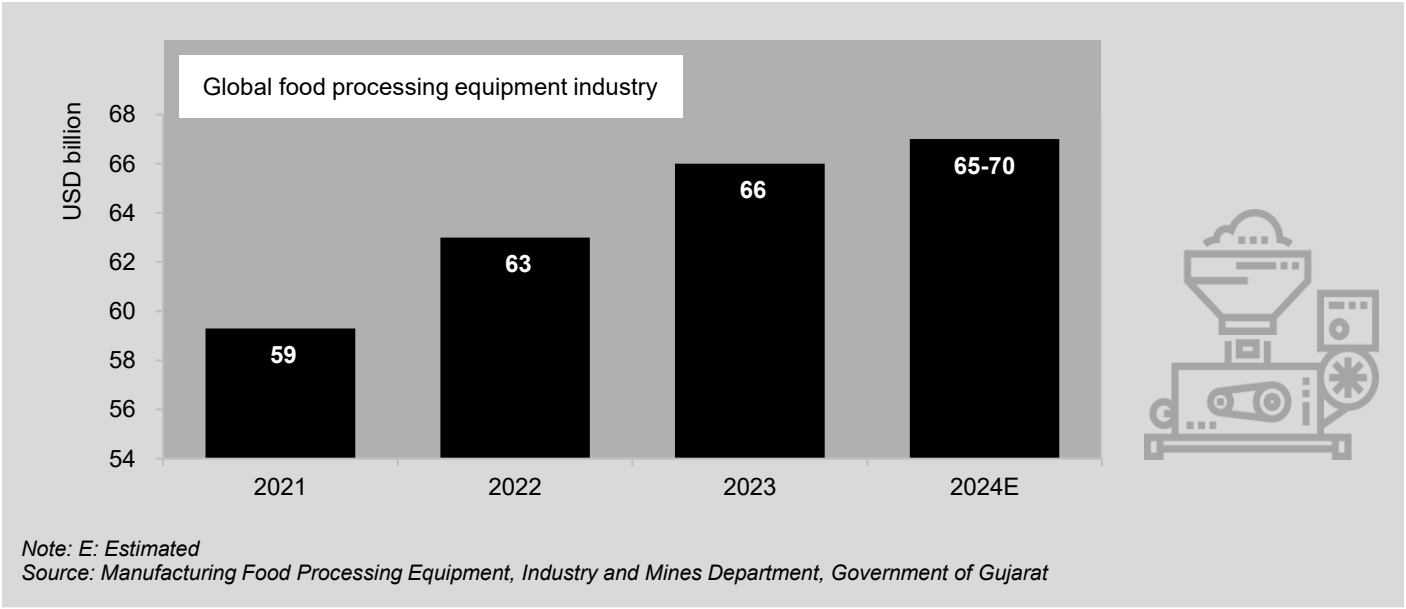
5.1 Global food processing industry is worth $66 billion as of 2023

The global food processing equipment industry grew modestly between 2021 and 2024 from $59 billion to $65-70 billion, weighed down by Covid-19, geopolitical concerns and intensifying economic growth worries.

In 2024, the Asia-Pacific region is estimated to have dominated the global food processing equipment market, driven by the rising demand for processed foods in emerging and developing economies such as India, China, Indonesia and Thailand. This region is expected to log the highest CAGR between 2024 and 2027 owing to the rapid expansion of its food and beverage industry, fuelled by increasing urbanisation, growing health awareness and higher disposable incomes. The meat, poultry and seafood processing equipment segments are estimated to have accounted for the largest share of the food processing equipment industry in 2024, while the beverage processing equipment segment is expected to be one of the sectors with the fastest CAGR growth in the food processing equipment industry between 2024 and 2027.

India's imports accounted for $0.9-1 billion worth of food processing machinery which made up ~2.5% of global trade of food processing machinery (April 2023 - March 2024).

Figure 25 Global food processing industry



Note: E: Estimated
Source: Manufacturing Food Processing Equipment, Industry and Mines Department, Government of Gujarat

5.2 Reasons for importing machinery across segments

Crisil Intelligence has compared various types of machines that are typically imported by the Indian food processing industry vs indigenous counterparts, in terms of specification and pricing. At the outset, imported machines stand out for their advanced technology and automation features. These also top in terms of energy efficiency. Imported machines are, however, more expensive vis-à-vis domestically built machines, but offer better value over the long term. But Indigenous machines also have some advantages over imported machines: these can be customised more to suit the need of customers. Further, local support is more readily available in case of breakdowns.

Table 28 Reasons for importing machinery across segments

	Fryers / ovens	Imported fryers offer better batch consistency but are costlier
	Milk pasteurisation	Imported systems offer precise temperature control and more automated operations
	Fruit and vegetable sorting	Imported machinery offers advanced multispectral imaging for better quality output
	Baking	Imported oven excels in energy efficiency and has automatic cleaning system
	Metal detector	Indian machinery is less pricey; but, imported machinery offers more advanced features
	Confectionery	Chinese sandwich creamery machinery (used for cream filling in biscuits and other products) offers more capacity at a similar price range
	Carbonation	Imported machinery has advanced blending and carbonation technology, ensuring consistent quality of beverage output

Note: Crisil compared the machines by sourcing quotations from suppliers, comparing information from B2B online marketplaces, etc. Established brands do not provide standalone machineries but provide entire process systems.

Source: Crisil Intelligence

Table 29 Fryers / ovens – Imported ovens excel in energy efficiency and automatic cleaning

Machine	Commercial oven	Commercial oven	Indian	Commercial oven	Imported
Application		Standard and custom sizes available		Gastronomy and bakery (dehydrating, steaming, grilling, roasting, etc.)	
Capacity		24 trays		10 trays GN 1/1	
Cooking range		-260°C – 350°C		30°C – 260°C	
Control system		Digital control panel with basic programmable features		9.5" touch panel, advanced automation (Chefunox, Multi Time, etc.)	

Machine	Commercial oven	Commercial oven	Indian	Commercial oven	Imported
Humidity control		Manual humidity control		Automatic climate control, with 10% increment adjustments	
Construction		Heavy-duty stainless-steel construction		High-resistance AISI 304 stainless steels	
Additional features		Semi-automatic cleaning, energy-efficient heating elements		Adaptive cooking, automatic washing, Wi-Fi connectivity	
Energy type		3 KW		Gas (22 kW) or Electric (1 kW)	
Dimensions (WxDxH)		740 x 770 x 1020 mm		750 x 783 x 1010 mm	
Weight		112 kg		117 kg	
Cost		Rs 7.5-8.0 lakh		Rs 11.5-12.0 lakh	

Source: Company brochures, Crisil Intelligence

Observations

- **Technology and automation**: Imported ovens have cutting-edge features, including adaptive cooking and Wi-Fi-enabled control for remote monitoring. Indian-manufactured ovens focus on straight-forward programmable features, making it user-friendly and ideal for operations not requiring complex automation
- **Capacity**: Both ovens accommodate different tray capacities, with Indian-manufactured ovens providing customisation options for businesses requiring specific configurations
- **Energy efficiency:** Imported ovens excel in energy efficiency with advanced features for optimised heating and consumption. Indian-manufactured ovens have less advanced technology, but have energy-efficient heating elements; are designed to balance performance and operating cost
- **Washing and maintenance:** Imported ovens boast automatic cleaning systems, thereby greatly reducing manual labour. Indian ovens offer semi-automatic cleaning, which is effective but requires more manual involvement
- **Cost and value:** Imported ovens are positioned as premium products for high-end users requiring advanced technology and precision, while Indian ovens deliver excellent price value, and offer robust performance and reliability for cost-conscious buyers
- **Suitability:** Imported ovens are the go-to for premium establishments, large-scale bakeries and professional kitchens demanding precision and efficiency. Indian ovens are ideal for small-to-mid-sized bakeries, cafes and catering services looking for durable and economical equipment

Table 30 Fryers / ovens – Imported fryers offer better batch consistency, but are costlier

Machine	Snack fryer	Snack fryer	Indian	Snack fryer	Imported
Country of origin		India		USA	
Heating system		Immersed heat transfer tubes, leading to uneven heating and faster oil degradation		Under-pan fired design for uniform heat distribution and energy efficiency	
Oil quality		Higher oil volume, slower turnover, potential oil degradation		Low oil volume, rapid turnover, better oil quality retention	
Automation		Manual monitoring and intervention, increasing labour dependency		Advanced PLC systems automate frying, stirring, unloading and batch initiation	
Safety and maintenance		Manual stirring increases risks and inconsistency in batch quality		Chip-Stirr® system eliminates manual stirring, reducing operational risks	
Cleaning and maintenance		Is a more manual effort; cleaning is less streamlined		Flat-bottom pan and hoist-assisted conveyor simplify cleaning, reducing downtime	
Energy efficiency		Less energy-efficient due to higher oil volume and uneven heat distribution		Optimised for energy savings with lower oil volume and uniform heat distribution	
Batch consistency		Batch quality may vary due to manual processes and uneven heating		Consistent batch quality due to automated control and uniform heat	
Production speed		Slower turnover, with longer batch cycles and oil changes		Faster turnover with low oil volume, allowing quicker batch changes	
Design complexity		Basic design, more suitable for small-scale, local operations		Advanced design, engineered for high throughput and export-oriented production	
Operational scalability		Limited scalability, suited for smaller-scale operations with more manual oversight		Scalable for high-volume operations, with minimal manual oversight	
Cost efficiency		Lower initial cost, but higher ongoing costs due to labour dependency and energy inefficiency		Higher initial cost, but lower long-term operational costs due to automation and energy efficiency	
Market suitability		Best suited for small-to-medium-scale, domestic operations with less automation		Ideal for large, export-driven markets with high-throughput requirement	

Source: Company brochures, Crisil Intelligence

Table 31 Fruits and vegetables – Imported machinery offers advanced multispectral imaging for better quality output

Machine	Fruit and vegetable sorting machine	Indian	Imported
Country of origin		India	Norway
Technology		Basic optical sensors and mechanical grading systems for visible defect detection	Multispectral imaging, laser technology and NIR spectroscopy for advanced surface and internal defect detection
Sorting precision		Sorting accuracy based on size, weight and visible defects; lower precision	High-precision sorting for internal as well as external defects, including subtle discolorations and texture inconsistencies
Internal quality assessment		No internal quality assessment: only surface-level defects are considered	NIR spectroscopy detects internal ripeness, defects and quality beyond surface appearance
Speed and throughput		Slower sorting with potential for more manual intervention and inconsistencies	High-speed sorting with minimal waste due to automation and AI integration
Maintenance and downtime		More downtime due to manual monitoring and less sophisticated maintenance capabilities	Designed for minimal downtime, with remote diagnostics and streamlined maintenance procedures
Sensor technology		Basic optical sensors (e.g., CCD cameras) for size, weight and visible defects	Advanced multispectral imaging and NIR spectroscopy to assess colour, shape, texture and internal quality
Integration into processing line		Limited integration capabilities, typically standalone operations with more manual involvement	Seamless integration into automated lines, enhancing throughput
Product range		Best suited for standard fruits and vegetables with basic sorting requirement	Suitable for a wide range of fruits and vegetables, including delicate produce requiring high precision
Data processing		Basic data processing without AI or machine learning, limiting sorting optimisation	Real-time data processing with AI and machine learning algorithms for sorting optimisation and waste reduction

Source: Company brochures, Crisil Intelligence

Table 32 Milk pasteurisation - imported machines offer precise temperature control and automated operations

Machine	Milk pasteurisation system	Indian	Imported
	Country of origin	India	Sweden
	Heating system	Standard plate heat exchanger with basic heat recovery, leading to higher costs	Regenerative plate heat exchanger (PHE) with efficient heat recovery and precise temperature control
	Energy efficiency	Moderate energy efficiency, requiring more power for heating	Up to 95% energy recovery, reducing processing costs and improving thermal efficiency
	Automation	Semi-automated or manual control, increasing human intervention and operational complexity	Programmable Logic Controller (PLC) and Supervisory Control and Data Acquisition (SCADA)-controlled, fully automated for precise temperature control, flow adjustments, and cleaning
	Product quality and shelf life	Variability in pasteurisation quality, leading to inconsistent batch outcomes and shorter shelf life	Consistent pasteurisation, enhancing product quality and extending shelf life
	Safety and compliance	Meets Indian FSSAI and Bureau of Indian Standards (BIS) standards, but lacks international compliance for export markets	Complies with ISO, HACCP, FSSAI and global food safety standards, ensuring export market suitability
	Cleaning and maintenance	Manual cleaning, increasing labour costs, downtime and potential hygiene concerns	Integrated CIP (clean-in-place) system, reducing downtime and maintaining high hygiene standards
	Hold-up volume	Higher hold-up volume, leading to more product loss and inefficiency	Low hold-up volume, reducing product loss during heating and cooling cycles
	Temperature control precision	Less precise temperature control, with potential for fluctuations affecting product consistency	Advanced temperature regulation with minimal fluctuation, ensuring optimal pasteurisation
	Flow rate control	Manual flow rate control, requiring operator intervention for adjustment	Automated flow rate adjustment based on real-time data, optimising efficiency

Source: Company brochures, Crisil Intelligence

Table 33 Metal detector – Indian machinery less pricey but imported counterparts offer more advanced features

Machine	Food metal detector	Food metal detector	Indian	Food metal detector	Imported
Country of origin		India		United States	
Aperture size		Standard and custom sizes available		350 x 150 mm (custom sizes available)	
Construction material		Stainless steel (SS)		Stainless steel (SS)	
Belt type		Food-grade PU belt		Food-grade PU belt	
Rejection system		Pusher/ flap type with bin		Pusher rejection with collection bin	
Power supply		230 V, single phase		90-250 V, single phase	
Ingress protection		IP 65 (standard), IP 67		IP 69K (SS), IP 65 (aluminium)	
Communication		RS232, RS485, ethernet		RS485, ethernet/wireless	
Detection sensitivity		Comparable sensitivity levels		High for both ferrous/ non-ferrous	
Cost		Rs 7-9 lakh		Rs 10-11 lakh	
Applications		Food, pharma, chemicals, etc.		Bakery, meats, dairy, etc.	

Source: Company brochures, Crisil Intelligence

Observations

- **Cost effectiveness**: The Indian machinery is more budget friendly compared with the US one, making it attractive for domestic businesses.
- **Ingress protection**: While the imported machinery offers IP 69K for heavy wash-downs, locals generally provide IP 65, which is sufficient for most standard applications but with optional upgrades.
- **Customisation**: Both models offer customisation for aperture size, but Indian machinery may have better local availability and faster support for custom-builds.
- **Connectivity**: Locally sourced machinery has competitive communication options, though the imported make includes advanced features such as wireless connectivity as standard.

Table 34 Confectionery - Chinese sandwich creamery machinery* offers more capacity at a similar price range

Machine	Sandwich cream machinery	Sandwich cream machinery	Indian	Sandwich cream machinery	Imported
Country of origin		India		China	
Number of nozzles		12		12-16	
Biscuit size					
▪ Round		28-50 diameter		28-60 diameter	
▪ Square		30-45		30-50	
▪ Rectangular (minimum)		25 x 65		20 x 60	
▪ Rectangular (maximum)		40 x 65		45 x 70	
Stacking (on edge)		3 rows		3 rows	
Output per minute		~600 sandwiches		600-700 sandwiches	
Cream deposition		0-6 gram		0-8 gram	
Power required		3 H.P. (440 V - 3 phase)		2-3 H.P. (380 V - 3 phase, varies by model)	
Cost		Rs 5.5-6 lakh		Rs 4.5-6 lakh	
Material quality		Stainless steel (grade 304 or equivalent)		Stainless steel (grade 304 or equivalent)	
Warranty		1 year		Typically, 1-2 years	
After-sales support		Available in India, quicker response time		May vary, slower support if imported	
Lead time		Requires more lead time, since machinery has to be manufactured on a consignment basis		Requires comparatively since machinery is readily available	
Ease of spare parts		Readily available locally		Spare parts are comparatively difficult to be sourced	
Customisability		Moderate - some level of customisation offered		Moderate - depends on the manufacturer	

**Used for cream filling in biscuits and other products*

Source: Company brochures, Crisil Intelligence

Key observations

- **Output and performance:** Both Indian and Chinese machinery perform similarly in terms of output and functionality, though the latter has a slightly higher maximum output range.
- **Cost:** Indian machinery is competitively priced, but certain Chinese options may be slightly cheaper or offer more nozzles in the same price range.
- **Power requirements:** Chinese machinery typically operates on 380V (common in China), while Indian machinery operates on 440V, making it more convenient for local use.
- **Durability and support:** Indian machines have an advantage in terms of local support and availability of spare parts, which is crucial for minimising the downtime. Chinese machinery might require additional lead time for parts and support.

  Customisation: Both Indian and Chinese manufacturers offer moderate customisation, but Indian machinery may be easier to modify for specific local requirements.

Table 35 Carbonation - imported machinery has advanced blending and carbonation technology, ensuring consistent quality of beverage output

Machine	Carbonation machine	Carbonation machine	Indian	Carbonation machine	Imported
Country of origin		India		Germany	
Automation		Semi-automated and manual systems, requiring some human oversight, increasing labour costs and operational variability		Full automation with advanced control systems, including automated blending, carbonation and packaging, reducing labour involvement and increasing production consistency	
Production capacity		Designed for small to medium-sized production with lower throughput, suitable for businesses with moderate production needs		High throughput, engineered for large-scale production with high-volume output and efficiency	
Energy efficiency		Operates with standard energy consumption, without integrated energy-saving technologies such as variable frequency drives (VFDs) or heat recovery		Utilises regenerative heat recovery systems, VFDs for motor control and energy-efficient pumps, minimising energy consumption	
Compliance and market reach		Complies with local Indian regulations (FSSAI, BIS), but lacks international certifications, restricting global market reach		Fully compliant with international standards (ISO, HACCP, FDA) for global distribution, ensuring consistent product quality	
Flexibility		Limited to certain types of carbonated beverages and packaging options (primarily suited for smaller batches in PET or glass bottles)		Capable of handling a wide variety of beverages (carbonated soft drinks, juices and more) and a range of packaging formats (PET, glass, cans, etc.)	

Machine	Carbonation machine	Carbonation machine	Indian	Carbonation machine	Imported
Blending and carbonation		Basic carbonation system with manual adjustments for CO2 levels, leading to potential inconsistencies in carbonation		Advanced blending and carbonation technologies, including precision CO2 dosing, ensuring optimal beverage quality and consistency	
System design		Simpler design, suitable for standalone or semi-automated lines, with manual intervention required for maintenance and adjustments		Highly engineered for seamless integration into large-scale automated beverage production lines, ensuring high efficiency and minimal downtime	
Operational control		Limited control systems, typically relying on mechanical controls and basic electrical systems for operations		Equipped with integrated PLC and SCADA systems for real-time monitoring, process control and predictive maintenance, ensuring smooth operations	
Maintenance		Manual intervention required for troubleshooting and repairs, with less advanced diagnostic tools and higher downtime risks		Remote diagnostics, predictive maintenance features and easy integration with centralised maintenance management systems to minimise the downtime	

Source: Company brochures, Crisil Intelligence

5.3 Case study: Imported plant and machinery at a beverage bottler in West Bengal

This case study examines the technological improvements associated with imported machinery in contrast to local options, emphasizing production efficiency, quality and cost considerations. The evaluation underscores how advanced technology from global providers such as Kronos AG and Seidel has revolutionised the operations of a notable bottling firm in India, allowing it to sustain a competitive advantage in the marketplace.

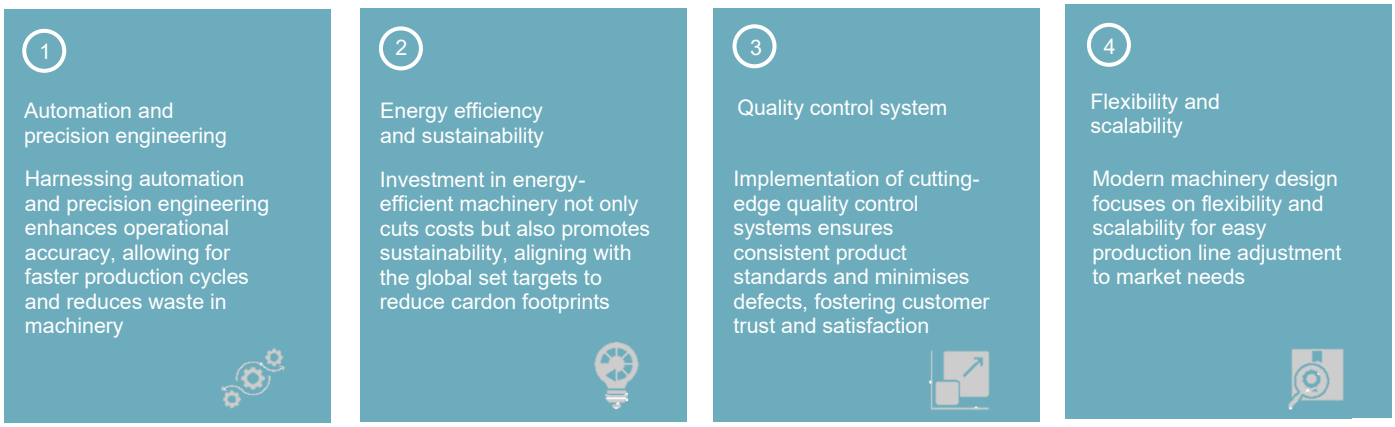
Company overview

The company is a prominent bottler and franchisee for one of the most recognised beverage brands globally. Situated in a region with high demand, it is tasked with the production, packaging and distribution of a diverse array of beverages such as carbonated drinks, juices and bottled water. To address the increasing demand and uphold rigorous quality standards, the company has made significant investments in advanced machinery imports. The machines, obtained from leading German and American manufacturers are known for their precision, efficiency and dependability. The company's dependence on imported technology highlights its dedication to providing exceptional product quality while enhancing operational efficiency.

Technological advancements in imported plant and machinery

In the highly competitive beverage industry, companies are constantly seeking ways to enhance efficiency, improve product quality and reduce operational costs. As mentioned, a prominent beverage bottling company has recognised the importance of integrating advanced technological innovations into its imported equipment and machinery. This expansion explores the various technological advancements that are transforming the bottling process, enhancing productivity, control system and ensuring sustainability.

Figure 26 Technological advancements in imported plant and machinery



Source: Crisil Intelligence

Automation and precision engineering: Imported machinery from Germany and the US with cutting-edge automation technologies to facilitate the smooth integration of diverse production processes. For instance, the automated bottling lines surpass domestic options. Additionally, the incorporation of robotic systems, including robotic arms for labelling, packaging and palletising, decreases the need for

manual labour and lowers the likelihood of errors. Furthermore, precision-engineered components with high tolerance guarantee reliable performance, thereby minimising downtime and maintenance needs.

Energy efficiency and sustainability: Contemporary imported machinery prioritises energy efficiency as a fundamental aspect. VFDs enhance energy usage by modifying motor speeds in accordance with production requirements. Heat recovery systems capture and repurpose waste heat generated during production, lowering energy expense. Additionally, these machines adhere to global environmental standards, including ISO 50001, which focus on energy management.

Quality control system: The design of imported machinery is compatible with stringent specifications, guaranteeing accurate filling, uniform carbonation and excellent sealing, which are essential for maintaining the longevity and flavour of beverages. Although domestic options are advancing, they may still show minor variations in fill levels, carbonation and packaging integrity. The use of high-speed cameras and automated defect detection systems in imported machinery significantly improves quality control, minimising the need for rework and reducing waste.

Flexibility and scalability: Advanced machinery from international leaders boasts high-speed filling lines that can handle thousands of bottles each hour while minimising waste. The meticulous coordination of conveyor systems, liquid dispensing units and capping devices guarantees optimal production efficiency. Conversely, local equipment may face challenges with increased volumes, resulting in bottlenecks and elevated costs per unit.

5.4 Technological advancements: Imported vs domestic machinery – a cost benefit analysis

The choice between imported and domestic machinery involves a careful evaluation of quality, cost and operational efficiency. While imported machinery offers advanced technological capabilities and superior performance, domestic alternatives are often more affordable upfront. The following table provides a detailed comparison of key parameters to highlight tihe trade-offs and advantages of each option.

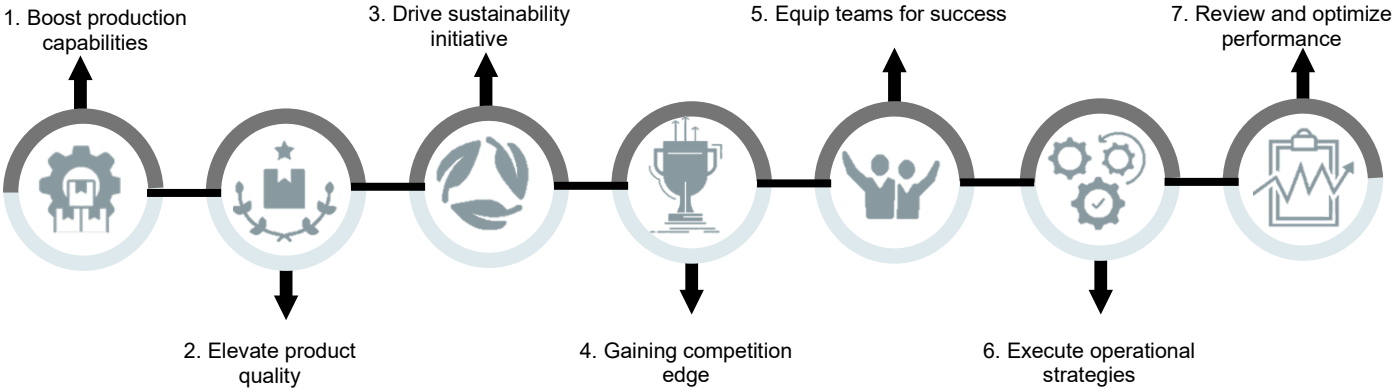
Table 36 Imported vs domestic machinery – a cost benefit analysis

Features	Imported machinery	Domestic machinery
Initial investment	Higher upfront cost due to advanced technology and import duties	Lower upfront cost, making it accessible for smaller operations
Production speed	Higher-speed bottling line, more ideal for larger capacities	Comparable lower-speed bottling line, more ideal for smaller capacities
Energy efficiency	Advanced energy-saving features (VFDs, heat recovery monitoring)	Less focus on energy efficiency, leading to higher operational cost
Quality control	Integrated AI-driven vision inspection and real-time monitoring	Basis quality checks with limited real-time capabilities
Maintenance and durability	High-grade materials ensure durability and lower maintenance needs	Frequent maintenance required due to lower-grade materials
Flexibility	Quick changeover systems for multiple product types	Limited adaptability for diverse product lines

Source: Crisil Intelligence

5.5 Strategic impact on operations

The strategic influence on operations for a beverage bottler representing an international brand through the import of advanced machinery from Germany and the US is significant. This initiative is crucial for boosting production, product quality, sustainability, competition, team success and operational performance.



Source: Crisil Intelligence

1. Boost production capabilities: The introduction of advanced machinery allows the beverage bottler to significantly increase its production capacity. High-efficiency equipment can operate at faster speed and with greater reliability, enabling the company to meet growing consumer demand without compromising on quality. This scalability is essential for maintaining market share and responding to fluctuations in demand, particularly during peak seasons or promotional periods.

2. Elevate product quality: Advanced machinery often incorporates cutting-edge technology that enhances the precision and consistency of the bottling process. This results in higher-quality products with fewer defects, in sync with stringent international standards. Improved quality not only ensures customer satisfaction but also strengthens brand reputation, fostering customer loyalty and encouraging repeat purchases.

3. Drive sustainability initiatives: The import of advanced machinery supports sustainability initiatives. Many modern machines are designed with energy efficiency in mind, reducing the overall carbon footprint of the production process. Additionally, they may facilitate the use of eco-friendly materials and packaging, aligning the company with global sustainability trends and consumer preferences for environmentally responsible products.

4. Gaining competitive edge: By leveraging advanced technology from leading manufacturers in Germany and the US, the beverage bottler can differentiate itself from competitors. The ability to produce higher volumes of superior quality products more efficiently can create a significant competitive edge in a crowded market. This advantage can be further amplified through innovative marketing strategies that highlight the brand's commitment to quality and sustainability.

5. Equip teams for success: Investing in advanced machinery also empowers operational teams by providing them with the tools necessary to perform at their best. Training the staff in new technologies enhances their skill sets and boosts morale, as employees feel more competent and engaged in their roles. A well-equipped workforce is more likely to innovate and contribute to continuous improvement initiatives, fostering a culture of excellence within the organisation.

6. Execute operational success: The integration of advanced machinery necessitates the development and implementation of effective operational strategies. This includes optimising workflows, refining supply chain logistics and enhancing inventory management practices. By aligning operational strategies with the capabilities of new machinery, the beverage bottler can streamline processes, reduce waste and improve overall efficiency, leading to cost savings and increased profitability.

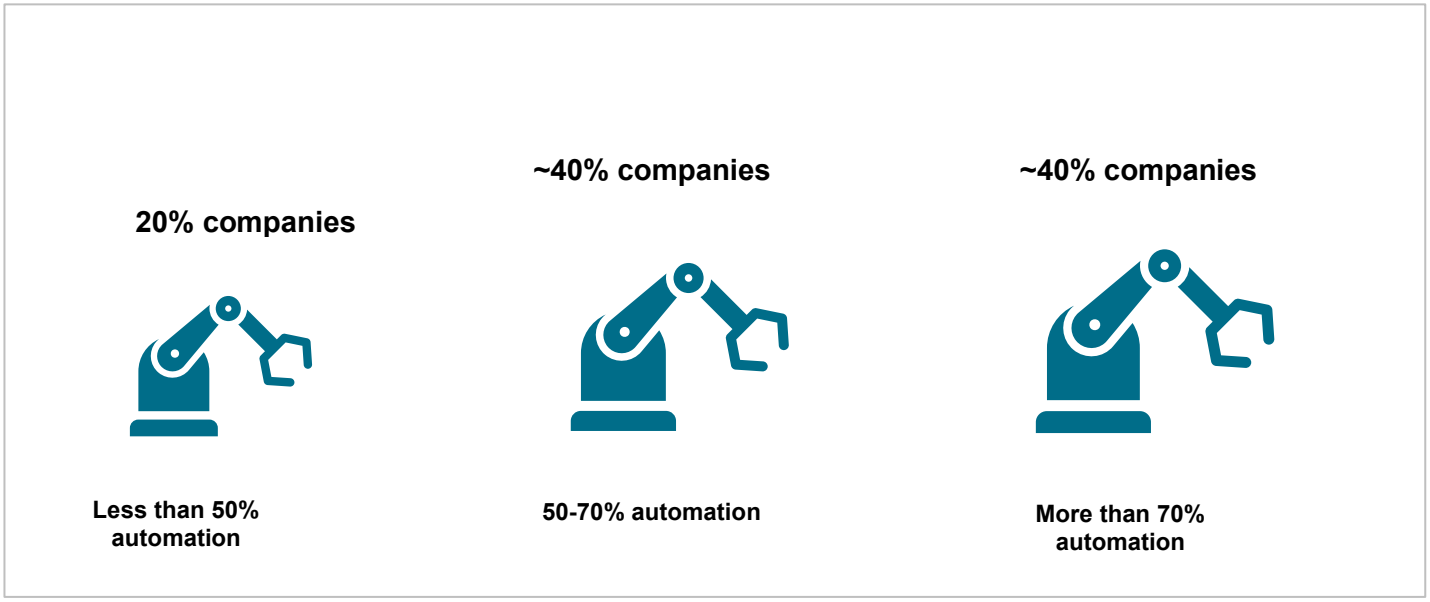
7. Review and optimise performance: Ultimately, the strategic impact of acquiring advanced machinery plays a crucial role in the continuous evaluation and improvement of performance. The integration of new technology facilitates this process.

Most food processing facilities we visited have over 50% automation

Widespread adoption of automation in the food processing industry can significantly enhance productivity, leading to increased revenue and profitability for all stakeholders involved. By leveraging automation, food processing units can benefit from a range of advantages, including enhanced precision, reduced errors and minimised contamination risks, as well as improved worker safety.

Crisil Intelligence spoke to ~100 food processing players across the country to understand the level of automation used in their plants. Of these 100 companies, 20-30 companies were large companies, while the remaining were MSMEs and smaller companies. About 40% of companies reported an automation level of 50-70%. About 40% reported 70%+ automation and 20% reported an automation of less than 50%. The companies belonged to various food processing sectors such as fruits and vegetables, RTE/RTC, meat, grains and pulses, spices, edible oil, oleoresins, etc.

Level of automation at food processing facilities



Note: The level of automation indicates the percentage of total work done by machinery, while remaining work is done by human labour.
Source: Crisil Intelligence

5.6 Food processing machinery existing standards in India

Inadequate coverage of small machinery and outdated standards are the key limitations

The food processing industry in India is a significant sector, with many small, medium and large manufacturers. The industry requires specialised machinery to ensure efficient and safe processing of food products. However, lack of standardised machinery can lead to safety risks, reduced productivity and non-compliance with regulatory requirements. In India, BIS and ISO are responsible for developing and implementing standards for food processing machinery.

Gaps in standards

Despite the efforts of BIS and ISO, there are several gaps in standards for food processing machinery in India, including:

- **Lack of comprehensive standards**: There is a need for comprehensive standards that cover all aspects of food processing machinery, including design, manufacture, installation and maintenance. There is an absence of overarching standards that address all facets of food processing machinery, including design, manufacture, installation and maintenance. The Department of Scientific and Industrial Research (DSIR) has highlighted that factors such as technology, price, credit, delivery and performance standards critically influence the adoption of packaging equipment in the Indian market, indicating the necessity for overarching standards.
- **Inadequate coverage of small-scale machinery**: Many small food processors in India use machinery that is not covered by existing standards, leaving a significant gap in ensuring safety and quality.
- **Limited standards for specific food products**: There is a need for standards specific to certain food products, such as dairy, meat and poultry processing, which have unique requirements.
- **Outdated standards**: Some standards for food processing machinery in India are outdated and do not reflect current technological advancements or international best practices.
- **Lack of harmonisation with international standards**: Indian standards for food processing machinery may not be fully harmonised with international standards, such as those developed by National Sanitation Foundation (US), American Society for Testing and Materials (ASTM) International which can create trade barriers and affect exports.
- **Insufficient emphasis on safety and hygiene**: Existing standards may not adequately address safety and hygiene aspects such as sanitation, cleaning and maintenance of machinery.
- **Limited coverage of emerging technologies**: There is a need for standards that address emerging technologies, such as automation, robotics and AI, which are increasingly being used in food processing.
- **Inadequate testing and certification procedures**: The testing and certification procedures for food processing machinery in India may not be robust, which can lead to non-compliant machinery being used in the industry.

6. Recommendations

Limited scope for reducing imports, focus on strengthening regulatory standards in food processing

Plant and machinery imports from the food processing sector form a limited share of capital goods imports in India. Food plant and machinery imports comprise 4-5% of total N6 principal commodity imports (including machinery for dairy, food, textile, etc.) and just 0.5-1.0% of total capital goods imports. Thus, import substitution for reduction of the import bill may not add to major reduction. From the technical capability and availability point of view, large Indian manufacturers have access to equipment. Mid-size and small players procure equipment from domestic manufacturers, local fabricators or reply on Chinese imports. Availability and access are not an issue, but adoption of modern and automated machinery is not highly prevalent because of economic cost of investment, returns and capital availability. Having said that, it is essential to develop local equipment manufacturers, especially for key electrical components that are imported even by Domestic equipment manufacturers to develop the manufacturing capability.

Any intervention on the food equipment side may not reduce the dependency of import equipment at an overall level. About 80% of the current demand for equipment is met by domestic entities while the rest is imported, barring categories where technology is the key reason for higher imports. With increase in the level of food processing and the level of automation in the industry, equipment imports may rise. In such a scenario, even if import dependency becomes 1.5x or 2.0x the current level, the share of equipment imports in overall imports will be insignificant (below 0.5% of the total import bill). Thus, intervention for import substitution will have a miniscule impact. For increasing the scope and capability of domestic manufacturers from a future standpoint, R&D and innovation will drive further growth of the market. Strengthening the regulations for food processing equipment can help boost the domestic sector. This process and comparison of Indian standards with key countries is shown below. Firstly, we compare the organisations setting standards for machinery in select countries and what are their focus areas.

Food processing machinery standards in developed countries

Table 37 Key organizations setting food processing equipment standards

	Country	Organization Name	Focus Area
1	USA	National Sanitation Foundation (NSF) or NSF International (Independent organization)	Voluntary Sanitation Standards for a wide range of food equipment
2	USA	3-A Sanitary Standards Inc. (3-A SSI) (Independent organization)	Voluntary Hygienic Design Standards, primarily for dairy and other food processing equipment
3	USA	Bakery Equipment Assessment Group (BEAG) (Independent organization)	Voluntary Sanitation Standards for Bakery Equipment
4	USA	American Society for Testing and Materials (ASTM) International (Independent organization)	Voluntary Technical Specifications, Test Methods, and Terminology for various types of food service equipment
5	EU	European Parliament and of the Council	Two of the primary legislative bodies within the European Union (EU)
6	Denmark	Deutsches Institut für Normung (DIN)	Recognized national standards organization, plays a crucial role in developing national standards covering an extensive range of technical fields, including those relevant to food processing machinery

Country	Organization Name	Focus Area
7 France	Association Française de Normalisation (AFNOR)	Recognized national standards organization and is actively involved in developing and publishing French national standards as well as contributing to European and international (ISO) standardization efforts
8 Italy	Ente Nazionale Italiano di Unificazione (UNI) (private, non-profit association)	Responsible for developing, publishing, and disseminating voluntary technical standards across various industrial, commercial, and service sectors, including food processing
9 India	Bureau of Indian Standards	Responsible for the development of Indian Standards across various sectors, including food

Note: The above list of products is indicative and not an exhaustive list
Source: Crisil Intelligence

Food processing equipment standards in the US and EU are more detailed and comprehensive

The standards for food processing equipment vary by region, with different requirements for material and hygienic design. In India, the Food Safety & Standards Regulation, 2011, sets basic requirements for food-grade, non-corrosive materials and cleanability.

In contrast, the United States has more detailed requirements, with the FDA's current good manufacturing practices (CGMPs) and NSF standards specifying material requirements, such as minimum chromium content for stainless steel, and emphasizing cleanable surfaces and easy dismantling for sanitation.

The European Union has comprehensive regulations on Food Contact Materials, with specific directives for materials like plastics and ceramics, and detailed hygienic design principles and guidelines provided by the European Hygienic Engineering and Design Group (EHEDG), covering surface roughness, drainability, and avoidance of crevices, with standards like EN 1672-2 providing hygiene and cleanability requirements.

India has a limited number of equipment-specific standards compared to the extensive range covered by NSF/ANSI in the US and CEN EN standards in Europe. The existing BIS standards seem to just focus on primary processing equipment such as potato graders, seed processing equipment, sugarcane crushers etc. There is a lack of comprehensive and updated standards for a wider variety of modern food processing equipment used in sectors like bakery, dairy, meat processing, and beverage production.

Table 38 Comparison of food processing equipment standards by region

Comparison of material standards		
India	**United States**	**European Union**
Basic requirement for food-grade, non-corrosive materials (which do not impart any toxicity to the food material) for food contact surfaces in Food Safety & Standards (Licensing and Registration of Food Businesses) Regulation, 2011, specifically in Schedule 4, Part II.	Detailed requirements in Food & Drug Administration's (FDA) current good manufacturing practices (CGMPs) for safe, durable, corrosion-resistant, non-absorbent, smooth, and easy-to-clean materials. NSF standards also specify material requirements. E.g. - NSF/ ANSI (American National Standards Institute) 51: Food Equipment Materials sets limitations on specific types of materials, including: ▪ Stainless steel (requiring a minimum chromium content of 16% when used in a food zone) ▪ Aluminum alloys ▪ Wrought alloys ▪ Casting alloys ▪ Copper and copper alloys ▪ Glass and glass-like materials (specifying thickness, formulation, and temper for impact resistance)	Comprehensive regulations on Food Contact Materials (FCMs) under the Framework Regulation, with specific directives for materials like plastics and ceramics, including authorized substances and migration limits. European Hygienic Engineering and Design Group (EHEDG) guidelines also provide detailed material guidance.
Comparison of hygienic design requirements		
India	**United States**	**European Union**
General requirements for cleanability in Schedule 4.	Strong emphasis in FDA's CGMPs on smooth, cleanable surfaces and easy dismantling for sanitation (FSMA). NSF standards also focus on design for cleanability.	Detailed hygienic design principles and guidelines provided by EHEDG, covering surface roughness, drain ability, and avoidance of crevices. EN 1672-2 provides hygiene and cleanability requirements.

Note: The above list of products is indicative and not an exhaustive list

Source: Crisil Intelligence

Table 39 Food processing equipment covered under Indian standards compared to select US & Europe standards

India	US & Europe
▪ Potato graders ▪ Seeds processing equipment ▪ Rice cleaning ▪ Groundnut graders ▪ Sugarcane crushers ▪ Vegetable Cutting machines	▪ Rotary rack ovens ▪ Dough mixers ▪ Planetary mixers ▪ Mincing machines ▪ Slicing machines ▪ Filling machines and auxiliary machines ▪ Automatic ice making equipment

Note: The above list of products is indicative and not an exhaustive list
Source: Crisil Intelligence

These standards should address the unique safety and hygiene requirements of each type of equipment (e.g., mixers, ovens, conveyors, filling machines).

Regulations should at least provide a list of permissible SS grade (314, 316, any other grade) and other metals for food-contact machinery and surfaces and make adherence to the standard compulsory for procuring and continuing license. The composition of various metals used in equipment should be highlighted in the marking clearly. The quality standardisation framework should be adopted along with FSSAI, BSI, ISI, industry participants and research institutes. FSSAI can expand its role to include standardised protocols for food processing equipment and plant design.

Develop detailed material standards and equipment specific standards: Develop specific standards for commonly used materials in food processing equipment, referencing international standards like those from American Society for Testing and Materials (ASTM) or International Organization for Standardization (ISO). These standards should specify the grades of materials (e.g., specific grades of stainless steel), their required properties (e.g., corrosion resistance, tensile strength), and permissible migration limits for substances that may come in contact with the food.

Incorporate comprehensive hygienic design principles: Adopt and mandate adherence to detailed hygienic design principles for food processing equipment, drawing inspiration from EHEDG guidelines and US regulations. These principles should cover aspects like smooth and cleanable surfaces with defined roughness, rounded internal angles, self-drainability, accessible design for cleaning and inspection, and minimization of crevices and dead spots. For e.g.

- In US - NSF/ANSI 2 covers a broad range of food equipment and specifies requirements for smooth angles and corners in food zones, cleanable fasteners, and equipment mounting to allow for cleaning underneath.
- In Europe - Good Manufacturing Practice (GMP) Regulation (EC) No 2023/2006 requires manufacturers of food contact materials, including food processing equipment, to establish and implement effective quality assurance and control systems to ensure hygiene and prevent contamination.

PLI scheme for food processing machinery and parts of machinery can help boost manufacturing and attracting investments in the sector

The PLI scheme is poised to drive significant growth in India's manufacturing sector over the next few years, particularly in capital-intensive segments. The scheme has made significant strides in attracting investments, generating employment and increasing exports in 14 key sectors, including electronics, textiles, medical devices, automobiles, food processing etc.

- The scheme which aims to drive industrial capex of Rs 2.6-2.8 lakh crore during the scheme period, is projected to contribute ~5% capex in key sectors.
- The incentives totaling Rs 1.8-1.9 lakh crore are expected to generate incremental revenue of Rs 30 lakh crore.

- Launched in March 2020, the scheme has attracted investments of Rs 1.61 lakh crore till December 2024, highlighting the promising nature of the scheme.

Table 40 Investments attracted in select sectors

	PLI Scheme	Total investments attracted (INR crores)	
1	PLI scheme for manufacturing solar PV module	35,000	till October 2024
2	PLI scheme for automobile and auto components	25,000	till December 2024
3	PLI scheme for large scale electronics manufacturing	10,905	till February 2025
4	PLI scheme for food processing industries	8,910	till October 2024
5	PLI scheme for IT hardware	5,472	till June 2024
6	PLI scheme for telecom sector	4,081	till January 2025
7	PLI scheme for promoting domestic manufacturing of medical devices	1,057	till December 2024

Source: Scheme documents, PIB

The PLI scheme for food processing machinery and parts of machinery (components) would help the food processing sector in following ways

- Creating domestic **manufacturing capabilities for major machinery components** and **attracting investments** in machinery manufacturing in India, contributing to the growth of capital goods sector. Additionally, it can create new job opportunities in the manufacturing sector.
- The scheme can help MSME Indian food processing companies to access modern and efficient machinery, improving their productivity and competitiveness in the global market. Research and development should also be the focus, helping domestic machinery players in innovation and capacity building. For this a **longer scheme duration would facilitate the creation of a robust ecosystem for research and development**, which will help domestic manufacturers to produce machinery with technological capabilities for higher capacity and efficiency.
- Furthermore, a PLI scheme would align with the government's **"Make in India" and "Atmanirbhar Bharat" initiatives**, aimed at promoting domestic manufacturing and reducing dependence on imports.
- By introducing a PLI scheme for food processing machinery, the government can provide a significant boost to the Indian food processing industry and contribute to the **country's economic growth and development**.

Table 41 R&D support, skill development, boosting marketing linkages are some other key recommendations to help the domestic manufacturers

1 Strategy for building cost effectiveness of local equipment players

- Stability in SS availability and prices (SS policy)
- Support and R&D investments for developing indigenous automated machinery for Indian snacks and promotion of Indian snacks in international markets
- Better credit facilities, low-interest loans to invest in new product development (NPD) equipment for export oriented high value products
- Raw material pricing risks: Providing information to manufacturers on measures to hedge raw material pricing risks such as long-terms contracts, buffer stocks, price indexing mechanisms, etc can help them manage their costs and maintain profitability
- Land parcels at concessionary rates for R&D/innovation focused investments in plant and machinery

2 Research and development support – industry 4.0, technology investments

- Advanced technology in food processing machinery can improve efficiency, food quality and global competitiveness.
- Manufacturer must be supported for R&D initiative in identified categories such as industrial 4.0, energy-efficient machinery, import substitution, Indian export potential foods. R&D grants, and infrastructure support should be extended to develop cost-effective, indigenous solutions tailored to Indian market needs.
- Technology demonstration centres can be developed, where food processors can access and test new innovations before large-scale adoption.
- Open-source knowledge repository - Food technology papers and journals access, create a culture of engagement with industry and details on technology upgradation projects for collaboration. Fostering collaboration between established industry players, academia and research institutions can help develop new technologies, products and processes for food processing industry.
- Focus on component manufacturing by joint ventures with global food machinery/component manufacturers with transfer of cutting-edge technologies.

3 Skill development - R&D focused workforce

- Industry apprenticeship: Adopting the dual education principle to bridge the gap between theoretical education and industry requirements.
- Collaborative projects between industry, academia and research institutions help develop a skilled workforce.

4 Boosting market linkages

- Increasing India's representation as a contingent in global expos, showcasing capabilities of domestic equipment.
- Having stringent quality controls for equipment may boost domestic demand driving volumes and industry growth.

Source: Crisil Intelligence

Table 42 Capabilities to be developed for reducing dependence on imports of machinery in primary processing operations

	Type of machinery	India's position with respect to the machinery				Key countries that import the machinery to India and their shares in FE trade	
		Share in FE trade	Level of domestic capability in machinery				
			High	Medium	Low		
1	Cleaning, grading, sorting machinery for grains and vegetables	16.4%	Domestic manufacturers are capable but imports from China are cheaper			China	11.7%
2	Miscellaneous/other machinery	12.9%		Quality standards can limit cheap imports		China	6.1%
3	Machinery for the manufacture of confectionery, cocoa or chocolate	7.7%			Technology-driven, established brands exist		
4	Parts of other food processing machinery	16.3%			Components need to be imported for existing machinery		
5	Machinery used in the bread grain milling industry and other machinery	5.2%	Technology-driven, established brands exist			China	5.5%
6	Bakery machinery	8.1%					
7	Rice milling	5.20%	Design standards by consulting industry players for reasonably priced machinery			China Thailand	1.0%
8	Machinery for preparation of fruits, nuts/vegetables	5.50%	Design standards by consulting industry players for reasonably priced machinery			China Vietnam	2.2%
	Total	**77.3%**					**26.5%**

Source: Crisil Intelligence

Annexure

China ⇨ This country has the lowest volume to value ratio for 31 out of 52 HS codes considered under food processing equipment category (imports).

Table 43 HS code wise list of lowest volume to value ratio

HS Code	Description	Country with lowest volume to value ratio
84371000	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables; machinery used in the milling industry or for the working of cereals or dried leguminous vegetables, other than farm-type machinery - machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables	China
84388090	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - other machinery - other	China
84382000	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - machinery for the manufacture of confectionery, cocoa or chocolate	Turkey
84389010	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - parts - of sugar manufacturing machinery	Others
84389090	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - parts - of other machinery	China
84378090	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables; machinery used in the milling industry or for the working of cereals or dried leguminous vegetables, other than farm-type machinery - other machinery - other	Others
84381010	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - bakery machinery and machinery for the manufacture of macaroni, spaghetti or similar products - bakery machinery	China
84378020	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables; machinery used in the milling industry or for the working of cereals or dried leguminous vegetables, other than farm-type machinery - other machinery - other machinery - rice mill machinery	China
84386000	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - machinery for the preparation of fruits, nuts or vegetables	China

HS Code	Description	Country with lowest volume to value ratio
84379010	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables; machinery used in the milling industry or for the working of cereals or dried leguminous vegetables, other than farm-type machinery - other machinery - parts - of flour mill machinery	Turkey
84379020	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables; machinery used in the milling industry or for the working of cereals or dried leguminous vegetables, other than farm-type machinery - other machinery - parts - of rice mill machinery	China
84379090	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables; machinery used in the milling industry or for the working of cereals or dried leguminous vegetables, other than farm-type machinery - other machinery - parts - other	Turkey
84361000	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, including germination plant fitted with mechanical or thermal equipment; poultry incubators and brooders - machinery for preparing animal feeding stuffs	China
84381020	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - bakery machinery and machinery for the manufacture of macaroni, spaghetti or similar products - machinery for manufacture of macaroni or spaghetti or similar products	China
84342000	Milking machines and dairy machinery - dairy machinery	China
84385000	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - machinery for the preparation of meat or poultry	China
84362900	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, including germination plant fitted with mechanical or thermal equipment; poultry incubators and brooders - poultry- keeping machinery; poultry incubators and brooders - other	Germany
84378010	Machines for cleaning, sorting or grading seed, grain or dried leguminous vegetables; machinery used in the milling industry or for the working of cereals or dried leguminous vegetables, other than farm-type machinery - other machinery - other machinery - flour mill machinery	Turkey
84369900	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, including germination plant fitted with mechanical or thermal equipment; poultry incubators and brooders - parts - other	China
84368090	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, including germination plant fitted with mechanical or thermal equipment; poultry incubators and brooders - other machinery - other	Others
84362100	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, including germination plant fitted with mechanical or thermal equipment; poultry incubators and brooders - poultry- keeping machinery; poultry incubators and brooders - poultry incubators and brooders	Italy
84349010	Milking machines and dairy machinery - parts - of milking machinery	Turkey
84349020	Milking machines and dairy machinery - parts - of dairy machinery	China

HS Code	Description	Country with lowest volume to value ratio
84369100	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, including germination plant fitted with mechanical or thermal equipment; poultry incubators and brooders - parts - of poultry-keeping machinery or poultry incubators and brooders	China
84369900	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, including germination plant fitted with mechanical or thermal equipment; poultry incubators and brooders - parts - other	China
84388010	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - other machinery - auxiliary equipment for extrusion cooking plant	Italy
84351000	Presses, crushers and similar machinery used in the manufacture of wine, cider, fruit juices or similar beverages - machinery	China
84383090	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - machinery for sugar manufacture - other	China
84388020	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - other machinery - for production of soya milk or other soya products (other than soya oil)	Italy
84384000	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - brewery machinery	Netherlands
84388030	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - other machinery - diffusing machines (diffusers)	China
84388040	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - other machinery - tea leaf rolling or cutting machine	China
84341000	Milking machines and dairy machinery - milking machines	Turkey
84383010	Machinery, not specified or included elsewhere in this chapter, for the industrial preparation or manufacture of food or drink, other than machinery for the extraction or preparation of animal or fixed vegetable or microbial fats or oils - machinery for sugar manufacture - sugar cane crushers	China
84359000	Presses, crushers and similar machinery used in the manufacture of wine, cider, fruit juices or similar beverages - parts	China
84368010	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery, including germination plant fitted with mechanical or thermal equipment; poultry incubators and brooders - other machinery - germination plant fitted with mechanical and thermal equipment	Others
84198110	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 8514), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising,	China

HS Code	Description	Country with lowest volume to value ratio
	pasteurising, steaming, drying, evaporating, vaporising, condensing or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric - other machinery, plant and equipment - for making hot drinks or for cooking or heating food - friers	
84198120	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 8514), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising, pasteurising, steaming, drying, evaporating, vaporising, condensing or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric - other machinery, plant and equipment - for making hot drinks or for cooking or heating food - other kitchen machines	China
84198190	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 8514), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising, pasteurising, steaming, drying, evaporating, vaporising, condensing or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric - other machinery, plant and equipment - for making hot drinks or for cooking or heating food - other	Turkey
84198950	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 8514), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising, pasteurising, steaming, drying, evaporating, vaporising, condensing or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric - other machinery, plant and equipment - other - pasteurizers	Others
84211100	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - centrifuges, including centrifugal dryers - cream separators	China
84211910	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - centrifuges, including centrifugal dryers - other - bowl centrifuges	Germany
84211920	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - centrifuges, including centrifugal dryers - other - basket centrifuges	Germany
84211930	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - centrifuges, including centrifugal dryers - other - continuous automatic centrifuges	Germany
84211940	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - centrifuges, including centrifugal dryers - other - self-cleaning centrifuges	China
84211950	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - centrifuges, including centrifugal dryers - other - decanter centrifuges horizontal bowl	China
84211960	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - centrifuges, including centrifugal dryers - other - screw conveyor centrifuges	China
84211991	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - centrifuges, including centrifugal dryers - other - other - for chemical industries	Others

HS Code	Description	Country with lowest volume to value ratio
84211999	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - centrifuges, including centrifugal dryers - other - other - other	China
84212200	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases - filtering or purifying machinery and apparatus for liquids - for filtering or purifying beverages other than water	China
84336010	Harvesting or threshing machinery, including straw or fodder balers; grass or hay mowers; machines for cleaning, sorting or grading eggs, fruit or other agricultural produce, other than machinery of heading 8437 - machines for cleaning, sorting or grading eggs, fruit or other agricultural produce - machines for cleaning	China
84336020	Harvesting or threshing machinery, including straw or fodder balers; grass or hay mowers; machines for cleaning, sorting or grading eggs, fruit or other agricultural produce, other than machinery of heading 8437 - machines for cleaning, sorting or grading eggs, fruit or other agricultural produce - machines for sorting or grading	China

Note: Countries who are not top five exporters to India are classified under others.
Others: Crisil Intelligence

Table 44 There is presence of global equipment players in China

Company Name	Registered entity in China	Location in China
Bühler Group	Bühler (Wuxi) Commercial Co., Limited	Wuxi and Changzhou
GEA Group	GEA Process Engineering (Shanghai) Co., Limited	Suzhou, Tianjin, and Shanghai
Tetra Pak	Tetra Pak (Kunshan) Co., Limited	Hohhot
JBT Marel Corporation	JBT FoodTech (Kunshan) Co., Limited	Shanghai
SPX FLOW	SPX (Shanghai) Flow Technology Co., Limited	Shanghai
Heat and Control	Heat and Control (Nanjing) Co., Limited	Nanjing, Jiangsu Province
Alfa Laval	Alfa Laval (China) Limited	Qingdao and Shanghai
Danfoss	▪ Danfoss (China) Investment Co., Limited ▪ Danfoss Power Solutions (Zhejiang) Co., Limited ▪ Danfoss Power Solutions (Nanjing) Co., Limited	Wuqing of Tianjin, Haiyan of Zhejiang and Anshan of Liaoning
Krones AG	Krones Machinery (Taicang) Co., Limited	Taicang, Jiangsu Province
Middleby Corp	Middleby (Shanghai) Food Equipment Co., Limited	Qingdao and Zhuhai

Source: CRISIL Intelligence

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