



Assessment of the infrastructure and logistics requirements of India's food processing sector

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Ministry of Food Processing Industries, Government of India

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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 assessment of the infrastructure and logistics requirements of India's food processing sector, which studies the current infrastructure and logistics available to the food processing sector, gaps in the current infrastructure and the required future investments to support the future demand.

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 agriculture infrastructure and logistics available to the food processing sector in the country 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 245.9 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.

This report assesses the current infrastructure and logistics facilities available to the domestic food processing sector and identifies key gaps in the sector. The report provides an in-depth examination of cold chain infrastructure and evaluates investments in select infrastructure and logistics segments (with a focus on storage, transport and logistics) that would support the sector for future growth. Furthermore, it explores the challenges faced by farmers – the key stakeholder for raw material production and also explores challenges faced at key food categories within the food processing sector.

It is important to study the infrastructural need and logistics demand of the sector, considering the increasing consumer demand for processed foods and evolving export opportunities. It aligns with the ongoing government initiatives to strengthen infrastructure and logistics segments that support the sector, such as the Pradhan Mantri Kisan Sampada Yojana (PMKSY), Production Linked Incentive (PLI) scheme and Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME).

Our study reveals that the limited and regional disparity of cold storage facilities available in the country leads to significant post-harvest losses for the food processing sector. The total cold storage capacity in India is estimated to be 37- 40 million metric tonnes, with a shortfall of 10 -15 million metric tonnes. The existing cold storage infrastructure is primarily utilized for key export commodities, including potatoes and fruits, and also serves the pharmaceutical industry for the storage of export-bound products. High transport and logistics costs, inadequate rural roads, limited grain storage capacity, rising export freight charges, high compliance costs further exacerbate the problem. Farmers also face significant challenges in transporting their produce to buyers, with high transportation costs and poor road conditions being major hindrances.

The report highlights the need for investment in select infrastructure segments, including cold chain warehousing, reefer trucks, agri-warehousing, and rural road connectivity. While an investment of Rs 7.5-8.5 lakh crore between 2025 and 2047 is considered the bare minimum for these sectors, the actual requirement for state-of-the-art infrastructure is expected to be considerably higher. A benchmarking exercise with the United States reveals that India's cold chain storage capacity for horticulture, dairy, and meat products needs to increase to approximately 175-185 million tonnes, representing a significant expansion from the current capacity of 37-40 million metric tonnes. This underscores the need for a more ambitious investment strategy to address the existing infrastructure deficit and unlock the full potential of these sectors. This report aims to provide a comprehensive understanding of the current state of infrastructure in the country and provide valuable insights and recommendations for the development of the food processing industry in India.

We have employed a holistic approach, leveraging sector expertise, an internal database, and extensive primary and secondary research, to conduct this study. The methodology includes mapping the current environment, identifying key

data sources, selecting stakeholders for primary interactions, designing questionnaires, analysing data and interpreting potential outcomes.

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.

Authors

Anjali Nathwani | Director

Apurva Salvi | Associate Director

Hansmukh Asrani | Manager

Contents

Executive Summary	13
1. Overview of India's food processing sector	16
1.1 Key segments of India's food processing sector	16
1.2 Stature of India's food processing sector at the global level	16
1.3 Enterprises in India's food processing sector	19
1.4 FDI inflows to the food processing industry peaked in fiscal 2023	22
1.5 Overview of global food and beverage industry	23
2. Assessment of infrastructure supporting the food processing sector	24
2.1 Overview of key infrastructure categories	24
2.2 Road network.....	25
2.3 Logistics and allied highway infrastructure	25
2.4 Port network.....	26
2.5 Indian Railways.....	28
2.6 Airport freight traffic	29
2.7 Agricultural warehousing storage	30
2.8 Cold storage sector in India.....	31
3. Investments in infrastructure segments support growth of the food processing sector	36
4. Assessment of supply chain integration for transportation & storage across food categories by shelf life	39
4.1 Overview of the general food processing supply chain	39
4.2 Category-wise overview of infrastructure and logistics supply chain	41
4.3 Level of integration & coordination between different modes of transport & storage facilities	55
5. Segment-wise analysis of infrastructure and logistical challenges in the food processing industry	62
6. Farmer-level assessment of infrastructure and logistics in India's food processing sector	67
7. Analysis of efficiency and capacity utilisation of logistics networks, key gaps and bottlenecks	74
8. Overview of regulatory and policy barriers.....	77
9. Assessment of investments in key identified gaps that support food processing industry	79
10. Recommendations	83

List of tables

Table 1: Comparison of select infrastructure in the US and India	14
Table 2: Value of agricultural production — gross production value of food for top 10 countries (\$ billion).....	17
Table 3: Agricultural products for which India is among the top two producers in the world, 2020	17
Table 4: Agricultural products for which India is among the top ten producers in the world, 2020	18
Table 5: India has ~2.3 million unincorporated enterprises in the food processing sector, making up ~98% of all units	19
Table 6: Government initiatives to boost infrastructure and manufacturing in the food processing sector	21
Table 7: Indian road network.....	25
Table 8: Status of MMLPs that are under development	26
Table 9: Indian ports likely to witness sustained traffic growth over FY26-28	27
Table 10: Operational performance from FY14-FY24	27
Table 11: Investments in key infrastructure sectors related to food processing	36
Table 12: Summary of needs and challenges based on the player categories interviewed.....	62
Table 13: Estimated post-harvest losses for select vegetable categories (percentage of total production).....	63
Table 14: Post-harvest monetary losses for select fruit categories	64
Table 15: Cold storage requirement for major fruits and vegetables in India	66
Table 16: Key challenges to storage infrastructure.....	75
Table 17: High land acquisition costs, import duties and complex licensing processes hinder private logistics growth	76
Table 18: Regulatory barriers.....	77
Table 19: Policy barriers	78
Table 20: Regulatory and policy issues lead to high operational costs, reduced investments and wastages	78
Table 21: Investments supporting current level of infrastructure and volume and investments required by fiscal 2047	81
Table 22: Comparison of select infrastructure in the US and India	81

List of figures

Figure 1: Key segments of India's food processing sector based on food category	16
Figure 2: FDI equity inflows to the food processing industry	22
Figure 3: The global F&B market will continue its growth momentum in the medium term.....	23
Figure 4: Indian railway network route in km	29
Figure 5: Indian railway network – freight carried in million tonnes	29
Figure 6: Indian airport freight in '000 tonnes	30
Figure 7: Agricultural warehousing storage capacity	30
Figure 8: Foodgrains form more than 40% of warehousing demand.....	31
Figure 9: TCW constitutes almost 90% of the cold storage market.....	32
Figure 10: Review of India's cold storage market.....	33
Figure 11: 10-15% fruits and vegetables are lost due to lack of cold storage	34
Figure 12: Meat and seafood see 7-8% wastage due to lack of cold storage	35
Figure 13: Food processing industry supply chain.....	40
Figure 14: Infrastructure and logistics value chain for grains and pulses	41
Figure 15: Infrastructure and logistics value chain for fruits and vegetables	43
Figure 16: Infrastructure and logistics value chain for dairy products.....	44
Figure 17: Infrastructure and logistics value chain for RTE and RTC products.....	46
Figure 18: Infrastructure and logistics value chain for beverages (alcoholic and non-alcoholic)	47
Figure 19: Infrastructure and logistics value chain for meat and poultry	49
Figure 20: Infrastructure and logistics value chain for seafood, fisheries/marine products	50
Figure 21: Infrastructure and logistics value chain for healthy foods (indicative)	52
Figure 22: Infrastructure and logistics value chain for bakery and confectionary	53
Figure 23: Process flow for fruits and vegetables	55
Figure 24: Process flow for RTE foods	56
Figure 25: Process flow for confectionary products	57
Figure 26: Process flow for packaged snacks	58
Figure 27: Process flow for probiotics	59
Figure 28: Process flow for dried spices	61
Figure 29: Below is an infographic which depicts the methodology to calculate the cold storage requirements	65
Figure 30: Produce grown by farmers.....	67
Figure 31: Farmers' preferred channels of sales for their produce.....	68

Figure 32: Buyers’ proximity to farmers across states 69

Figure 33: Challenges faced by farmers in the transportation of produce 70

Figure 34: Locations where primary processing takes place 70

Figure 35: Storage duration for different food categories 71

Figure 36: Major storage challenges faced by farmers 71

Figure 37: Major challenges in using cold storage facilities 72

Figure 38: Logistics and transportation scenario from the farmers’ perspective 73

Figure 39: Capacity utilisation of logistics players 74

Figure 40: Technologies under implementation in the logistics and warehousing sector in India 79

Figure 41: Segment-wise break-up of investments needed between FY25 and FY47 in INR crores 80

List of abbreviations

Abbreviation	Full Form
APMC	Agricultural Produce Market Committees
APCs	Agro-processing clusters
ASI	Annual Survey of Industries
AI	Artificial Intelligence
AS/RS	Automated storage and retrieval system
BFL	Backward-forward linkages
CAGR	Compound annual growth rate
DFCCIL	Dedicated Freight Corridor Corporation of India Limited
DFCs	Dedicated Freight Corridors
EDFC	Eastern Dedicated Freight Corridor
FPOs	Farmer producer organisations
FIDF	Fisheries and Aquaculture Infrastructure Development Fund
FAO	Food and Agriculture Organization
FCI	Food Corporation of India
FSSAI	Food Safety and Standards Authority of India
FTLs	food testing laboratories
FDI	Foreign direct investment
FTLs	Full-truckload
GPS	Global positioning system
GST	Goods and Services Tax
GDP	Gross domestic product
GTKM	Gross tonne-kilometers
GVA	Gross value added
ICDs	Inland container depots
JNPT	Jawaharlal Nehru Port Terminal
KM	Kilometre
LTL	Less-than-truckload
LPI	Logistics Performance Index
MFPS	Mega Food Parks Scheme
MT	Metric tonnes
MSMEs	Micro, small, and medium enterprise
MoAFW	Ministry of Agriculture and Farmers' Welfare
MoFPI	Ministry of Food Processing Industries
MoRTH	Ministry of Road Transport and Highways
MCA	Model Concessionaire Agreement
MAP	Modified Atmosphere Packaging
MMLPs	Multi-modal logistics parks
NAM	National Agriculture Market
NSS	National Sample Survey
OG	Operation Greens
POL	petroleum oil and lubricants
PMFME	Pradhan Mantri Formalisation of Micro Food Processing Enterprises
PMGSY	Pradhan Mantri Gram Sadak Yojana
PMKSY	Pradhan Mantri Kisan Sampada Yojana
PM-MKSSY	Pradhan Mantri Matsya Kisan Samridhi Sah-Yojana
PLI	Production Linked Incentive

Abbreviation	Full Form
PLISFPI	Production Linked Incentive Scheme for Food Processing Industry
RTC	Ready-to-cook
RTE	Ready-to-eat
SMEs	Small and medium enterprises
SWCs	State warehousing corporations
SMPO	Syama Prasad Mookerjee Port
TCV	Temperature-controlled vehicles
TCW	Temperature-controlled warehousing
ULIP	Unified Logistics Interface Platform
US	United States
WDFC	Western Dedicated Freight Corridor

Executive Summary

India is the second-largest producer of food globally. By category, the country ranks first in milk, spices, pulses and bovine and second in horticulture crops, fish and aquaculture, and paddy. The food processing sector has emerged as a significant segment of the Indian economy, making substantial contributions to the country's gross domestic product (GDP), employment and investment. In fiscal 2023, the sector accounted for 7.66% of gross value added (GVA) in the manufacturing sector and 8.45% in the agriculture sector (at 2011-12 prices).

India's logistics sector is a critical pillar of its economy, enabling trade, facilitating market access and supporting economic growth. The logistics ecosystem pertaining to the food processing industry is vast and evolving rapidly with a strong push towards digitalisation, multimodal integration and infrastructure development. The logistics ecosystem and key infrastructure consist of the following components.

- Modes of transport: Roads, rail, air and waterways
- Infrastructure: Road network, port network, airport network and railway network
- Storage: Grain warehousing and cold storage
- Technology and digital initiatives such as Unified Logistics Interface Platform (ULIP), E-logs, Fastag etc.
- Food processing facilities
- Regulatory and policy support from the Government

Crisil Intelligence interacted with approximately 100 food processing players across India to understand the needs and challenges of the industry and categories they operate in, including those operating in mega food and integrated parks and standalone facilities. Some of these players were also beneficiaries of Ministry assisted schemes. In terms of challenges faced, limited and regional disparity of cold storage available in the country leads to significant post-harvest losses for the food processing sector. Presently, total cold storage capacity in India is 37-40 million metric tonnes, out of which 33-35 million metric tonnes is estimated to be available for food, as the rest is required for pharmaceutical products. Based on our estimates, the shortfall is 10-15 million metric tonnes. While the country has adequate cold storage capacity available for potato, onion and tomato face an estimated shortfall of 20-30% considering current capacities. The shortfall further increases for fruits and meat and sea food. High transport and logistics costs and inadequate rural roads and other infrastructure are other key challenges with respect to infrastructure and logistics. Industry participants have also pointed out that inadequate implementation of schemes and lack of uniformity in taxation across various states also hinder growth prospects for them.

Farmers also face challenges in terms of infrastructure and logistics. To transport their produce from the farm to buyers, farmers pay anywhere between Rs 500 and Rs 5,000. High cost of transportation, unavailability of labour for loading and unloading of the produce and poor road conditions act as hindrances while transporting it to the buyer. A significant proportion of farmers from Punjab and Uttarakhand sells their produce to buyers within a 0-20 km radius. The trend is also observed in Telangana, Andhra Pradesh and Odisha, where a substantial number of buyers is located close to farms. The transportation of produce to buyers, however, is predominantly facilitated through rented vehicles and not by the farmers' own vehicles, highlighting high reliance on third-party logistics in the agricultural supply chain. Based on a nation-wide survey of farmers, perception is that most state farmers are satisfied with the logistics and transport services prevalent.

Based on the analysis of our interactions with logistics players catering to the food processing industry, we gleaned the average capacity utilisation of facilities and fleets is 70-80%, with peak utilisation reaching 90-95% during harvest seasons



and festivals. Demand remains steady throughout the year, with some fluctuation during off-peak seasons. Overall, the facilities and fleets have been operating at an above 70% capacity utilisation rate, reflecting strong demand for cold storage and transportation services in the sector. Challenges to efficiency of the sector are fragmented supply chain, inadequate warehousing and storage, reduced flexibility by logistics players and lack of coordination between stakeholders.

In terms of regulatory aspect, multiplicity of regulations, inconsistent food safety standards, multiple licensing and approvals and lack of integrated policy are some of the key barriers hindering sector. Regulatory and policy issues lead to high operational costs, reduced investments and wastages. Overcoming regulatory and policy barriers is essential to unlocking the potential of India’s food processing sector. Addressing these challenges through streamlined regulations, cohesive policies and targeted investments can significantly improve infrastructure and logistics facilities. This, in turn, will enhance supply-chain efficiency, reduce food wastage and increase farmers’ incomes.

Our findings indicate that select infrastructure segments supporting the food processing sector will see an investment of Rs 280-300 lakh crore between FY25 and FY47. These segments include core sectors such as railways, roads and ports and select sectors such as cold chain warehousing, reefer trucks, agri-warehousing and rural road connectivity. These select sectors (cold chain warehousing, reefer trucks, agri-warehousing and rural road connectivity) are expected to see Rs 7.5-8.5 lakh crore investment between FY25 and FY47.

However, investment required for advanced infrastructure is anticipated to be significantly higher than this estimate. Based on the comparison with infrastructure facilities in countries such as the United States, required investment in advanced infrastructure in the food processing sector expected to be much higher than Rs 7.5-8.5 lakh crore. A comparison of refrigerated warehousing and grain warehousing capacity in both the countries show that, India should have an estimated ~140-150 million tonnes of cold chain warehousing storage only for food as against 37 million tonnes it has as of now (which includes 10-15% for pharmaceutical products as well). The country should have an agricultural warehousing capacity of ~900-1,000 million tonnes vs ~150 million tonnes available as of now.

Table 1: Comparison of select infrastructure in the US and India

Parameter	Volume of current infrastructure available (FY24) in million tonnes		India’s requirement based on comparison with the US
	 US	 India	
1 Cold chain warehousing or temperature-controlled warehousing	>30 (~3000 million cubic feet)	~37 to 40 (incl. 10-15% for pharma purposes)	<ul style="list-style-type: none"> India’s primary fruit & vegetable production: 4.5 to 5 times of the US (FAO data) India’s requirement: 4.5 to 5 times of the US, that is: ~140-150 million tonnes
2 Agricultural warehousing	553 (grain storage capacity)	~149 to 150	<ul style="list-style-type: none"> India’s crop production: ~1.8 times of the US (FAO data) India’s requirement: ~1.8 times of the US, that is: ~900-1,000 million tonnes

Source: Crisil Intelligence

To reduce post-harvest losses and improve supply-chain integration, it is crucial to address inefficiencies in cold chain networks, agri-warehousing, rural connectivity and food processing clusters. Implementing consultation programmes at the farm level, tailored to the specific requirements of each region, and leveraging advanced technology solutions can enhance efficiency, sustainability and global competitiveness. Furthermore, simplification of regulations by having single window clearance system to reduce bureaucratic hurdles and improve the speed of clearances for food exports or even the setting up of a food processing unit can help speed up growth for the sector.













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

Grains and pulses 	Fruits and vegetables 	Dairy 	Ready-to-eat / Ready-to-cook 	Non-alcoholic beverages 	Meat and poultry 
Edible oil 	Bakery and confectionery 	Tea and coffee 	Spices 	Sugar 	Oleoresins 

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 Agriculture Organization of the United Nations (FAO), China, India and the United States (US) had the highest gross production value of food between 2018 and 2022. China’s gross production value of food exceeded \$1.6 trillion in 2022, while that of India stood at ~\$505 billion.

Table 2: Value of agricultural production — gross production value of food for top 10 countries (\$ billion)






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 (Islamic Republic of)		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 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 3: 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					

Agricultural products	Production (million tonnes)		Production (%)	Top producers by volume	
	World	India	India / World	Rank 1	Rank 2
Groundnut (excluding shelled)	53.8	10.0	18.5	China 	India 
D Commercial crops					
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: Agriculture Statistics at Glance, 2022, 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 4: 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	Producers ahead of India	India's rank
Total cereals	3066.0	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: Agriculture Statistics at Glance, 2022, 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

In terms of number of units, India's food processing sector is dominated by small unincorporated enterprises. In terms of production value, about 98% of units account for 35-40% of the market. Conversely, the remaining 2% of entities control a significant 60-65% of the market

Table 5: India has ~2.3 million unincorporated enterprises in the food processing sector, making up ~98% of all units

State/UT	Registered units		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 units		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 F&B as per ASUSE FY23-24

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

Table 6: Government initiatives to boost infrastructure and manufacturing in the food processing sector

1 Production Linked Incentive (PLI) scheme

The PLI scheme was announced in Union Budget 2021-22, with a capital outlay of Rs 1.97 lakh crore 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 from fiscal 2022 to fiscal 2027. The scheme consists of three components: incentivising manufacturing in four food product segments (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), and incentivising branding and marketing abroad for promoting Indian brands in the global market. Additionally, the PLI scheme for promoting millet-based products was launched in fiscal 2023 with an outlay of Rs 8,000 crore, using the scheme's savings. As on 31st March 2025, a total of 170 applications from 132 companies are approved under PLI Scheme with an investment of Rs 8,910 crore has been done against the target of Rs 7,722 crore along with 3.4 lakh employment generated.

2 Pradhan Mantri Kisan Sampada Yojana (PMKSY)

MoFPI implemented PMKSY, a central sector umbrella scheme, in fiscal 2018. PMKSY is one of the important interventions by the government in the food processing sector. It has contributed substantially towards strengthening the food preservation and processing infrastructure of the country. In all, so far, 1,604 projects have been sanctioned under various component schemes of PMKSY, since their respective dates of launch. On their operationalisation, the approved projects are expected to leverage their investment of Rs 22,780 crore, benefiting about 5.1 million farmers, and are expected to result in the direct/indirect employment of more than 0.74 million people.

As of 31st March 2025, the project cost under various sub-schemes of PMKSY were as follows:

Sr. no.	Scheme	Project Cost (Rs crore)
1	Mega food parks*	4,660
2	Creation of infrastructure for agro-processing clusters (APCs)	2,294
3	Backward-forward linkages (BFL)*	693
4	Integrated cold chain and value addition infrastructure (cold chain)	11,466
5	Setting up/upgradation of food testing laboratories (FTLs)	1,177
6	Operation Greens – Long Term Interventions (OG)	2,103
7	Creation/ Expansion of Food Processing and Preservation Capacities (Unit Scheme)	8,443
8	Human Resources and Institutions –Research & Development	97
9	Human Resources and Institutions- Skill*	19

3 Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME)

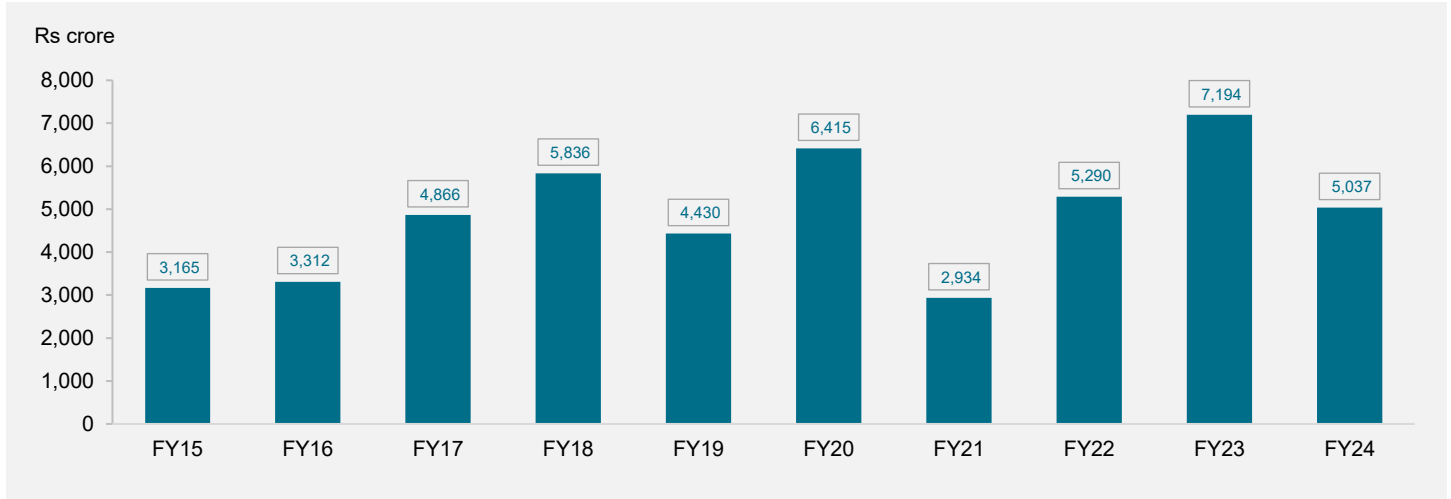
To address the challenges faced by the unorganised food processing sector, the government launched the PMFME scheme to support micro-enterprises, focusing on financial aid, technology, machinery, branding, marketing and food safety. As part of the Atmanirbhar Bharat Abhiyan, this scheme is operational for five years with an outlay of Rs 10,000 crore. As of March 2025, Rs 2,793 crore has been released under the scheme, and it has generated indirect/direct employment for over 7 lakh people.

Source: Budget documents, MoFPI, Sansad, Crisil Intelligence

1.4 FDI inflows to the food processing industry peaked in fiscal 2023

The data highlights the annual trends in foreign direct investment (FDI) equity inflows to the food processing industry in India, measured in both Indian rupee and US dollar. FDI inflows have varied significantly over the years, with the highest inflows of Rs 7,190 crore (equivalent to \$895.34 million) in fiscal 2023. Inflows were low at Rs 2,930 crore in fiscal 2021 due to Covid-19. In fiscal 2024, inflows decreased from the previous fiscal to Rs 5,004 crore (\$608.31 million). This trend reflects fluctuations influenced by global economic conditions and investment policies.

Figure 2: FDI equity inflows to the food processing industry



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

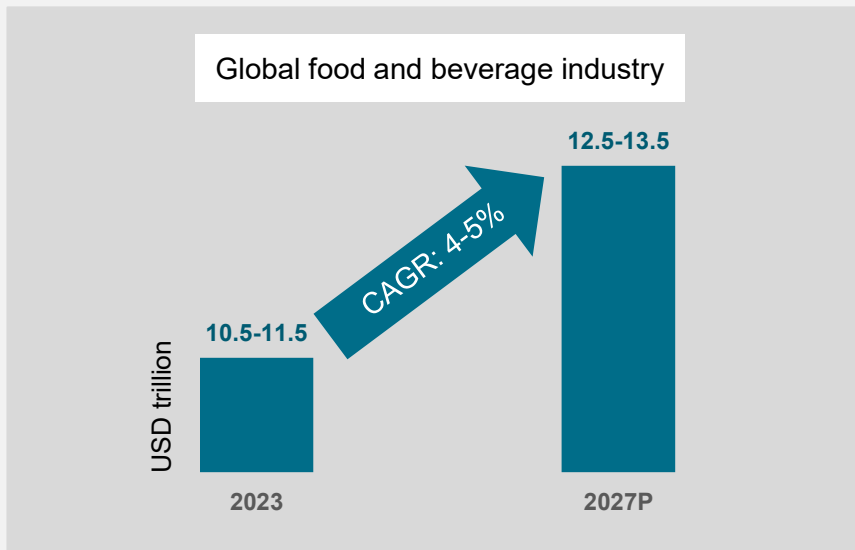
1.5 Overview of global food and beverage industry

Global food and beverage industry to clock a CAGR of 4-5% between 2023 and 2027

The global food and beverage (F&B) industry was valued at \$10.5-11 trillion in 2023. It is expected to reach \$12.5-13 trillion at a compound annual growth rate (CAGR) of 4-5% by 2027, driven by increasing urbanisation and disposable income in developing countries, rising demand for convenient and healthy food options, and growing popularity of e-commerce for F&B purchases.

The Asia-Pacific region is a key market for F&B, owing to the large and growing population, rising disposable income, and growing demand for processed, convenient and healthy foods.

Figure 3: The global F&B market will continue its growth momentum in the medium term.



Source: Crisil Intelligence

The F&B sector's strengths and growth drivers include rising global population, evolving consumer demand, growing disposable income, technological innovations and sustainability.

The industry is robust but sensitive to external factors such as geopolitical tensions, policy changes and extreme weather events. These dynamics can disrupt supply chains, demand and international trade.

2. Assessment of infrastructure supporting the food processing sector

2.1 Overview of key infrastructure categories

India's logistics sector is a critical pillar of its economy, enabling trade, facilitating market access and supporting economic growth. The logistics ecosystem pertaining to the food processing industry is vast and evolving rapidly with a strong push towards digitalisation, multimodal integration and infrastructure development.

The logistics ecosystem and key infrastructure consist of the following components:

- **Modes of transport**
 - **Road:** Dominates freight movement, especially for short and medium distances
 - **Rail:** Efficient for bulk and long-distance cargo; focus on Dedicated Freight Corridors (DFCs)
 - **Air:** Used for high-value and time-sensitive cargo
 - **Waterways:** Cost-effective, with focus on inland waterways and coastal shipping
- **Infrastructure**
 - **Road network:** India's road network spanned ~6.3 million kilometre (km), including national and state highways and other roads, as of fiscal 2025
 - **Ports:** The country had 13 major ports and more than 200 non-major ports as of fiscal 2025
 - **Airports:** India had 138 operational airports as of September 2025 as per Airport Authority of India data, with improved cargo handling at all major airports
 - **Railways:** India has the fourth-largest rail network in the world, with 68,584 route km as of fiscal 2024. Modernisation of railways is underway as part of Indian Railways' freight reform agenda to increase its share of freight transport, improve efficiency and reduce costs
- **Storage**
 - **Warehousing:** India's warehouses are evolving from basic godowns to modern, tech-enabled logistics hubs. They play a crucial role in the food processing industry
 - **Cold storage:** India is one of the world's largest producers of perishable goods such as fruits, vegetables and dairy, making cold storage crucial for reducing wastage and increasing shelf life
- **Technology and digital initiatives**
 - **Unified Logistics Interface Platform (ULIP):** ULIP integrates digital systems across ministries and departments, facilitating real-time information exchange, reducing delays and costs, and enhancing transparency and visibility within the logistics ecosystem
 - **E-logs, FASTag, and Goods and Services Tax (GST) e-way bill:** The introduction of E-logs, FASTag and GST e-way bill has enhanced transparency and efficiency within the logistics ecosystem

- **IoT, artificial Intelligence (AI) and blockchain:** Adoption of IoT, AI and blockchain for supply-chain visibility and management is growing, leading to higher efficiency and effectiveness
- **Regulatory and policy support**
 - **National Logistics Policy (2022):** Aims to reduce logistics cost to 8% of GDP and improve the Logistics Performance Index (LPI)
 - **PM Gati Shakti:** An infrastructure master plan integrating transport and logistics planning
- **Processing facilities:** Food parks, independent facilities belonging to individuals, small businesses and large enterprises

The details and assessment of the country's existing infrastructure supporting the food processing industry are provided below.

2.2 Road network

India has the world's second-largest road network

India's road network spans ~6.3 million km, transporting 64.5% of all goods and accounting for 90% of total passenger traffic in the country. Road transportation has gradually increased over the years with improvement in connectivity between cities, towns and villages. The road network can be divided into the below-mentioned categories.

Table 7: Indian road network

Category	Length (km)	Percentage of total		Connectivity to
		Length	Traffic	
1 National highways	146,114	2%	40%	Union capital, state capitals, major ports, foreign highways
2 State highways	179,535	3%	60%	Major centres within the states, national highways
3 Other roads	6,019,723	95%		Main roads, rural roads, production centres, markets
Total	6,345,372	100%	100%	

Source: MoRTH annual report, Crisil Intelligence

2.3 Logistics and allied highway infrastructure

A network of 35 multi-modal logistics parks planned as part of Bharatmala Pariyojana

In October 2021, the Ministry of Road Transport and Highways (MoRTH) completed the Model Concessionaire Agreement (MCA) for multi-modal logistics parks (MMLPs) under the Bharatmala Pariyojana. As part of the Bharatmala Pariyojana initiative, a network of 35 MMLPs is planned, with an estimated investment of Rs 46,000 crore. Once operational, these parks will have the capacity to handle about 700 million tonnes of cargo, functioning as key hubs for cargo aggregation and distribution in various regions. The MMLPs will provide multi-modal connectivity to industrial and agricultural centres, consumer hubs, and export-import gateways, such as seaports. In some cases, the development of the MMLPs is being coordinated with inland waterway terminals under the Sagarmala Programme to significantly reduce the cost of inland cargo transportation, offering a more efficient alternative to traditional road-based movement.

Table 8: Status of MMLPs that are under development

Sr. no.	MMLP	State	Location	Land (acre)	Investment (Rs crore)	Mode
1	Jogighopa	Assam	Jogighopa	190	694	EPC
2	Chennai	Tamil Nadu	Mappedu	184	1,424	PPP
3	Indore	Madhya Pradesh	Pithampur	255	1,111	PPP
4	Bengaluru	Karnataka	Dabbaspete	400	1,770	PPP
5	Nagpur	Maharashtra	Sindi	231	920	PPP
6	Jalna	Maharashtra	Jalna	63	91	EPC

Source: MoRTH annual report, Crisil Intelligence

Work on the Jogighopa MMLP is in advanced stages. Meanwhile, feasibility study reports are being prepared for MMLPs at Patna, Jammu, Coimbatore and Hyderabad.

2.4 Port network

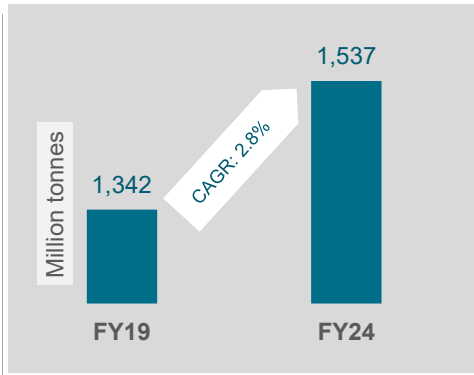
India is the 16th largest maritime country in the world, with a coastline of 7,516.6 km

India's port sector features a balanced capacity distribution between its 12 major ports, with six on the west coast and six on the east coast, highlighting the strategic importance of both coastlines for maritime trade. The west coast, home to key ports such as Mumbai, Jawaharlal Nehru Port and Kochi, handles a significant share of the country's cargo due to its proximity to international shipping routes. These ports are equipped for various cargo types, supporting diverse industries. Similarly, the east coast, with important ports such as Chennai, Visakhapatnam and Kolkata, plays a vital role in trade with Southeast Asia. Government initiatives focus on enhancing infrastructure at these ports to meet growing trade demands. The even distribution of port capacity promotes regional development, reduces congestion and improves hinterland connectivity, benefiting inland industries. The government is committed to modernising port facilities through initiatives such as the Sagarmala Programme to align with global trade dynamics.

India's port traffic is projected to have grown 5-7% in fiscal 2025, following an estimated increase of 7.8% in fiscal 2024. The robust growth in fiscal 2024 was driven by a surge of 37% in iron ore traffic, fuelled by increased exports to China after the withdrawal of export duties in the previous fiscal. In fiscal 2025, India's port traffic growth was driven by container traffic. Despite the ongoing Red Sea crisis and rising shipping costs, container traffic is projected to have grown by 8-10% in fiscal 2025 due to favourable macroeconomic developments, increasing household consumption and benefits of containerisation.

Over FY 26-28, India's port traffic is expected to grow a moderate 2-6%. However, this growth is likely to be tempered by several factors, including a slowdown in the petroleum oil and lubricants (POL) segment owing to reduced crude oil consumption.

Table 9: Indian ports likely to witness sustained traffic growth over FY26-28



Source: Crisil Intelligence

	Growth rate (%)			
	FY20 to FY23	FY24E	FY25F	FY26 to FY28F
Major ports	2.2%	4.5%	2 to 6%	3 to 5%
Minor ports	3.7%	11.5%	6 to 8%	2 to 6%
All ports	3.0%	7.8%	5 to 7%	2 to 6%

Performance of major Indian ports has improved considerably over the last decade

The operational performance of India's major ports has improved significantly over the past decade. Total traffic handled across 13 major ports increased from 555.5 million tonnes in FY14 to 819.3 million tonnes in FY24, reflecting infrastructure upgrades and improved cargo handling capacity. Paradip Port recorded the highest volume at 145.4 million tonnes in FY24, nearly doubling its FY14 throughput. Average turnaround time across all ports declined from 53.8 hours in FY14 to 48.1 hours in FY24, indicating enhanced port efficiency, although certain ports like SMP Kolkata and Mumbai continue to face relatively high turnaround times. The average output per ship berth day also rose sharply from 12,468 tonnes to 18,925 tonnes, driven by ports such as Cochin, Jawaharlal Nehru Port, and Kamarajar, which reported significant productivity gains. These trends underscore the growing capacity utilization and operational optimization of Indian ports, positioning them to support higher trade volumes and logistics demand.

Table 10: Operational performance from FY14-FY24

Major ports in India	Traffic handled (Million Tonnes)		Average Turnaround Time (Hours)		Average output per ship berth day (tonnes)	
	2013-14	2023-24*	2013-14	2023-24*	2013-14	2023-24*
1 Syama Prasad Mookerjee Port (SMP), Kolkata	12.9	16.9	61.9	82.6	3,308	5,365
2 Haldia	28.5	49.5	70.6	50.1	6,130	13,698
3 Paradip	68.0	145.4	52.6	41.6	18,179	33,014
4 Visakhapatnam	58.5	81.1	57.1	65.9	10,928	13,687
5 Chennai	51.1	51.6	39.8	44.9	15,001	18,728
6 V.O. Chidambaranar Tuticorin	28.6	41.4	70.3	51.4	9,633	15,401
7 Cochin	20.9	36.3	27.4	33.4	15,881	25,963
8 New Mangalore	39.4	45.7	46.8	40.4	16,304	19,218
9 Mormugao	11.7	20.6	66.2	65.6	10,525	17,772
10 Jawaharlal Nehru Port	62.4	85.8	41.8	26.0	25,522	28,648

Major ports in India	Traffic handled (Million Tonnes)		Average Turnaround Time (Hours)		Average output per ship berth day (tonnes)	
	2013-14	2023-24*	2013-14	2023-24*	2013-14	2023-24*
11 Mumbai	59.2	67.3	93.4	63.0	9,415	11,152
12 Deendayal (Kandla)	87.0	132.4	69.6	54.2	15,131	18,217
13 Kamarajar (Ennore)	27.3	45.3	2.2	44.4	22,386	27,197
Total	555.5	819.3	53.81**	48.06**	12,468**	18,925**

Note: *Provisional, **Average

Source: Annual report Ministry of ports, shipping & waterways, CRISIL Intelligence

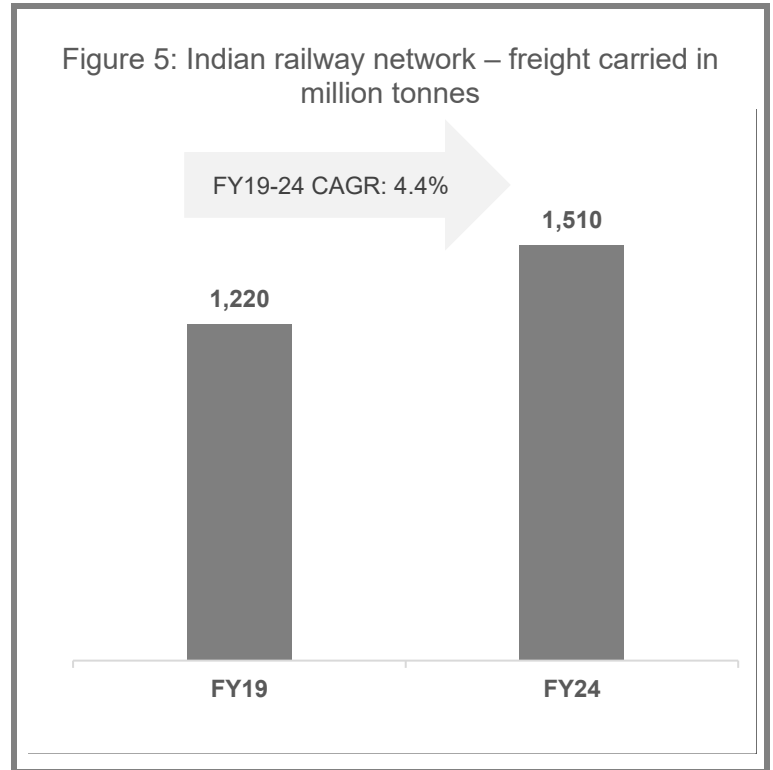
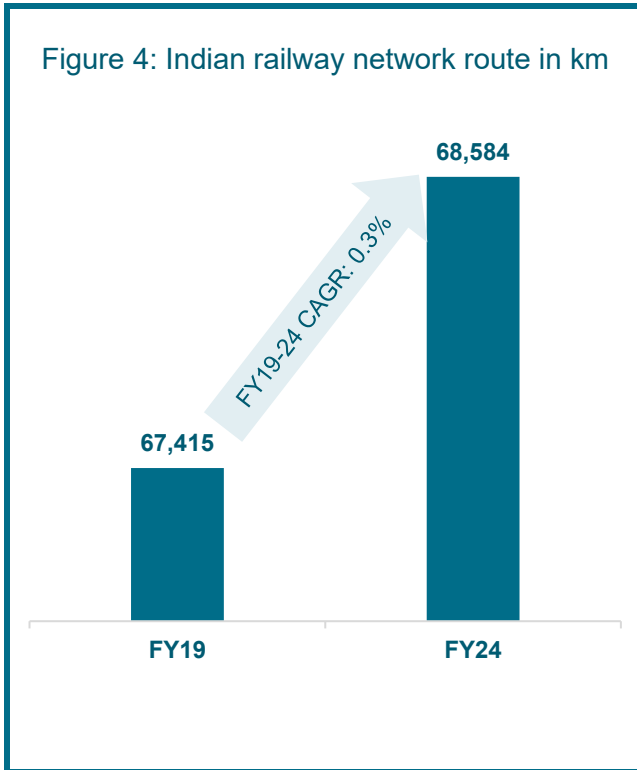
Transporting perishable and processed foods by sea requires meticulous planning to avoid delays. Factors such as port congestion, customs clearance, and shipping schedules must be taken into account to calculate the total lead time. Unforeseen delays can cause stock to expire, emphasizing the need for accurate planning and execution.

2.5 Indian Railways

The fourth-largest network in the world, powering growth and connectivity

According to Economic Survey 2023-24, Indian Railways, with 68,584 route km (as of March 31, 2024) and 125.4 million employees (as of April 1, 2024), is the fourth largest network in the world under single management. The network expanded from ~64,000 route km in fiscal 2010 to 68,454 route km in fiscal 2024. In FY23 and FY24, Indian Railways transported approximately 6,440 million and 6,480 million passengers, as well as 1509 million tonnes and 1500 million tonnes of freight, respectively. Over the past decade, the Indian railway sector has undergone significant transformation, including the expansion of metro rail networks, introduction of high-speed and semi-high-speed trains, and modernisation of railway stations.

In terms of freight carried, the Indian railway network has seen robust growth. It carried ~1,221 million tonnes of freight in fiscal 2019, which increased to 1,512 million tonnes by fiscal 2024, clocking a CAGR of 4.4%.



Source: India rail yearbook

Dedicated freight corridors to help enhance the efficiency of freight transport across the country

India's Dedicated Freight Corridors (DFCs), spearheaded by the Ministry of Railways through the Dedicated Freight Corridor Corporation of India Limited (DFCCIL), represent a transformative initiative aimed at enhancing the efficiency of freight transportation across the country. These corridors, specifically the Eastern and Western DFCs, are designed to facilitate faster and more reliable movement of goods, thereby reducing logistics costs and decongesting existing railway networks. By providing exclusive tracks for freight trains, DFCs enable higher speed operations and increased load capacities, which are crucial for meeting the growing demands of India's economy.

Quantitatively, significant progress has been made in the development of these corridors. As of March 2025, the Eastern Dedicated Freight Corridor (EDFC), stretching from Ludhiana to Sonnagar (1,337 km), and the Western Dedicated Freight Corridor (WDFC), extending from Jawaharlal Nehru Port Terminal (JNPT) to Dadri (1,506 km), have collectively achieved 96.4% operational status, with 2,741 km out of the total 2,843 km commissioned and operational. In October 2024 alone, the EDFC facilitated 5,915 train runs, covering 11,088 million gross tonne-kilometers (GTKM) at an average speed of 44.6 km/h, while the WDFC handled 5,109 train runs, covering 5,643 million GTKM at an average speed of 51.3 km/h. These figures underscore the substantial enhancement in freight capacity and efficiency brought about by the DFCs, contributing significantly to the modernization of India's freight transportation infrastructure.

2.6 Airport freight traffic

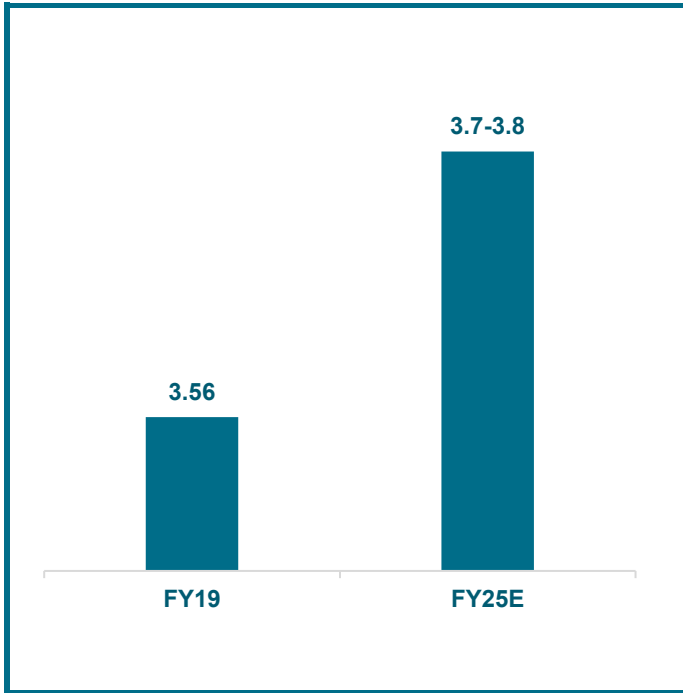
Airport freight traffic estimated to have surpassed FY19 levels in FY25

For fiscal 2025, total freight traffic at Indian airports is estimated to have risen by 11-13% to 3.7 - 3.8 million tonnes, surpassing pre-Covid levels of FY19. Reasons for the high growth in FY25 include:

- International freight traffic seen growing faster than domestic on account of shipping constraints and a booming e-commerce sector among the strongest growth drivers.

- To boost share of Indian carriers in international cargo, DGCA has limited non-scheduled cargo flights by foreign carriers to six airports and not allowing international carriers to operate domestic only cargo legs within India.

Figure 6: Indian airport freight in '000 tonnes

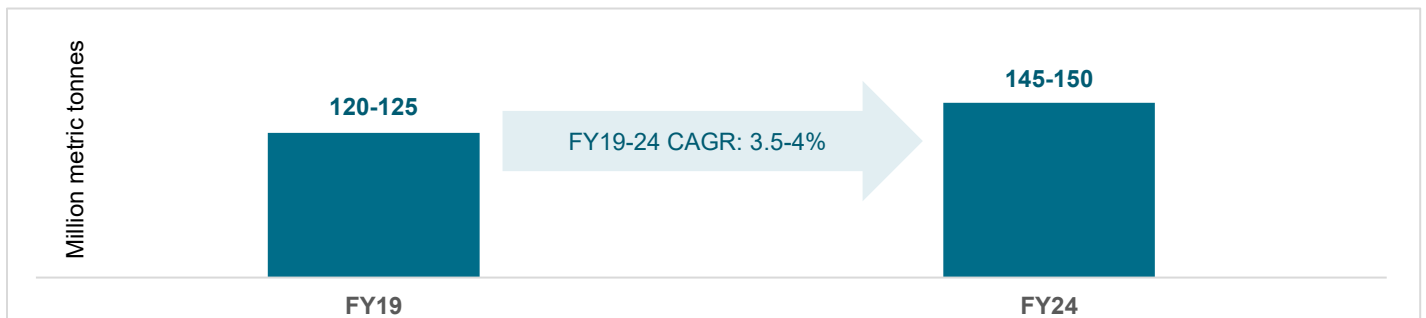


Source: AAI, Crisil Intelligence

2.7 Agricultural warehousing storage

Agricultural warehousing demand in India increased to 145-150 million metric tonnes in fiscal 2024 from 120-125 million metric tonnes in fiscal 2019, clocking a CAGR of 3.5-4%. Demand has been rising on the back of increasing agricultural production, government initiatives and infrastructure development. Growth in warehousing demand was slightly slower in fiscal 2024 due to production of key crops being below optimal levels, resulting from a poor monsoon season caused by the El Nino weather phenomenon.

Figure 7: Agricultural warehousing storage capacity



Source: Ministry of Agriculture and Farmers' Welfare (MoAFW), Crisil Intelligence

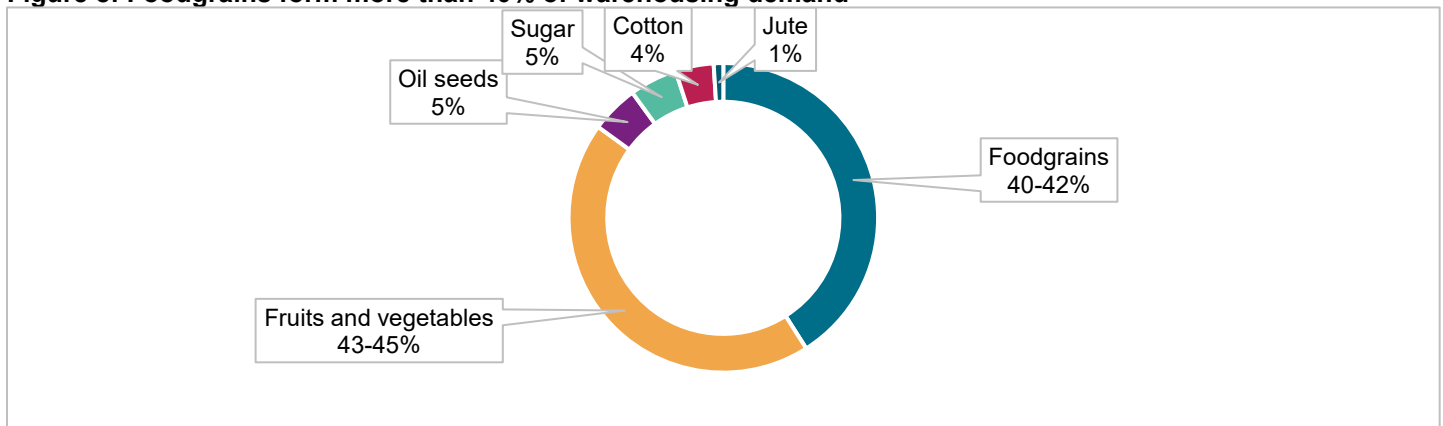
Foodgrains form the bulk of agricultural warehousing demand

Rice and wheat constitute over 75% of the total foodgrain production, accounting for the majority of foodgrains stored. Uttar Pradesh and Punjab lead in rice and wheat production, respectively. Accordingly, both these states top the warehousing capacity of the Food Corporation of India (FCI) and state warehousing corporations (SWCs), together.

The FCI on average stores 35-40% more than its storage capacity. Foodgrains procured by the FCI are at risk of damage/loss due to manual handling and unscientific storage facilities.

Though foodgrains, fruits and vegetables account for 45-50% of the total agricultural production, demand for warehousing facilities is higher for foodgrains due to a longer shelf life (6-12 months) and seasonality.

Figure 8: Foodgrains form more than 40% of warehousing demand



Source: MoAFW, National Horticulture Board, Crisil Intelligence

2.8 Cold storage sector in India

India's cold storage sector plays a crucial role in maintaining the freshness of perishable goods such as fruits, vegetables, dairy, meat and pharmaceuticals. It comprises two primary components: temperature-controlled warehousing (TCW) and temperature-controlled vehicles (TCVs).

TCW refers to facilities where products are stored at specific temperatures to prolong their shelf life and prevent spoilage. These warehouses are equipped with modern refrigeration technology to cater to varying temperature needs, ranging from deep-freeze for seafood and meat to chilled environments for fruits and vegetables.

TCVs ensure safe transportation of these perishable goods from farms or factories to retail outlets or distribution centres, while maintaining the required temperature throughout the journey. These vehicles are designed with insulated bodies and advanced refrigeration systems to prevent temperature fluctuations, preserving product quality during transit.

Together, TCW and TCV form the backbone of India's cold chain infrastructure, reducing post-harvest losses, improving food security and supporting industries relying on temperature-sensitive products.

Cold storage sector to see strong growth over the next five fiscals

We estimate the combined TCW and TCV market value at ~Rs 42,600 crore in fiscal 2024, logging a 5-6% CAGR between FY20 and FY24. Multi-purpose storage leads TCW with the highest share in value terms due to consistent demand in meat, seafood, fruits and vegetables, pharma and e-commerce storage. We estimate the TCW market value at ~Rs 37,200 crore in fiscal 2024 and the TCV market at ~Rs 5,400 crore.

Despite lower production, demand for potato cold storage increased 3-4% in fiscal 2024, driven by capacity availability at right locations. Capacity for potato cold storage is expected have remained flat in fiscal 2025, with current utilisation at 85-90%. Demand is expected to increase at a 1-3% CAGR over the next three years, remaining vulnerable to lower prices and returns on investment.

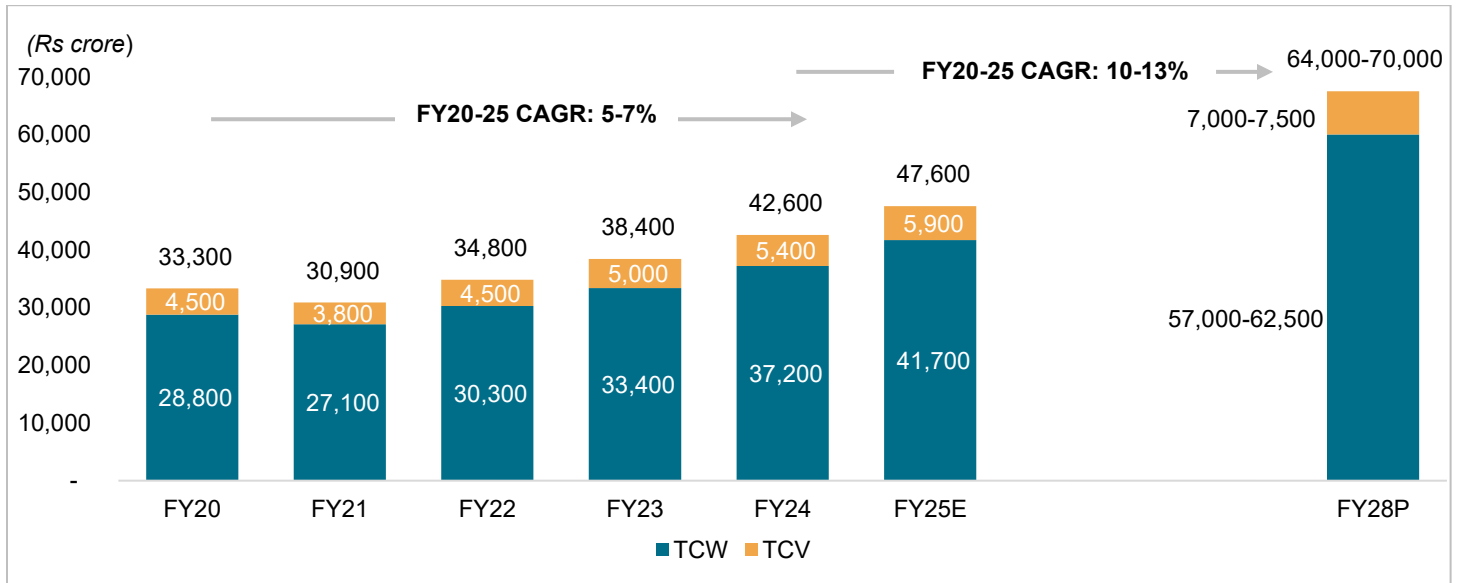
High wastage rates across commodities continue to drive demand for cold storage. Crisil expects the cold storage market to log an 10-13% CAGR over the next four fiscals, reaching Rs 66,000-69,000 crore by fiscal 2028.

Figure 9: TCW constitutes almost 90% of the cold storage market



Source: Crisil Intelligence

Figure 10: Review of India's cold storage market



Note: E – estimated; P – projected

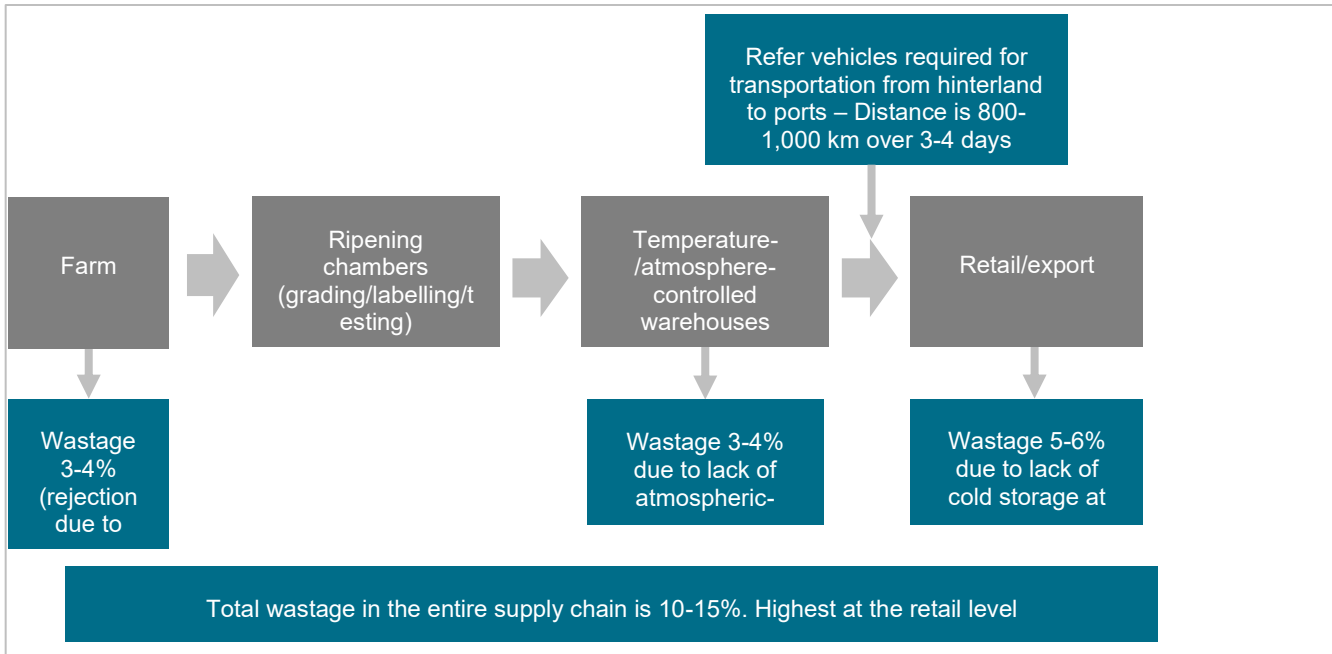
Source: Crisil Intelligence

TCV demand to rise going forward, driven by key segments

We expect demand for TCVs to increase at a 6-8% CAGR over FY24-FY28, exceeding the previous four-year CAGR, despite an anticipated 2-3% price increase.

Domestic demand for goods remains sluggish, contrasting with a surge in demand for temperature-controlled transportation of export commodities. This is a result of the end consumer's reluctance to foot the additional bill for the temperature-controlled transportation. For short distances of up to 300 km, other mechanisms, such as ice bags, are used to maintain temperature.

Figure 11: 10-15% fruits and vegetables are lost due to lack of cold storage



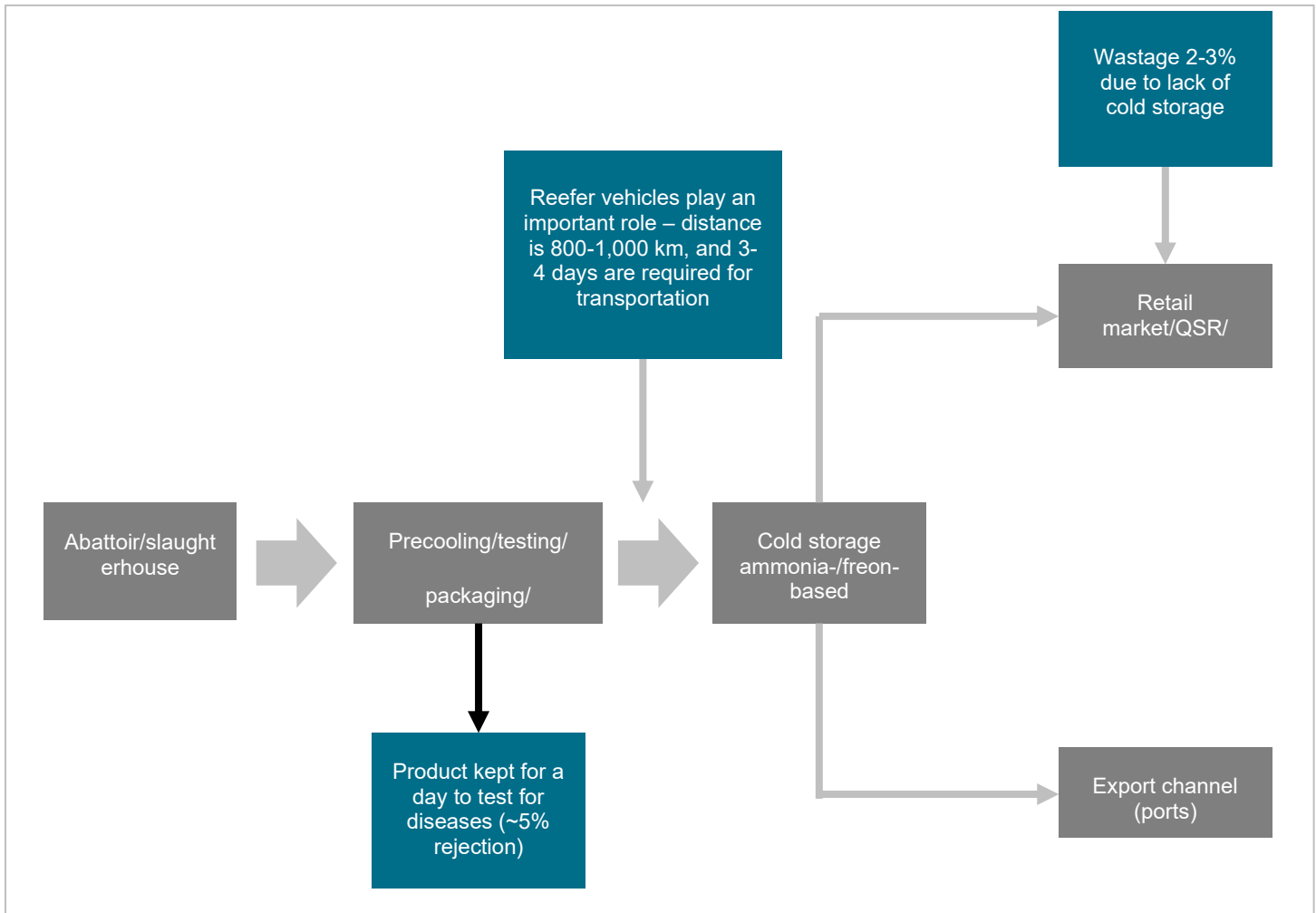
Source: MoFPI, Crisil Intelligence

Significant losses occur in the fruits and vegetables supply chain due to inadequate cold storage and handling facilities, leading to a total wastage of 10-15%. At the farm level, 3-4% of the produce is rejected due to poor quality. After harvest, fruits and vegetables are sent to ripening chambers for grading, labelling and testing for diseases or chemicals. The next critical stage is temperature- or atmospheric-controlled warehouses where another 3-4% of the produce is lost due to insufficient storage facilities.

From here, the produce is transported using reefer vehicles, carrying it over long distances (800-1,000 km) for 3-4 days, to retail outlets or ports for export. At the retail and export levels, the lack of cold storage contributes to the highest losses, with 5-6% of the produce wasted. The overall inefficiencies in maintaining optimal temperatures across the supply chain result in substantial wastage, underlining the need for improved cold chain infrastructure to preserve the quality of perishable goods.

An industry which operates on thin margins, 10-15% wastage has large impact on profitability and survival of small entities which may see higher wastages.

Figure 12: Meat and seafood see 7-8% wastage due to lack of cold storage



Source: Crisil Intelligence

The flowchart above illustrates the cold chain process crucial for maintaining the quality and safety of meat and seafood products. It begins at the abattoir or slaughterhouse, where meat is initially processed. Seafood follows a similar path after being harvested. The products then go through precooling, testing for contamination or disease, packaging, grading and labelling. This step ensures only safe and high-quality products move forward, though ~5% may be rejected during testing. Next, the meat and seafood are stored in cold storage facilities, typically using ammonia- or freon-based refrigeration systems, to maintain the low temperatures required to preserve freshness. Reefer vehicles are essential for transporting products over long distances (800-1,000 km over 3-4 days). During this period, it is critical that temperatures of 2-8°C are consistently maintained to prevent spoilage and ensure safety.

After transportation, the products are either sent to retail markets or corporate buyers. However, the lack of an adequate cold storage facility at this stage can result in a 2-3% wastage of goods. Alternatively, the meat and seafood may be routed through export channels to international markets via ports. Throughout the supply chain, maintaining cold temperatures through reefer vehicles and storage facilities is key to reducing spoilage and ensuring the meat and seafood remain safe for consumption.

3. Investments in infrastructure segments support growth of the food processing sector

Estimated investment of Rs 31-32 lakh crore between FY19 and FY24 in select infrastructure segments supporting the food processing sector

Investments in infrastructure segments, such as cold chain logistics, storage facilities, and transportation networks, are crucial for the growth and development of the food processing sector in India. A well-developed infrastructure enables the efficient transportation of raw materials and finished goods, reduces post-harvest losses, and increases the shelf life of perishable products. Moreover, modern infrastructure facilities, such as cold storage and warehousing, can help to maintain the quality of food products, thereby enhancing their export potential and competitiveness in the global market.

The table below outlines the estimated investment in various core sectors and key identified sectors with major gaps in India over FY19-FY24 and FY25-FY47. The total estimated investment for the core sectors (roads, railways and ports) and the key identified sectors is Rs 31-32 lakh crore over FY19-FY24, with an average annual investment of Rs 3-4 lakh crore.

Table 11: Investments in key infrastructure sectors related to food processing

Key infrastructure sectors for food processing	Investment made in FY19-24 in INR crores		Investment needed in FY25-47 in INR crores	
	Total	Average yearly investment	Total	Average yearly investment for FY25-30
Core sectors				
Roads	17,50,000 to 18,00,000	~3,00,000	165,00,000 to 175,00,000	5,00,000 to 5,30,000
Railways	11,50,000 to 12,00,000	~2,00,000	100,00,000 to 110,00,000	3,00,000 to 3,20,000
Ports	55,000 to 6,00,000	9,000 to 10,000	6,30,000 to 6,50,000	19,000 to 21,000
Identified sectors with major gaps				
Cold chain warehousing	3,800 to 4,300	650 to 700	1,15,000 to 1,20,000	2,500 to 2,800
Reefer vehicles	2,800 to 3,300	500 to 550	17,500 to 19,500	620 to 670
Rural roads connectivity	1,40,000 to 1,50,000	21,000 to 23,000*	5,50,000 to 6,50,000	21,000 to 23,000

Key infrastructure sectors for food processing	Investment made in FY19-24 in INR crores		Investment needed in FY25-47 in INR crores	
	Total	Average yearly investment	Total	Average yearly investment for FY25-30
Agricultural warehousing	6,500 to 7,000	1,000 to 1,200	50,000 to 55,000	1,300 to 1,400
Total	31,00,000 to 32,00,000		280,00,000 to 300,00,000	

Note: *FY22 investment in rural roads was an outlier, and has been excluded for average annual investment calculation

Source: Crisil Intelligence

Projected investment of Rs 280-300 lakh crore between FY25 and FY47 in select infrastructure segments supporting the food processing sector

The total projected investment for the longer term (FY25-FY47) is Rs 280-300 lakh crore.

- Roads:** The roads sector received an investment of Rs 17.5-18 lakh crore between **FY19-FY24**, driven by large-scale highway expansion, improved rural connectivity, and the implementation of projects under Bharatmala programme, the National Infrastructure Pipeline and past awarded contracts. The investment between FY25-FY47 is expected to be **Rs 165-175 lakh crore**, fuelled by expressway expansions, multimodal logistics parks and the adoption of smart highway technologies. With increasing urbanisation and freight demand, future investments will focus on electric vehicle-compatible highways, sustainable road materials and AI-based traffic management.
- Railways:** Indian Railways received an investment of Rs 11.5-12 lakh crore between FY19-FY24, supported by network modernisation, electrification and the launch of semi-high-speed trains such as Vande Bharat. Despite these efforts, ageing infrastructure, capacity bottlenecks and slow private sector participation have restrained growth. **Investment is projected at Rs 100-110 lakh crore between FY25-FY47**, with major capital flowing into high-speed rail projects, dedicated freight corridors and AI-driven scheduling for improved operational efficiency. Increased private sector involvement will drive further modernisation and competitiveness.
- Ports:** About **Rs 0.55-0.6 lakh crore was invested in the sector over FY19-FY24**, primarily focusing on port modernisation, private sector participation and container traffic. However, issues such as inadequate hinterland connectivity and congestion at major ports have limited expansion. **Investment is projected at Rs 6.3-6.5 lakh crore between FY25-FY47**, driven by automation, deep-water port development and seamless multimodal logistics integration. Enhanced port capacity and digitalisation will be critical for meeting India's growing trade demand.
- Cold chain warehousing:** The sector received **Rs 4,300 crore between FY19-FY24** in investment, largely driven by government subsidies, rising demand for perishable goods storage and growing organised retail. However, high operational costs, lack of uniform distribution and infrastructure inefficiencies have constrained large-scale development. We project an investment of **Rs 1.15-1.2 lakh crore between FY25-FY47**, with major drivers being food security concerns and demand for advanced temperature-controlled storage solutions to reduce post-harvest losses.
- Reefer vehicles:** The segment received an investment of Rs 2,800-3,300 crore between FY19-FY24, driven by rising demand in the pharmaceutical, dairy and fresh produce sectors. However, high vehicle costs, inconsistent cold chain infrastructure and fuel price volatility have restricted growth. Investment is forecast at **Rs 17,500-19,500 crore between FY25-FY47**, supported by stricter food safety regulations, increased frozen food consumption and the shift

towards electric and fuel-efficient reefer trucks. Advancements in refrigeration technology will further enhance efficiency in perishable goods transport.

- 6. Rural road connectivity:** Investments in the sector ranged from Rs 1.4 lakh crore to Rs 1.5 lakh crore between **FY19-FY24**, driven by government initiatives such as the Pradhan Mantri Gram Sadak Yojana (PMGSY) and the need for better access to markets, healthcare and education. However, funding gaps, maintenance issues and seasonal disruptions have slowed progress. Investment is projected to be Rs 5.5-6.5 lakh crore **between FY25-FY47**, focusing on all-weather roads, improved surface quality and digital connectivity for rural areas. Strengthening these road networks will play a crucial role in enhancing rural economies and integrating them with national markets.
- 7. Agricultural warehousing:** The sector received **Rs 6,500-7,000 crore** in investment **between FY19-FY24**, driven by the need to enhance grain storage, reduce post-harvest losses and boost private-sector participation. Despite substantial investments, ageing infrastructure, limited rural storage facilities and inefficient supply chains continue to hamper scalability. Investment is projected at **Rs 50,000-55,000 crore between FY25-FY47**, with key focus areas including mechanised warehousing, blockchain-based inventory management and strengthening rural storage networks. These developments will enhance supply-chain efficiency and reduce wastage across agricultural value chains.

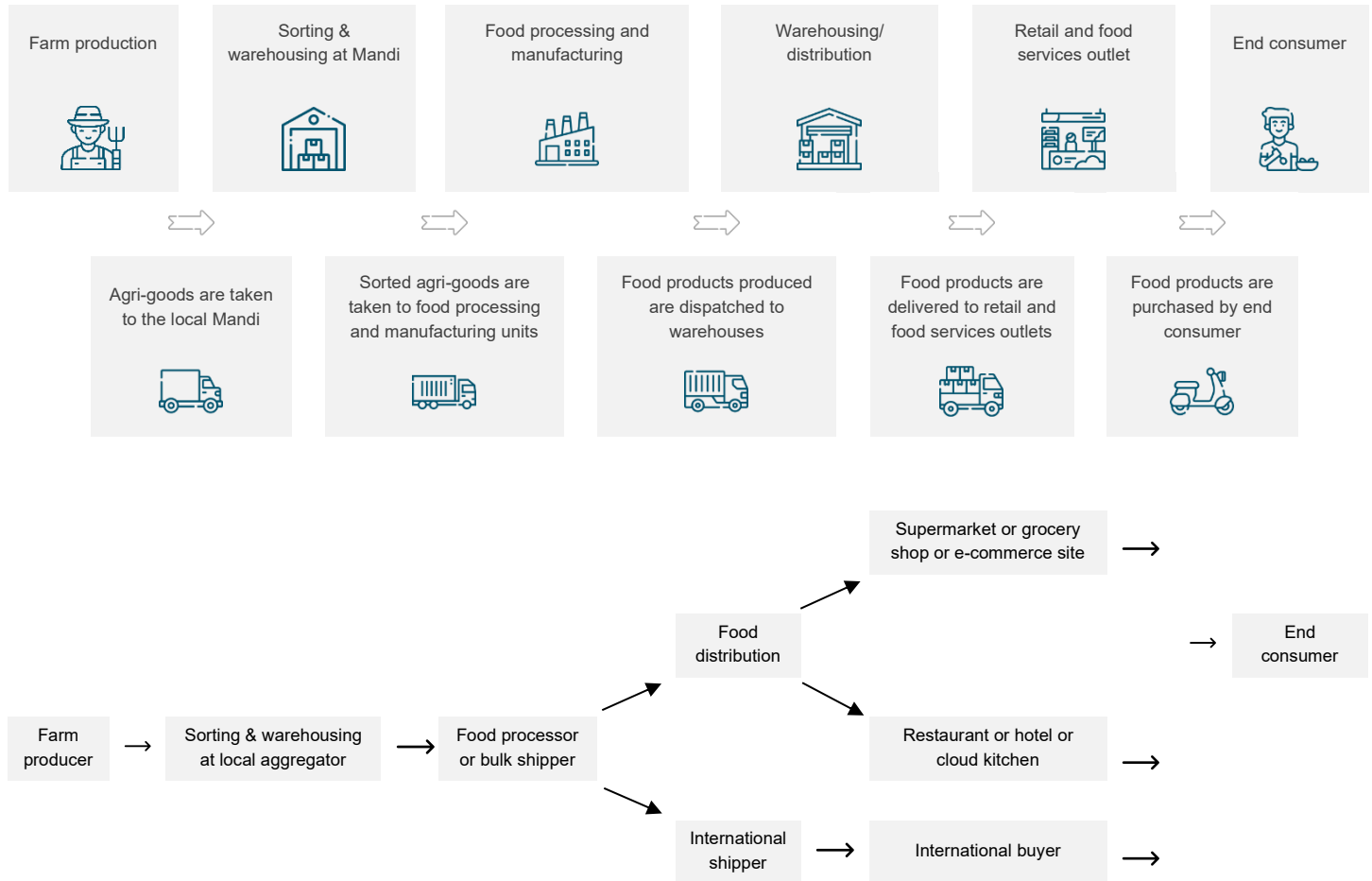
4. Assessment of supply chain integration for transportation & storage across food categories by shelf life

4.1 Overview of the general food processing supply chain

The food processing value chain in India begins at the farm production stage, where agricultural goods are harvested and transported to local mandis (markets) for initial sorting and warehousing. This stage is critical for aggregating produce from various farms. The sorted produce is then purchased by food processors or bulk shippers, who handle the next phase — food processing and manufacturing. Here, the agri-goods undergo various processes to convert them into consumer-ready or semi-processed products. These are then stored and moved to cold chains or warehouses, preserving quality and extending shelf life.

From warehousing, goods are sent through a robust distribution network that delivers to retail stores, quick commerce platforms, and food service outlets like restaurants and cloud kitchens. The supply chain also includes international shippers and buyers, catering to export demand. Ultimately, products reach the end-consumer, completing a complex but efficient farm-to-fork journey. This integrated chain ensures food safety, quality, and accessibility, while also enhancing value for stakeholders across the ecosystem — from farm growers to retailers and consumers.

Figure 13: Food processing industry supply chain



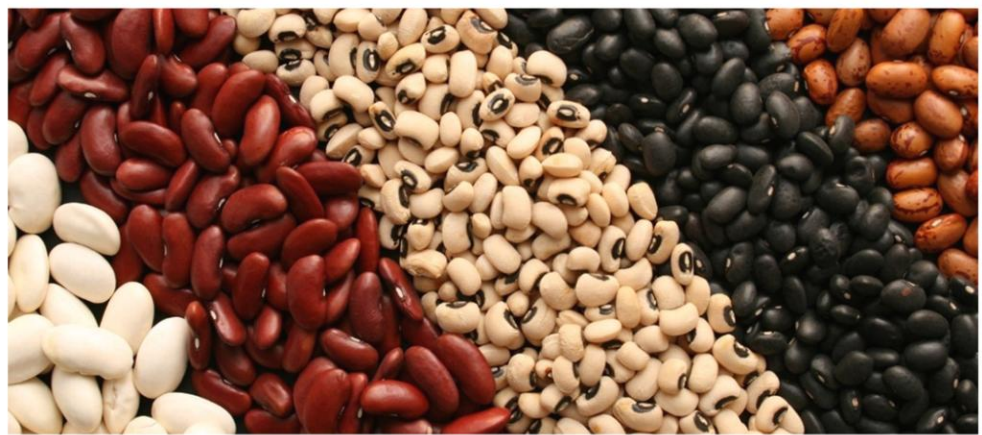
Source: Crisil Intelligence

4.2 Category-wise overview of infrastructure and logistics supply chain

Food processing in India requires a robust infrastructure and logistics value chain to ensure safe and efficient transportation of raw materials and finished goods. India's infrastructure and logistics landscape is characterised by a complex network of roads, railways, ports and warehouses that play a crucial role in supporting the food processing industry. Given below are the brief infrastructure and logistics value chains of select categories, along with key insights gathered from primary sources.

Grains and pulses

In terms of production, India ranks second in rice and wheat and first in pulses in the world.



India is a major producer of rice, wheat and pulses. In terms of production, Total rice production in India is estimated at 137.825 million metric tonnes (MT) in fiscal 2024, wheat at a record 113.292 million MT and millets at 17.572 million MT. India is the largest producer of millets in the world, with a 20% share in global production as of fiscal 2022 — Barnyard (99.9% production share), finger millet (53.3%), Kodo millet (100%), little millet (100%) and pearl millet (44.5%).

Figure 14: Infrastructure and logistics value chain for grains and pulses



Source: Crisil Intelligence

- **Cultivation and harvesting:** Grains and pulses are cultivated and harvested using suitable techniques and best practices. Once harvested, the produce is typically stored in on-farm storage facilities or rural warehouses to maintain quality and prevent losses. Rural markets and mandis provide infrastructure for selling the produce. The e-National Agriculture Market (e-NAM) platform facilitates trading between farmers and processors across regions

- **Primary processing and storage:** Grains and pulses are transported to wholesale markets, known as mandis. These grains and pulses undergo the primary process of sorting and grading either at the farm or at the mandi or at a processing facility of a private player. After this, they are auctioned and sold to traders, processors and exporters. Then the produce is stored in warehouses, which prevents spoilage and enables inventory management
- **Milling facility:** The milling stage is a critical component of the value chain, where grains and pulses are transformed into various products, such as flour, oil and pulses. Milling units benefit from their proximity to mandis and freight terminals to source grains and deliver processed products to packaging units
- **Packaging and distribution:** Processed grains and pulses are distributed through air cargo terminals, rail or trucks, depending on demand, ensuring timely delivery

Other key insights

Automated warehouse management systems are more efficient for inventory control and distribution.

Grain processing player, West Bengal

Fruits and vegetables

India ranks second in fruit and vegetable production in the world, after China.



India's diverse climate ensures the availability of all varieties of fresh fruits and vegetables. As per the National Horticulture Database (second advance estimates) published by the National Horticulture Board, in fiscal 2024, India produced 112.6 million MT of fruits and 204.9 million MT of vegetables.

Processing vegetables mainly involves freezing and packaging to increase shelf life and preserve nutrient value. Individual quick freezing is a crucial process while freezing vegetables and some fruits. The process involves rapidly freezing individual pieces of vegetables, such as peas, carrot or broccoli, to a temperature of -30°C to -40°C . This process helps preserve nutrients, texture and flavours. In some cases, vegetable processing also involves retorting, which is sterilising the product to increase its shelf life under ambient temperature conditions.

Figure 15: Infrastructure and logistics value chain for fruits and vegetables



Source: Crisil Intelligence

- **Aggregation and collection:** Rural markets and mandis serve as initial aggregation points for the harvested produce. Farmers utilise e-NAM for direct trading with buyers. After harvest, the produce is transported to warehouses or pack houses equipped with grading and pre-cooling facilities
- **Transportation:** Refrigerated trucks and railway goods sheds are critical for transporting perishable produce to cold storage facilities or processing units
- **Pack houses:** Pack houses located near private freight terminals facilitate sorting and packaging for export or regional distribution
- **Cold storage:** Cold storage units near inland container depots (ICDs) and air cargo terminals extend shelf life and preserve quality for export markets
- **Processing units:** Processed products (juices, purees) are transported to retail outlets or exporters using freight terminals and air cargo infrastructure
- **Distribution:** Efficient supply chains involving warehouses, cold storage and air cargo terminals ensure timely delivery

Other key insights

While cold chain logistics have seen progress over the years, there is still a scope for improvement. Investment in temperature-controlled transport and storage is critical.

Warehousing, logistics & cold chain player, West Bengal

Dairy

India ranks first in milk production, contributing 25% to the world's total milk output.



India's prominence in the dairy sector is national and global. India's dairy sector has witnessed strong growth over the past decade, with milk production increasing from 187.3 million MT in fiscal 2019 to 239.3 million MT in fiscal 2024, logging a CAGR of 5%.

The most critical process in dairy is pasteurisation. It is a heat treatment process that involves heating milk or dairy products to a high temperature for a short period, followed by rapid cooling, to kill off pathogenic bacteria and extend the shelf life of the product.

Figure 16: Infrastructure and logistics value chain for dairy products



Source: Crisil Intelligence

- **Milk collection:** Milk is produced by millions of small and marginal dairy farmers, which is then collected by dairy cooperatives, private companies or individual traders, who transport it to chilling centres or processing plants. Further, rural markets, mandis and e-NAM help streamline milk collection from dairy farmers. Refrigerated transport connects collection centres to processing units
- **Pasteurisation and processing:** Processing facilities located near railway goods sheds or private freight terminals ensure efficient inbound logistics for raw milk and outbound distribution of processed dairy products

- **Packaging and cold storage:** Cold storage warehouses located at ICDs and private freight terminals maintain product quality for long-distance transport. Air cargo terminals facilitate exports
- **Distribution:** The distribution of dairy products in India is complex and multi-layered, involving a range of stakeholders, including wholesalers, retailers and distributors. Distribution relies on cold chain infrastructure and road transport for export or delivery to urban markets, ensuring freshness

Other key insights

In dairy and other perishable food product categories, the cost of cold chain logistics is very high, and the present vehicles are not capable to transport the raw materials beyond a certain range. Hence, we have to keep our processing unit within that range.

Dairy processing player, West Bengal

Ready-to-eat/ Ready-to-cook

India emerged as a significant exporter of French fries in fiscal 2024, with total exports reaching 135,877 tonnes.



The ready-to-eat (RTE) and ready-to-cook (RTC) category in India has seen significant (double-digit) growth over the past few years, driven by increasing urbanisation, growing per capita income and shifting consumer preference towards convenience foods.

This category requires extensive processing. Considering the production of potato chips, slicing and blanching are the critical processes. Slicing is critical for the shape of the chips. Blanching involves briefly submerging sliced potatoes in hot water or steam to remove excess starch, which makes chips crispy.

Figure 17: Infrastructure and logistics value chain for RTE and RTC products



Source: Crisil Intelligence

- **Ingredient procurement:** Mandis, rural markets and ICDs facilitate sourcing and aggregation of raw materials such as vegetables and spices
- **Processing facility:** Processing hubs near cold storages and transport terminals reduce transit time, ensuring operational efficiency
- **Packaging facility:** Proximity to packaging units with Modified Atmosphere Packaging (MAP) systems near freight hubs extends the shelf life of products meant for domestic and export markets
- **Distribution:** Warehouses, freight terminals and air cargo allow for rapid distribution to markets across India and the world

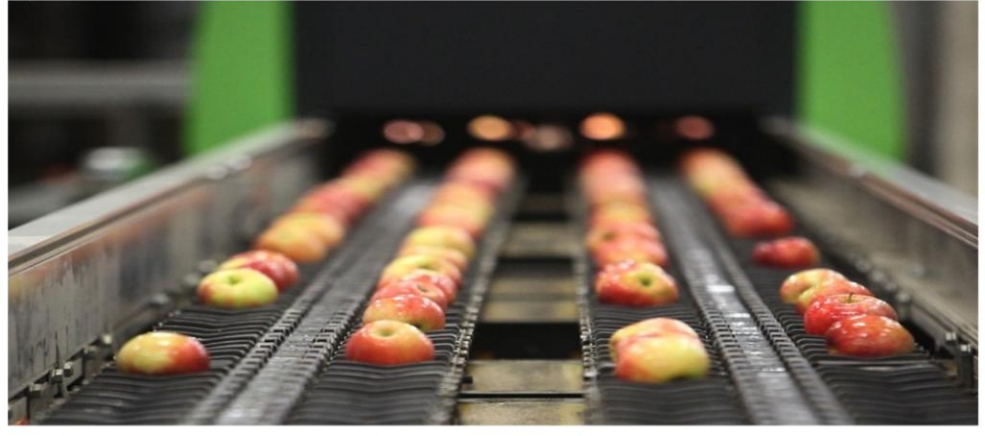
Other key insights

Earlier so many reefer trucks were not available. Now, at least, we have them available for tier 1 cities at convenience.

Ready-to-eat/ ready-to-cook manufacturer, Maharashtra

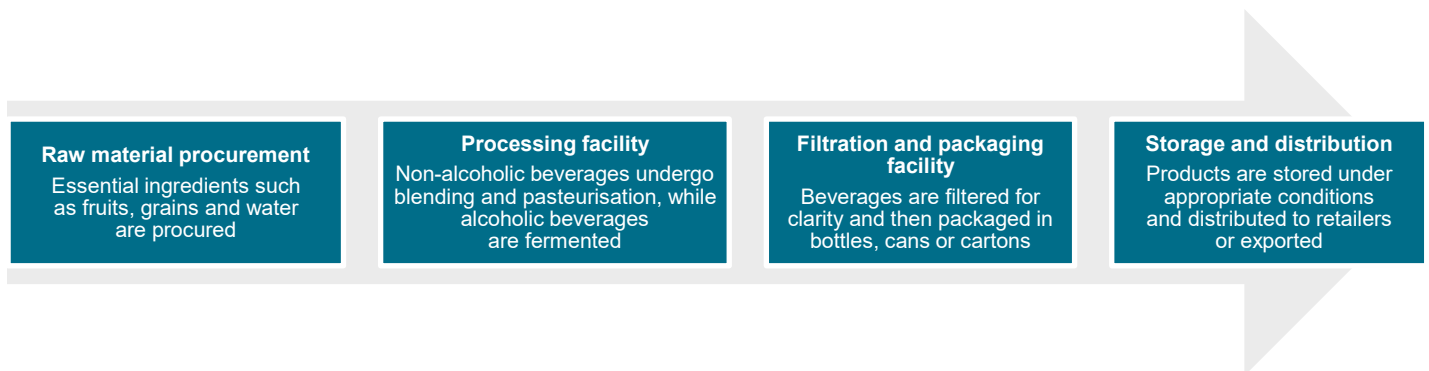
Beverages

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



Manufacturers of beverages are introducing innovative flavours and packaging to cater to diverse consumer preferences.

Figure 18: Infrastructure and logistics value chain for beverages (alcoholic and non-alcoholic)



Source: Crisil Intelligence

- **Raw material procurement:** Mandis, eNAM (National Agriculture Market) platforms and rural markets provide access to raw materials such as fruits and grains, supported by local storage facilities
- **Processing facility:** Beverage units near ICDs and private freight terminals ensure streamlined operations and cost-effective export logistics
- **Filtration and packaging facility:** Filtration units near freight hubs and air cargo terminals allow timely shipment of finished goods
- **Storage and distribution:** Warehouses and cold storage chains enable safe storage and distribution to retail and export markets

Other key insights

While cold chain logistics are not essential for all the varieties of tea products, they play a crucial role in the transportation of flavoured tea and ready-to-drink tea products. Improvements in this sector will enable better product preservation during distribution.

Beverage manufacturer, Maharashtra

Setting up a food processing business, even in food parks, is a challenge for new entrants. There are a lot of permissions required such as town planning, MPCB, factory permission, labour permission, FSSAI, GST, fire, etc. It should ideally be done via a single channel to make it easier for new entrants.

Beverage manufacturer, Maharashtra

Meat processing

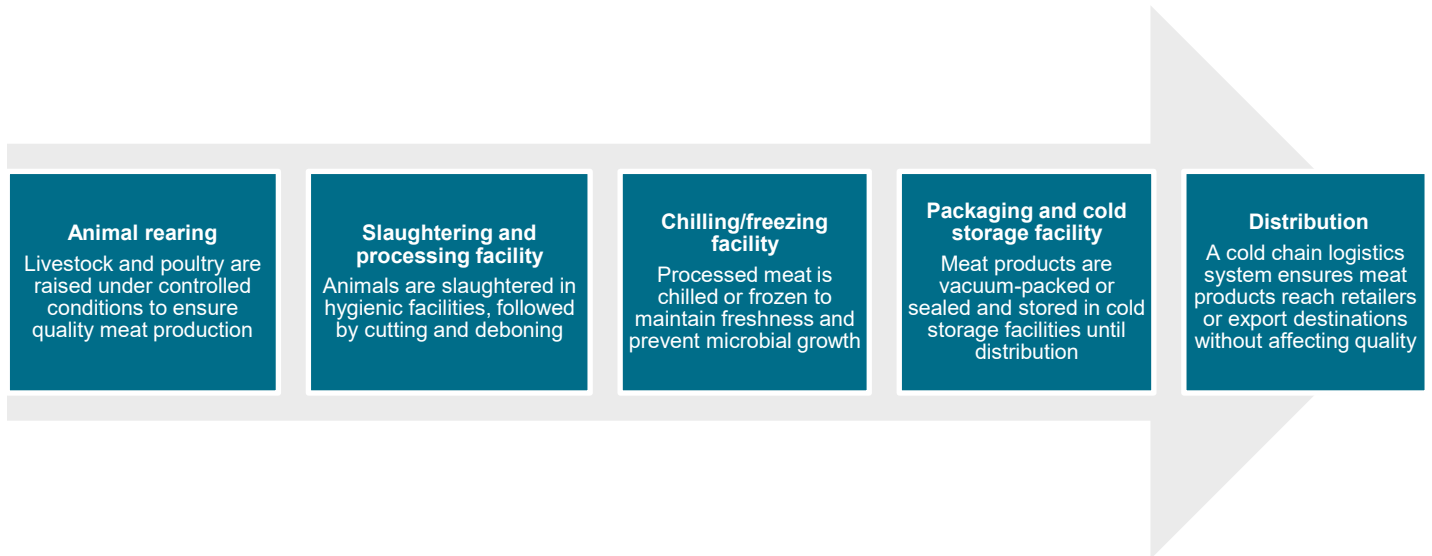
India ranks second in egg production as per the Food and Agriculture Organisation Corporate Statistical Database production data 2021.



According to the Food and Agriculture Organisation Corporate Statistical Database for 2021, India ranks fifth in meat production globally. Egg production in the country has increased from 78,480 million numbers in fiscal 2015 to 138,380 million in fiscal 2023, growing at 7.35% CAGR over the past nine years. The per capita availability of eggs has increased from 62 to 101 in the period. Meat production has increased from 6.69 million tonnes to 9.77 million tonnes.

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

Figure 19: Infrastructure and logistics value chain for meat and poultry



Source: Crisil Intelligence

- **Animal rearing:** Livestock markets (mandis) and rural markets are essential for sourcing animals. Transportation infrastructure, such as refrigerated vehicles, connects farms to processing units
- **Slaughtering and processing:** Facilities near railway goods sheds and private freight terminals streamline input supply and export logistics
- **Chilling/freezing facility:** Cold storage warehouses and air cargo infrastructure ensure the quality of processed meat for domestic and international markets
- **Packaging and cold storage:** Export-ready meat is stored in cold chain facilities near ICDs or air cargo terminals for faster international shipment
- **Distribution:** Private freight terminals, trucks and air cargo terminals facilitate efficient domestic and international distribution of meat products

Other key insights

Logistics infrastructure has improved with the development of dedicated cold storage facilities, better roads, and the expansion of national highways.

Meat processing player, Maharashtra

Seafood/ fisheries and marine products

India is the world's second-largest fish producer, accounting for 8% of the global output.



The fisheries and aquaculture sector plays a critical role in India's economy, providing livelihood to ~3 crore fishers and fish farmers while generating significant employment opportunities across the value chain. India ranks second in aquaculture production and leads in shrimp production and export. It is one of the largest producers in capture fisheries.

Since 2015, the Indian government has committed investment worth Rs 38,572 crore through key initiatives such as the Blue Revolution Scheme, Fisheries and Aquaculture Infrastructure Development Fund (FIDF), Pradhan Mantri Matsya Sampada Yojana (PMMSY), and its sub-scheme, Pradhan Mantri Matsya Kisan Samridhi Sah-Yojana (PM-MKSSY), to drive sustainable growth and development in the sector.

Figure 20: Infrastructure and logistics value chain for seafood, fisheries/marine products



Source: Crisil Intelligence

- **Fishing/ aquaculture:** Rural markets and coastal ports act as primary collection points for seafood. Ice plants and storage facilities ensure catch preservation during transit to sorting facilities
- **Sorting and grading:** Proximity to railway goods sheds and ICDs ensure efficient movement of graded seafood to processing units or export hubs
- **Primary processing facility:** Processing units near private freight terminals and coastal cities streamline operations, ensuring freshness
- **Chilling/freezing facility:** Cold storage facilities near air cargo terminals and ICDs enable quality preservation for exports
- **Cold storage and distribution:** Cold chains, air cargo terminals and freight terminals ensure seamless domestic and international distribution

Other key insights

There has been gradual improvement in refrigerated storage and transportation infrastructure, particularly in metropolitan regions and key highways.

Seafood processing player, Andhra Pradesh

Health food/ functional food

The health and functional food market in India is a rapidly growing segment.



The health and functional food market in India is driven by increasing consumer awareness about health and wellness, changing lifestyles and rising disposable incomes. The segment can be broadly categorised into the following:

- **Organic foods:** Includes organic fruits, vegetables, grains, pulses and processed foods
- **Functional foods:** Includes foods with added health benefits, such as probiotics, prebiotics, omega-3 fatty acids and antioxidants

- **Nutraceuticals:** Includes dietary supplements such as vitamins, minerals and herbal extracts
- **Specialty foods:** Includes gluten-free, lactose-free and other specialty foods catering to specific dietary needs
- **Healthy snacks:** Includes baked snacks, energy bars and other healthy snack options

Figure 21: Infrastructure and logistics value chain for healthy foods (indicative)



Source: Crisil Intelligence

- **Raw material sourcing:** Mandis and eNAM platforms provide access to organic produce. Warehouses in agricultural belts enable bulk procurement and storage
- **Processing facility:** Facilities located within food parks leverage logistics hubs for efficient movement of raw materials
- **Packaging and storage facility:** Warehouses equipped with eco-friendly and controlled-atmosphere systems ensure product quality before distribution
- **Distribution:** Efficient connections to urban centres via private freight terminals and air cargo terminals ensure timely delivery

Other key insights

The adoption of IoT-enabled cold chain monitoring, automated warehouses, and AI-powered route optimization has helped improve efficiency in logistics and warehousing.

Healthy/ functional food manufacturer, West Bengal

Bakery

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 or in the overall bakery industry. Baking gives biscuits their characteristic texture and structure, including crispiness, crunchiness and chewiness. It helps develop the flavour of the biscuits, along with colour and appearance.

Figure 22: Infrastructure and logistics value chain for bakery and confectionary



Source: Crisil Intelligence

- **Ingredient sourcing:** Warehouses near mandis store raw materials such as wheat and sugar. The ingredients are transported using railway goods sheds and freight terminals
- **Mixing and baking facility:** Production units located near private freight terminals ensure seamless access to raw materials and packaging supplies

- **Cooling and packaging facility:** Proximity to cold storage warehouses and warehouses ensures proper storage of finished goods
- **Storage and distribution:** Goods are stored in warehouses before being distributed through air cargo terminals, road transport or rail logistics

Other key insights

The logistics infrastructure has improved in India over the past 5-6 years, driven by enhancements in the road network and increased cold storage facilities.

Baked food manufacturer, Maharashtra

4.3 Level of integration & coordination between different modes of transport & storage facilities

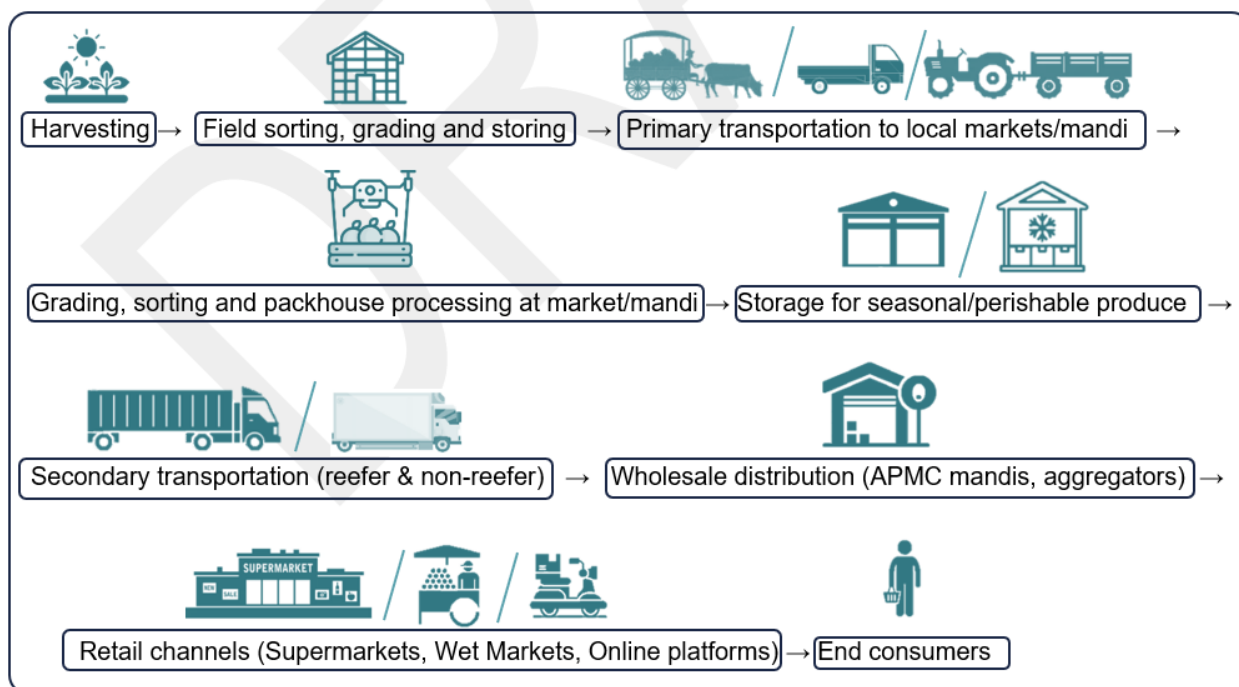
India needs requires seamless integration of transportation, warehousing and storage solutions tailored to the perishability of different food categories to make management of the food supply chain more efficient. From farm to end consumer, the journey of food products is dictated by factors such as shelf life, temperature sensitivity and market demand, necessitating precise coordination across multiple logistics channels. By aligning storage conditions with transportation modes, the industry ensures food safety, minimises wastage and enhances overall efficiency in distribution.

Highly perishable products, such as fresh fruits and vegetables, demand rapid post-harvest cooling, controlled-atmosphere storage and reefer transportation to maintain freshness within a short supply chain. Perishable products, including ready-to-cook foods, require blast freezing, chilled storage and specialised cold-chain logistics to prevent spoilage. Moderately perishable items, such as confectionery, necessitate temperature-controlled warehouses and conditioned transport to avoid melting or degradation. Shelf-stable products, such as packaged snacks, rely on ambient storage and bulk transportation via full-truckload (FTL) or less-than-truckload (LTL) shipments to optimise cost efficiency.

Specialty and temperature-sensitive foods, such as probiotics, require advanced refrigeration and strict regulatory compliance to maintain potency throughout distribution. Meanwhile, non-perishable bulk commodities, such as spices, undergo extensive drying, moisture-controlled packaging and long-term storage for extended shelf life, with large-scale exports often utilising sea freight. Each category presents distinct logistical challenges, making it imperative to adopt a strategic approach that integrates advanced cold-chain solutions, warehousing infrastructure and multimodal transportation networks.

1. Highly perishable products (shelf life up to one week): Fruits and vegetables

Figure 23: Process flow for fruits and vegetables



Source: CRISIL Intelligence

Integration and level of coordination required between various storage places and means of transport:

- **Cold-chain integration:** Controlled temperature logistics for high-value, perishable produce (berries, greens and exotic fruits)
- **Storage diversification:** Cold storage for perishables, dry warehouses for semi-perishables such as onions and potatoes
- **Transportation mix:** Non-refrigerated trucks for hardy vegetables; reefer vans for delicate, short-shelf-life products
- **Market linkages:** Coordination between farmers, wholesalers, farmer producer organisations (FPOs) and digital marketplaces for efficiency
- **Demand-supply synchronisation:** Technology-driven forecasting to reduce wastage and improve price realisation

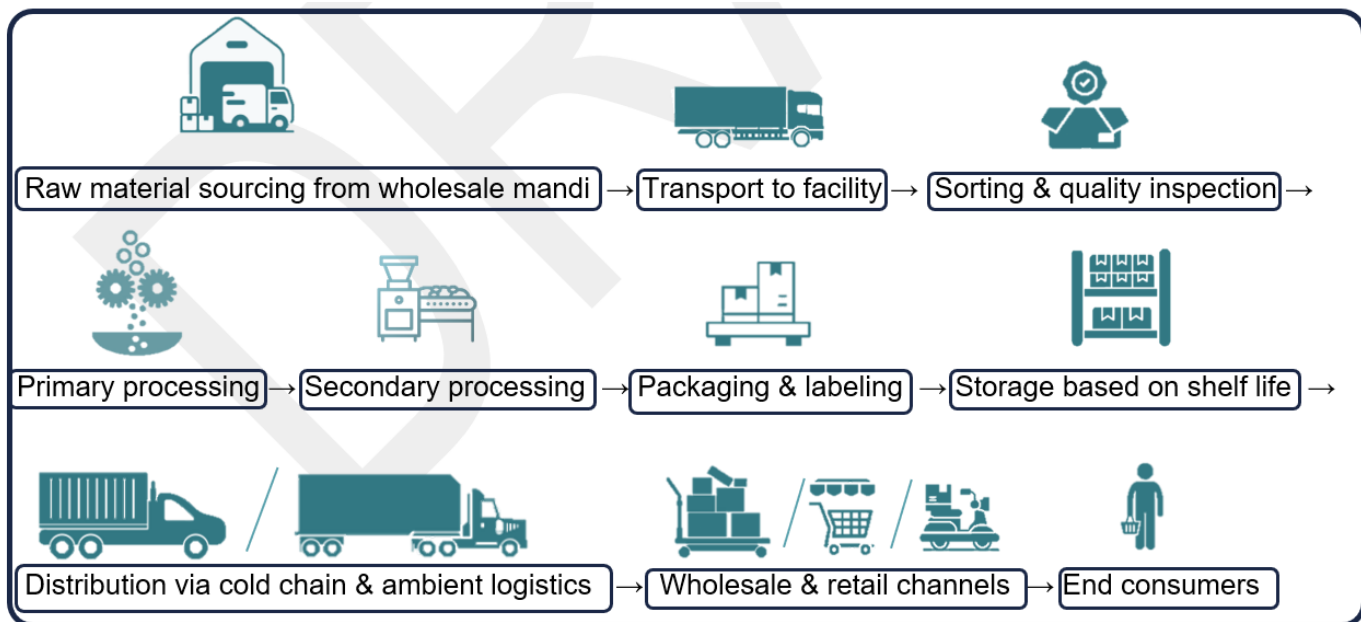
The journey of fruits and vegetables from Indian farms to end consumers involves a complex, multi-tiered supply chain that integrates storage, transportation and market linkages. After harvesting, a farm produce undergoes field sorting and grading at the farm. Thereafter, it goes through primary transportation to the local mandi, wherein further grading, sorting and packhouses process fruits through cleaning, waxing or ripening. If the produce is a seasonal perishable, it is preserved in controlled environments; if it is semi-perishable, it is stored in dry warehouses.

After that, secondary transport networks connect the produce to wholesale markets and thereafter to organised retail and e-commerce platforms, ensuring efficient distribution to end consumer. Proper cold-chain management, real-time demand forecasting and digital integrations play a crucial role in minimising post-harvest losses and improving farm-to-market efficiency.

2. Perishable products (shelf life more than one week): Process flow for ready-to-eat (RTE) foods in India

Items: Packaged pulp, instant curries, batter, frozen parathas, RTE biryanis, heat-and-eat snacks

Figure 24: Process flow for RTE foods



Source: Crisil Intelligence

Key processes in the supply chain, and integration and level of coordination required between various storage places and means of transport are explained below:

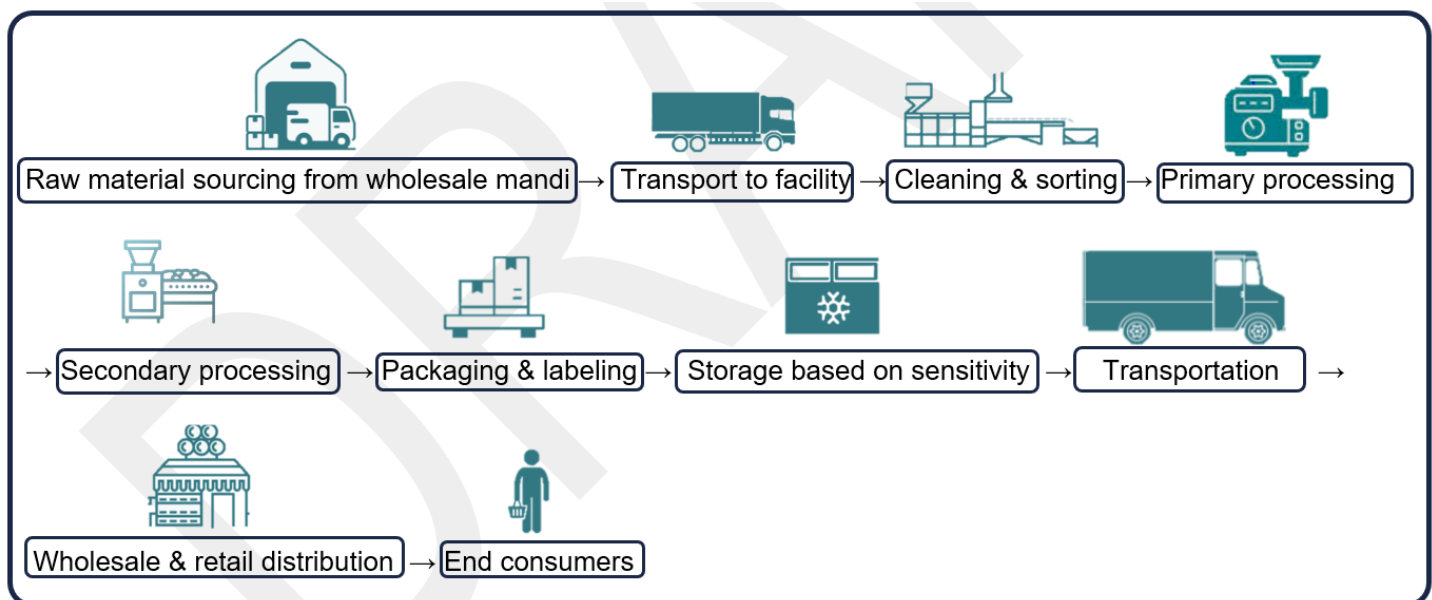
- **Primary processing:** Raw material is transported for cleaning/ cutting/ pasteurisation/ cooking/ blending
- **Secondary processing:** Baking/ frying/ freezing/ retort processing
- **Packaging and labelling:** Vacuum sealing, modified atmosphere packaging (MAP), retort pouches
- **Storage based on temperature:** Chilled: 0-5°C; frozen: -18°C; ambient: dry packaged
- **Multi-modal transportation:** Reefer trucks for frozen and chilled items, dry logistics for ambient-stored products
- **Retail and HORECA (hotels, restaurants and cafes) linkages:** Direct supply to supermarkets, quick commerce, restaurants and cloud kitchens
- **Reverse logistics:** Unused or near-expiry products are either redistributed or processed for waste minimisation

The RTE food supply chain in India is a highly coordinated system that ensures convenience foods maintain quality and safety from production stage to consumption. Raw materials such as grains, dairy, vegetables and meats undergo sorting, cleaning and processing through various techniques such as pasteurisation, frying or retort sterilisation. Packaging plays a crucial role, with vacuum sealing, MAP and retort pouches extending shelf life. Cold storage and distribution vary based on perishability — frozen foods are kept at -18°C, while chilled products require 0-5°C. A mix of reefer trucks and dry logistics ensures timely delivery to supermarkets, e-commerce platforms and food service chains. Efficient retail coordination and smart logistics reduce wastage while ensuring consumers receive fresh, RTE meals with minimal preparation.

3. Moderately perishable products (shelf life of more than a month): Process flow for confectionery products

Items: Chocolates, bakery, candies etc.

Figure 25: Process flow for confectionery products



Source: Crisil Intelligence

Key processes in the supply chain, and integration and level of coordination required between various storage places and means of transport are explained below:

- **Raw material:** Sugar, cocoa, dairy, flour, nuts
- **Packaging for shelf life:** Vacuum sealing, airtight wrapping and moisture barriers prevent spoilage and melting
- **Primary processing:** Grinding, roasting, mixing, refining
- **Secondary processing:** Tempering, moulding, baking, cooling
- **Packaging and labelling:** Airtight, foil, vacuum, temperature-controlled
- **Diverse transportation needs:** Chocolates and dairy-based sweets need reefer logistics, while dry confectionery moves via standard transport
- **Storage based on sensitivity:** Chocolates: 15-20°C; sweets: chilled 0-5°C; biscuits and dry sweets: ambient
- **Retail and festival demand coordination:** Seasonal spikes in demand require robust supply planning, especially during festivals
- **Transportation:** Reefer for heat-sensitive, standard for dry goods
- **Wholesale and retail distribution:** Supermarkets, sweet shops, kirana stores, e-commerce

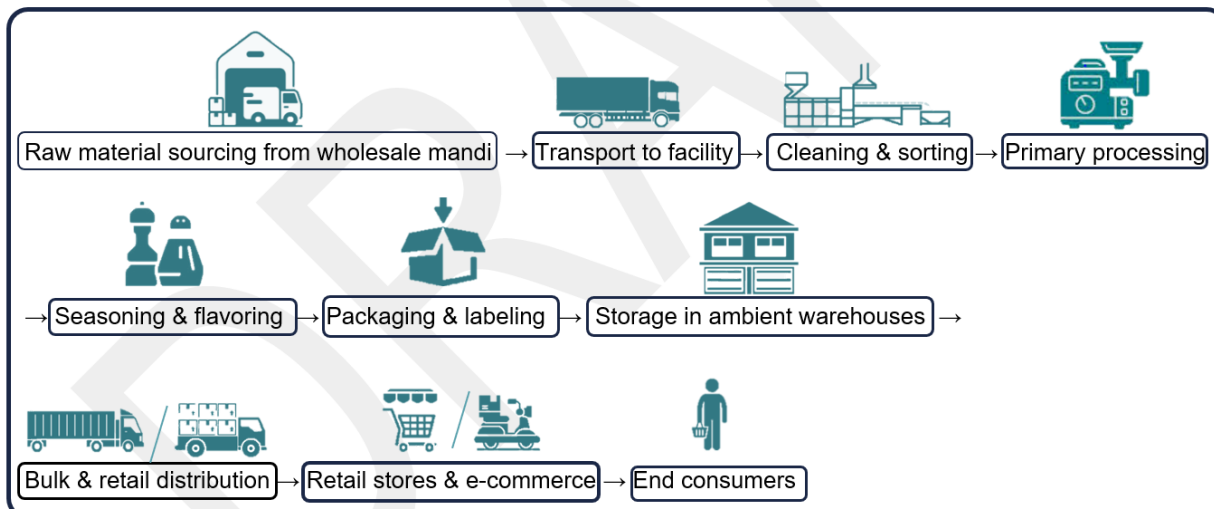
The confectionery supply chain in India is highly specialised, ensuring temperature-sensitive sweets and chocolates maintain quality throughout their journey. Raw materials such as sugar, cocoa, dairy and nuts undergo rigorous sorting before processing through grinding, roasting or tempering. Storage plays a crucial role — chocolates require temperature-controlled conditions (15-20°C) to prevent melting, while traditional sweets (such as rasgullas) need refrigeration at 0-5°C. Advanced packaging methods, such as foil wrapping and vacuum sealing, help extend shelf life and maintain freshness.

Transportation varies based on the product — reefer logistics for heat-sensitive items and standard distribution for dry confectionery. Seasonal demand fluctuations, especially during festivals, require precise inventory and logistics coordination to ensure timely supply while minimising waste.

4. Shelf-stable products (shelf life from six months to a year): Process flow for packaged snacks

Items: Savoury, chips, biscuits, extruded snacks and roasted nuts

Figure 26: Process flow for packaged snacks



Source: Crisil Intelligence

Key supply-chain processes, integration and coordination between storage and transportation:

- **Moisture and pest control:** Ensuring air-tight, nitrogen-flushed packaging to prevent spoilage
- **Diverse transportation networks:** Standard trucks for bulk loads and LTL for last-mile delivery to retailers
- **High-volume, low perishability:** Shelf life of six months to a year allows for cost-effective bulk logistics
- **Festive and seasonal demand planning:** Increased production and stockpiling before peak sales period
- **Wholesale mandi:** For sourcing potatoes, corn, wheat, pulses, edible oils and spices
- **Primary processing:** Cutting, roasting, frying, baking and extrusion
- **Packaging and labelling:** Nitrogen flushing and moisture-proof packing
- **Warehousing:** Dry warehousing (15–25°C) and pest-controlled

The supply chain of packaged snacks in India involves extensive coordination between raw material sourcing, processing, storage and retail distribution. Key ingredients such as potatoes, wheat, corn and pulses undergo sorting and processing through frying, baking and extrusion. Flavouring and seasoning follow before the product is packaged using nitrogen flushing or moisture-proof materials to maintain freshness.

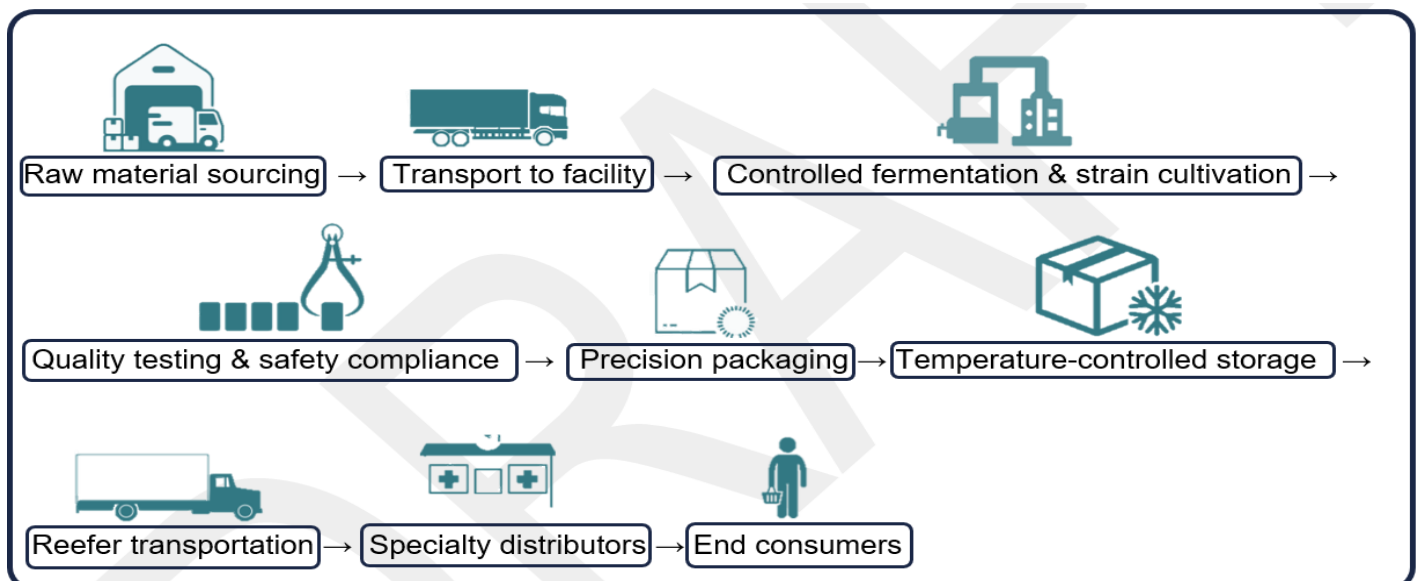
They are stored in dry, pest-controlled warehouses at 15–25°C temperatures, ensuring a long shelf life. Bulk shipments via FTL logistics ensure costs efficiency, while last-mile deliveries to retail stores and e-commerce platforms rely on flexible distribution networks.

Quality testing and regulatory compliance play a crucial role in maintaining food safety. Seasonal demand, especially during the festive season, requires strategic production planning and inventory management.

5. Specialty and temperature-sensitive foods (shelf life of up to a year): Process flow for probiotics

Items: Yogurt-based drinks, probiotic supplements and fermented foods (kefir, kimchi and kombucha)

Figure 27: Process flow for probiotics



Source: Crisil Intelligence

Key supply-chain processes, integration and coordination between storage and transportation:

- **Temperature-sensitive handling:** Live cultures require strict cold chain management (2–8°C) to retain efficacy
- **Advanced packaging technology:** Freeze-dried probiotics use desiccant packs to enhance shelf life
- **Regulatory compliance:** Strict quality control with Food Safety and Standards Authority of India (FSSAI), US Food and Drug Administration and pharmaceutical-grade safety standards
- **Specialised distribution channels:** Sold via health-focused retail, pharmacies and online platforms
- **Consumer education and awareness:** Marketing focuses on health benefits, dosage and storage requirements
- **Raw material sourcing:** Milk, fermentation cultures and prebiotic ingredients
- **Precision packaging:** Blister packs, refrigerated bottles and freeze-dried capsules
- **Temperature-controlled storage:** 2–8°C for live cultures and -18°C for freeze-dried cultures
- **Reefer transportation:** Cold chain couriers and insulated shipments
- **Specialty distributors:** Cold pharmacies, health stores, online retailers, direct purchase via e-commerce, hospitals, wellness clinics and supermarkets

The probiotics supply chain requires precision at every stage to maintain product efficacy. Raw materials such as milk, fermentation cultures and prebiotic ingredients undergo controlled fermentation and strain cultivation under strict quality standards.

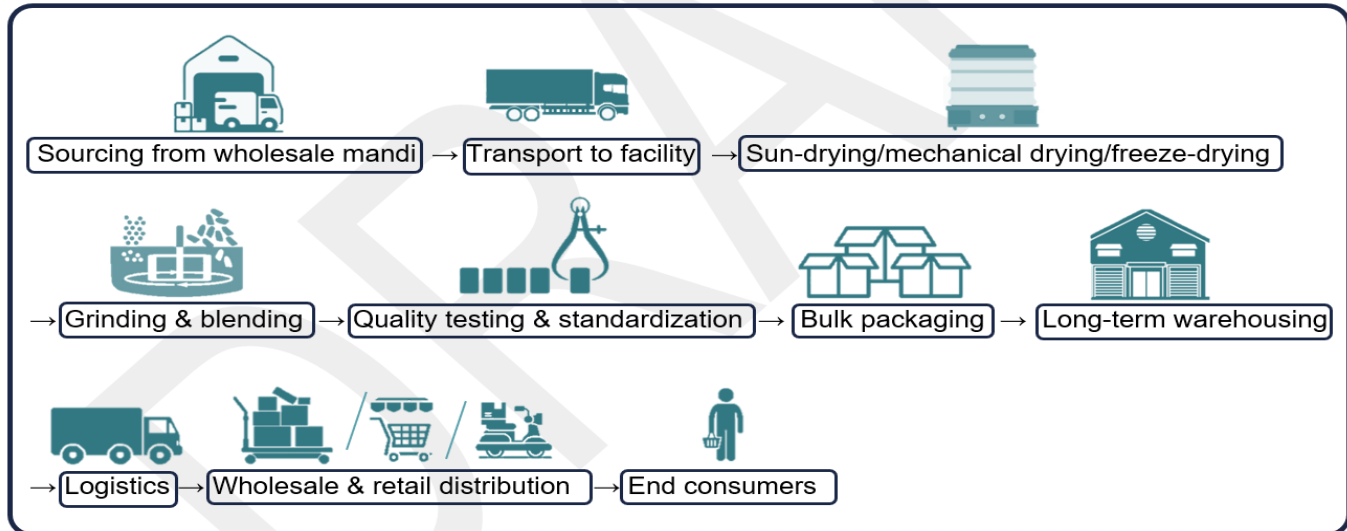
Compliance with regulatory bodies such as FSSAI and Good Manufacturing Practices is critical before packaging probiotics in specialised formats such as refrigerated bottles, freeze-dried capsules or blister packs. Temperature-controlled storage (2–8°C for live probiotics and -18°C for freeze-dried probiotics) ensures viability throughout the supply chain.

Cold chain couriers and insulated transport systems help maintain optimal conditions during distribution to pharmacies, supermarkets, online retailers and wellness clinics. In fact, specialised logistics and storage infrastructure are crucial to preserving potency, while marketing efforts emphasise consumer awareness about health benefits and storage requirements.

6. Non-perishable and bulk commodities (shelf life of up to a year): Process flow for dried spices

Items: Turmeric, black pepper, cumin, cardamom, chilli powder and coriander

Figure 28: Process flow for dried spices



Source: Crisil Intelligence

Key supply-chain processes, integration and coordination between storage and transportation:

- **Post-harvest drying methods:** Sun-drying for traditional spices, mechanical drying for efficiency and freeze-drying for premium spices
- **Moisture and pest control:** Airtight and vacuum-sealed packaging prevents contamination and extends shelf life
- **Bulk and retail distribution strategy:** Large-scale exports via sea freight; domestic movement through road transport and wholesalers
- **Standardisation and quality compliance:** FSSAI and Agmark certifications ensure purity and adherence to safety standards
- **Multi-channel retailing:** Sold via traditional markets, modern trade (supermarkets) and online platforms
- **Bulk packaging:** Moisture-proof, air-tight and vacuum-sealed
- **Long-term warehousing:** Ambient or humidity-controlled for high-value spices
- **Logistics:** Road transport for domestic markets
- **Wholesale and retail distribution:** Supermarkets, local grocery stores and e-commerce platforms
- **End customer:** Households, food manufacturers, and hotels, restaurants and cafes

5. Segment-wise analysis of infrastructure and logistical challenges in the food processing industry

The food processing sector in India is the second-largest producer of food globally and the leader in the production of milk, spices, pulses and bovine. The industry is second in horticulture crops, fish and aquaculture and paddy, among others. As it continues to expand, efficient infrastructure and logistics play a critical role in maintaining the quality and safety of food products from farm to table.

The food processing industry is a significant contributor to the GDP, accounting for a substantial share of the country's economic output. Its growth is inextricably linked to the development of robust infrastructure and logistics. Furthermore, as a major employer in India, the development of infrastructure and logistics in the food processing sector can lead to employment generation, stimulating economic growth and improving livelihoods.

Crisil Intelligence interacted with approximately 100 food processing players across India to understand the needs and challenges of the industry and categories they operate in, including those operating in mega food and integrated parks and standalone facilities. Some of these players were also beneficiaries of Ministry assisted schemes.

In terms of size, Crisil Intelligence has tried to cover big and small players. Some of the key challenges presently encountered across categories include inadequate cold chain infrastructure, poor road connectivity and insufficient logistics services, which can lead to losses and inefficiencies.

The unique challenges and needs faced by select categories are stated below.

Table 12: Summary of needs and challenges based on the player categories interviewed

Category	Key challenges and needs
1 Grains and pulses	Storage capacity is limited, leading to shortage of space, especially during harvest and peak seasons. Many storage facilities are old and not well maintained, which leads to spoilage
2 Fruits and vegetables	Limited container manufacturing capacity leads to reduced availability of containers, impacting exports
3 Dairy	Non-availability of chilled, thermally insulated transportation options for long-distance hauls necessitates financial support for brownfield expansion of logistics and warehousing infrastructure
4 RTE/ RTC	Non-availability of partial truck loading increases logistical costs since logistics companies prefer FTC. It also leads to inefficient logistics, as companies need to use multiple vehicles to transport products

Category	Key challenges and needs
5 Beverages	Infrastructure bottlenecks in rural sourcing regions are a key challenge. Rural areas have poor road connectivity, limited warehousing and cold chain facilities, which lead to loss of raw materials
6 Meat	Inadequate cold storage facilities and their high operating costs pose a challenge for players in maintaining a competitive edge globally
7 Seafood/ marine	Rising export freight charges is a key challenge. High freight costs are a result of increasing fuel costs, congested major ports and limited container availability
8 Healthy/ functional foods	Modern warehousing is not adequately available in the country
9 Bakery and confectionary	High compliance costs for cross-state transportation

Source: Crisil Intelligence

Most categories in the food processing sector face similar challenges in infrastructure and logistics, which can be bucketed into the following based on preliminary insights gathered during primary sourcing:

- Limited cold chain infrastructure:** The cold chain infrastructure in India faces scarcity of cold chain facilities, limited refrigerated transportation options and non-availability of chilled thermally insulated transportation options for long distances. Furthermore, the complex licensing requirements for cold chain storage facilities create additional hurdles. High operating costs, driven by electricity costs, also pose a significant challenge. Due to the limited availability of cold storage in the country, there are large post-harvest losses within each food category.

Table 13: Estimated post-harvest losses for select vegetable categories (percentage of total production)

Sr. no.	Farm level	Farmer level	Wholesale level	Retail level	Total
1	Potato	5	2	2	9
2	Carrot	6	2	2	10
3	Kohlrabi	5	5	5	15
4	Radish	5	5	5	15
5	Ridge gourd	5	5	5	15
6	Cowpea	5	5	5	15
7	Ladyfinger	5	5	5	15
8	Ash gourd	5	5	5	15
9	Tomato	7	5	4	16
10	Brinjal	5	6	6	17
11	Spine gourd	5	6	6	17
12	French bean	5	7	7	19
13	Cucumber	10	5	5	20
14	Onion	-	15	5	20
15	Bottle gourd	4	15	5	24
16	Chilli	5	15	5	25

Sr. no.	Farm level	Farmer level	Wholesale level	Retail level	Total
17	Pumpkin	5	15	5	25
18	Bitter gourd	5	15	5	25
19	Ginger	5	15	5	25
20	Cabbage	10	8	8	26
21	Pointed gourd	5	15	7	27
22	Sweet gourd	5	15	7	27
23	Garlic	7	15	5	27
24	Capsicum	5	15	8	28
25	Cauliflower	10	10	10	30
26	Pea	10	15	7	32

Source: Government of India (2017)

Table 14: Post-harvest monetary losses for select fruit categories (share of total value based on FY18 production values)

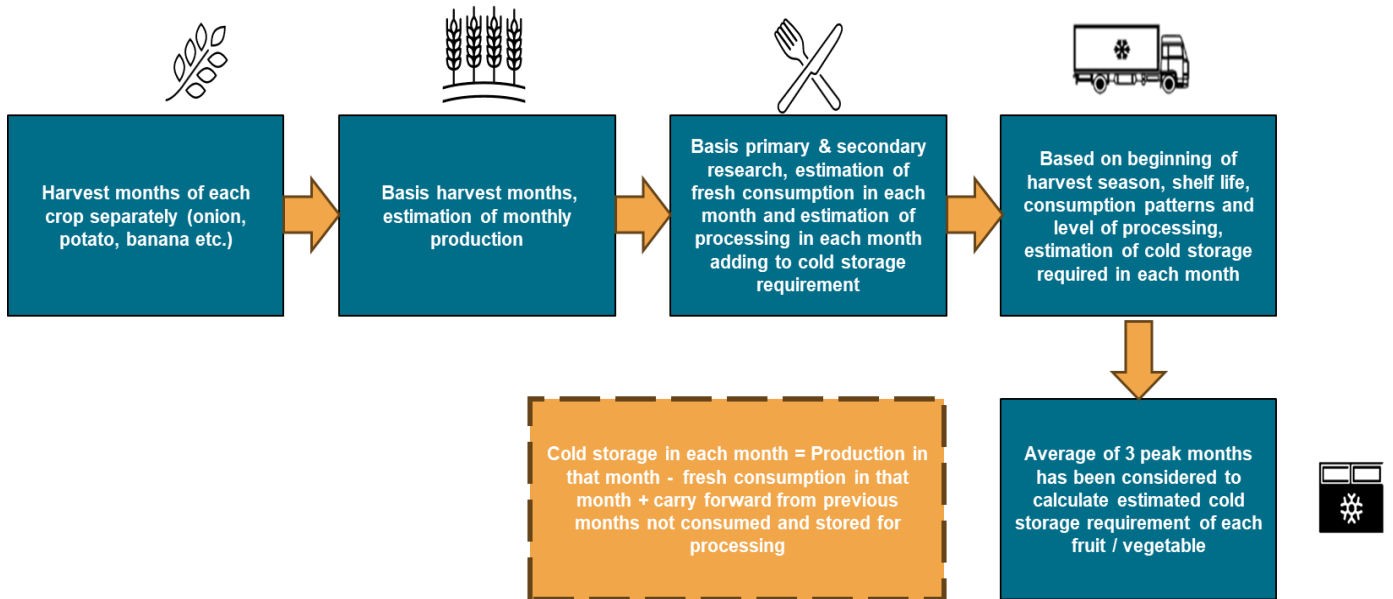
Category	Total loss (%)
1 Apple	10.4
2 Banana	7.8
3 Citrus fruits**	9.7
4 Grapes	8.6
5 Guava	15.9
6 Mango	9.2
7 Papaya	6.7
8 Sapota	9.7

Note: **Includes lemon, sweet lime and orange

Source: Institute of Economic Growth

Crisil Intelligence has identified the annual cold storage requirement of select major categories of fruits and vegetables based on production, consumption and storage shelf life of these categories. Based on our assumption for each of the below categories considering each product's harvest months and rough consumption, production pattern and shelf life in cold storage, annual cold storages have been calculated.

Figure 29: Below is an infographic which depicts the methodology to calculate the cold storage requirements



Source: Crisil Intelligence

Presently, total cold storage capacity in India is 37-40 million metric tonnes, out of which 33-35 million metric tonnes is estimated to be available for food, as the rest is required for pharmaceutical products. Based on our estimates, the shortfall is 10-15 million metric tonnes. While the country has adequate cold storage capacity available for potato, onion and tomato face an estimated shortfall of 20-30% considering current capacities. The shortfall further increases for fruits and meat and sea food.

Table 15: Cold storage requirement for major fruits and vegetables in India

Category	Estimated percentage consumed		Estimated annual cold storage requirement (million metric tonnes)
	fresh	processed	
1 Potato	90%	10%	19-20
2 Onion	93-94%	6-7%	8.5-9.5
3 Tomato	75-85%	15-25%	1.0-2.0
4 Mango	90-95%	5-10%	1.5-2.5
5 Banana	93-96%	4-7%	1.25-1.50
6 Citrus fruits	70-80%	20-30%	4.0-4.5
7 Rest of horticulture	NA	NA	3.5-4.0
8 Meat, sea food and dairy			9.5-10.5
Total requirement			47.0-55.0
Present capacity of Indian cold storage			37-40 (85-90% of this capacity is available for food as the rest is needed for pharmaceutical products)
Shortfall			10-15 million metric tonnes

Note: Not applicable as it includes multiple products

Source: Crisil Intelligence

2. **High transport and logistics costs:** High transportation costs triggered by fuel price fluctuations push up the expenses of moving perishable goods. Additionally, high container costs for exports further add to the financial burden. Congestion in urban centres causes delays and inefficiencies, while lag in exports due to macroeconomic issues disrupts the supply chain. Moreover, the limited warehousing capacity for storing raw materials and finished goods exacerbates the problem since it hinders the ability to store and manage inventory effectively.
3. **Inadequate rural roads and other infrastructure:** Rural logistical challenges pose a significant obstacle to the development of food processing infrastructure in India, with infrastructure bottlenecks in rural sourcing regions being a major concern. The lack of adequate roads and other essential infrastructure in these areas hinders the efficient transportation and handling of raw materials, making it difficult to maintain quality and reduce losses. This, in turn, can increase costs for food processing companies that rely on rural sourcing

Challenges pointed out by industry participants

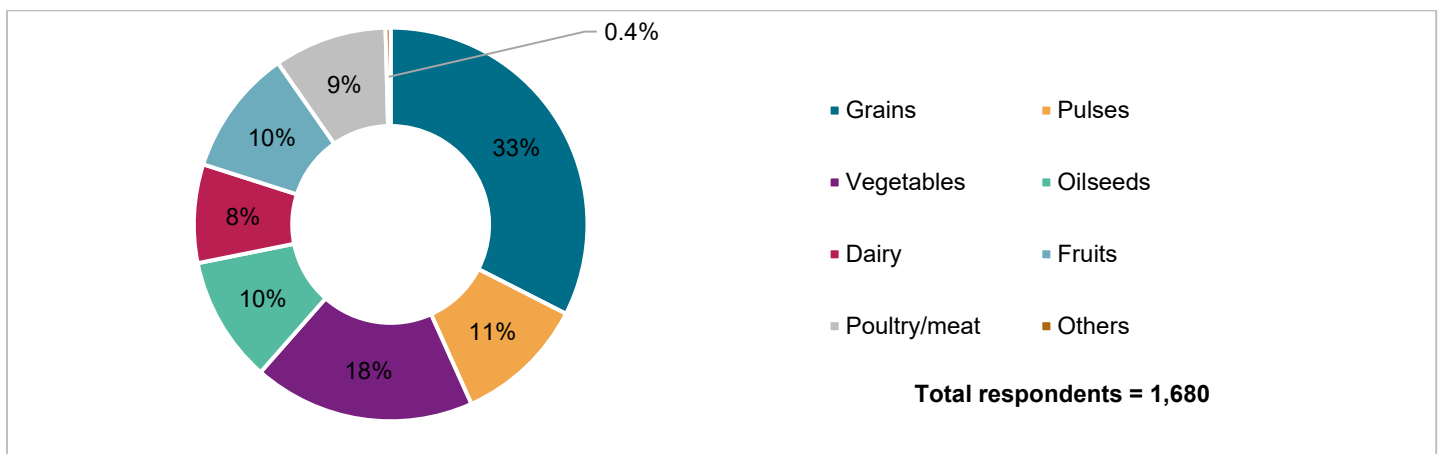
- a. **Lack of uniformity in taxation across states:** the lack of uniform taxation policies across states leads to inefficiencies. Furthermore, high taxes on refrigerated transport and high GST on services increase the overall cost of operations.
- b. **Inadequate implementation of schemes:** The implementation of existing schemes is inadequate, and improvements are needed to bring more companies under the ambit of the scheme, thereby increasing their reach and impact.

6. Farmer-level assessment of infrastructure and logistics in India's food processing sector

Crisil Intelligence surveyed 1,680 farmers spanning 26 states*, including Uttar Pradesh, Punjab, Kerala, Manipur, Arunachal Pradesh, Rajasthan, Karnataka, Gujarat, Haryana, Madhya Pradesh, Tamil Nadu, Telangana and Maharashtra, among others. Of them, 34% are small farmers (possessing land measuring more than four hectares), 41% are medium farmers (four to 10-hectare land) and the remaining 25% are large farmers, with more than 10-hectare land.

The farmers grow varied produce comprising grains, dairy, meat, fruits, vegetables and oilseeds.

Figure 30: Produce grown by farmers



Others include bananas, fisheries, rubber and paddy

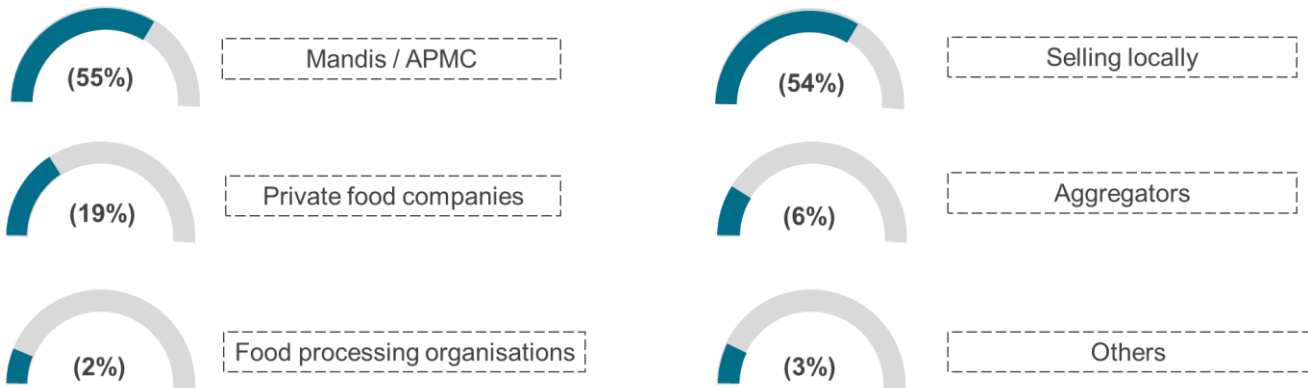
**Remaining states include Andhra Pradesh, Assam, Bihar, Chhattisgarh, Himachal Pradesh, Jharkhand, Meghalaya, Nagaland, Odisha, Sikkim, Tripura, Uttarakhand, West Bengal*

Source: Crisil Intelligence

55% of farmers prefer agricultural markets/ APMCs to sell produce

Following the harvesting season, 55% farmers opt for agricultural markets (mandis) or Agricultural Produce Market Committees (APMCs) to sell their produce, while 54% prefer selling their produce directly to consumers or small-scale traders in their vicinities. As many as 19% sell their produce to private players.

Figure 31: Farmers' preferred channels of sales for their produce



Total no. of respondents = 1,680

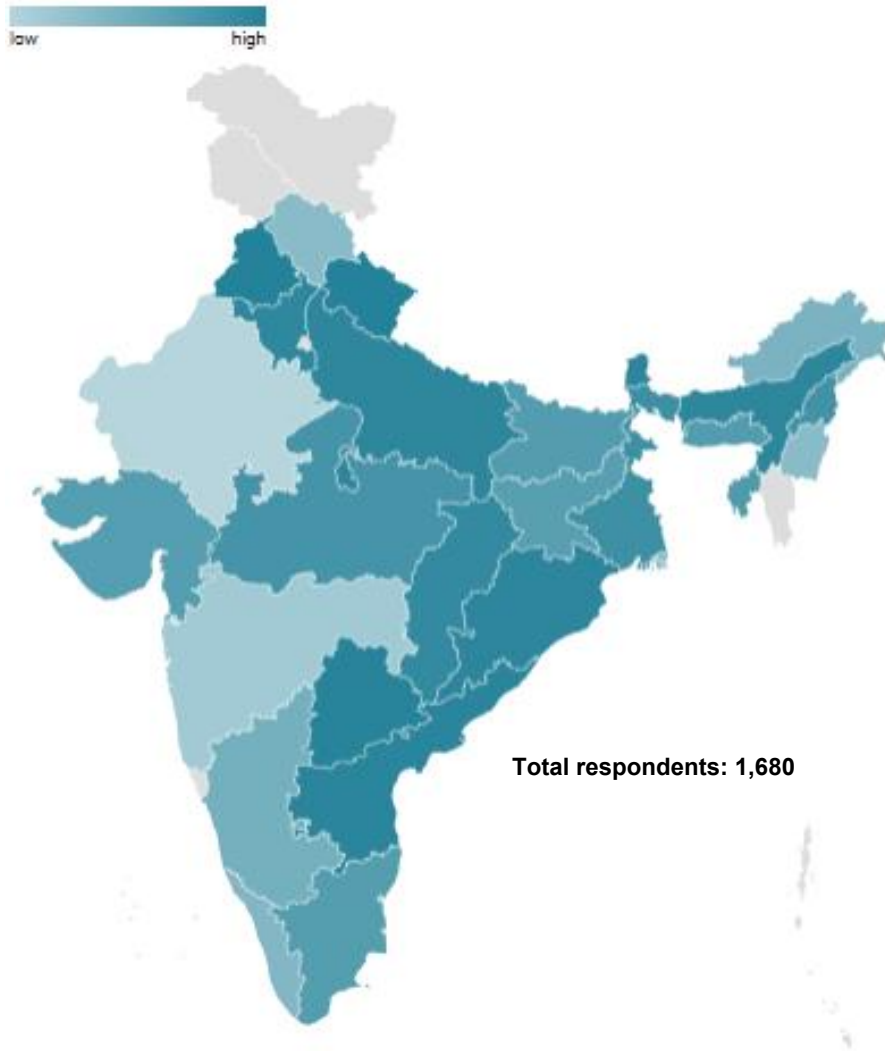
Note: The above is a multiple-option question survey wherein the respondents can choose more than one option, hence the total may not add up to 100%. Others include produce being sold at Indira Kranthi Patham centres, government dairies, sugar mills and produce not for sale

Source: Crisil Intelligence

Punjab and Uttarakhand among majority buyers of local farm produce

A significant proportion of farmers from Punjab and Uttarakhand sells their produce to buyers within a 0-20 km radius. The trend is also observed in Telangana, Andhra Pradesh and Odisha, where a substantial number of buyers is located close to farms. The transportation of produce to buyers, however, is predominantly facilitated through rented vehicles and not by the farmers' own vehicles, highlighting high reliance on third-party logistics in the agricultural supply chain.

Figure 32: Buyers' proximity to farmers across states



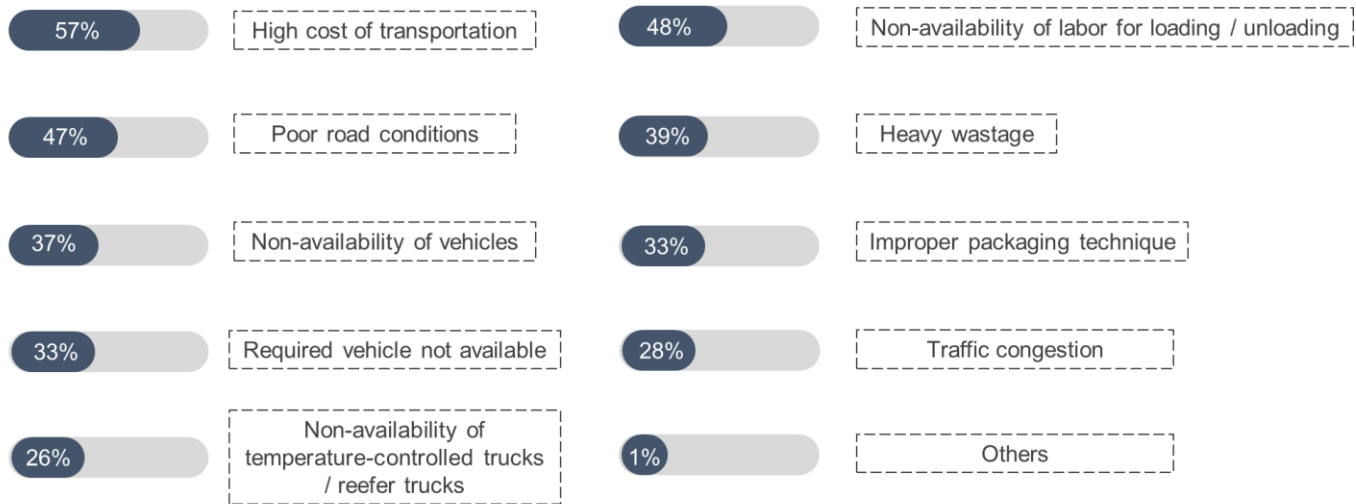
Low indicates lesser number of buyers within the radius of 0-20 km from farmers

Source: Crisil Intelligence

Cost major hindrance in transportation of produce from farmers to buyers

To transport their produce from the farm to buyers, farmers pay anywhere between Rs 500 and Rs 5,000. High cost of transportation, unavailability of labour for loading and unloading of the produce and poor road conditions act as hindrances while transporting it to the buyer.

Figure 33: Challenges faced by farmers in the transportation of produce



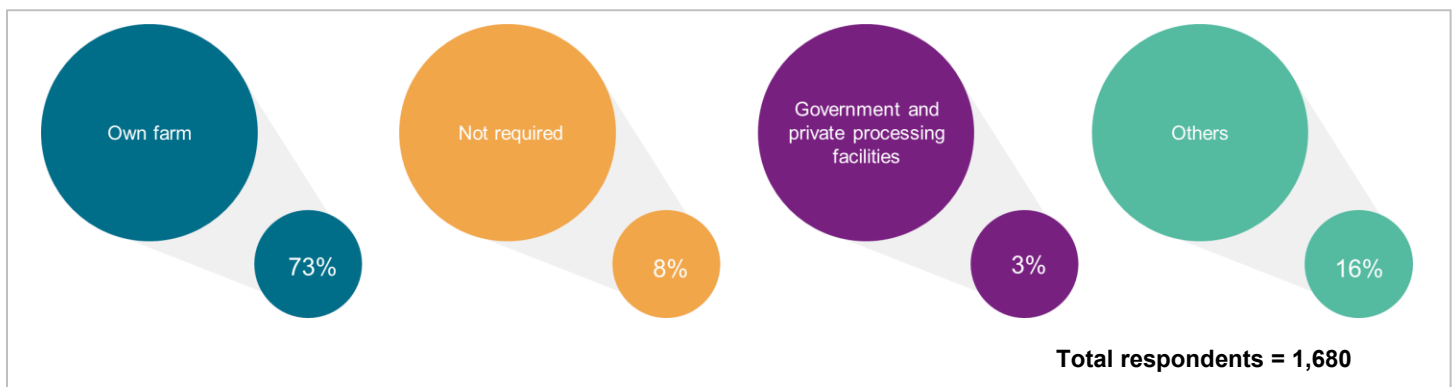
Total no. of respondents = 1,680

Note: The above is a multiple-option question wherein the respondent can choose more than one option, hence the total may not add up to 100%
Source: Crisil Intelligence

Majority of primary processing activities performed at farms

Primary processing is typically conducted at farms where sorting, washing, drying and grading are performed based on the size, colour and weight of the produce. The initial processing step is usually completed before the produce is transported. Alternatively, if primary processing is not undertaken at the farm, it is often carried out at private or government-owned processing facilities at the APMC market, ensuring that the produce is ready for sale.

Figure 34: Locations where primary processing takes place



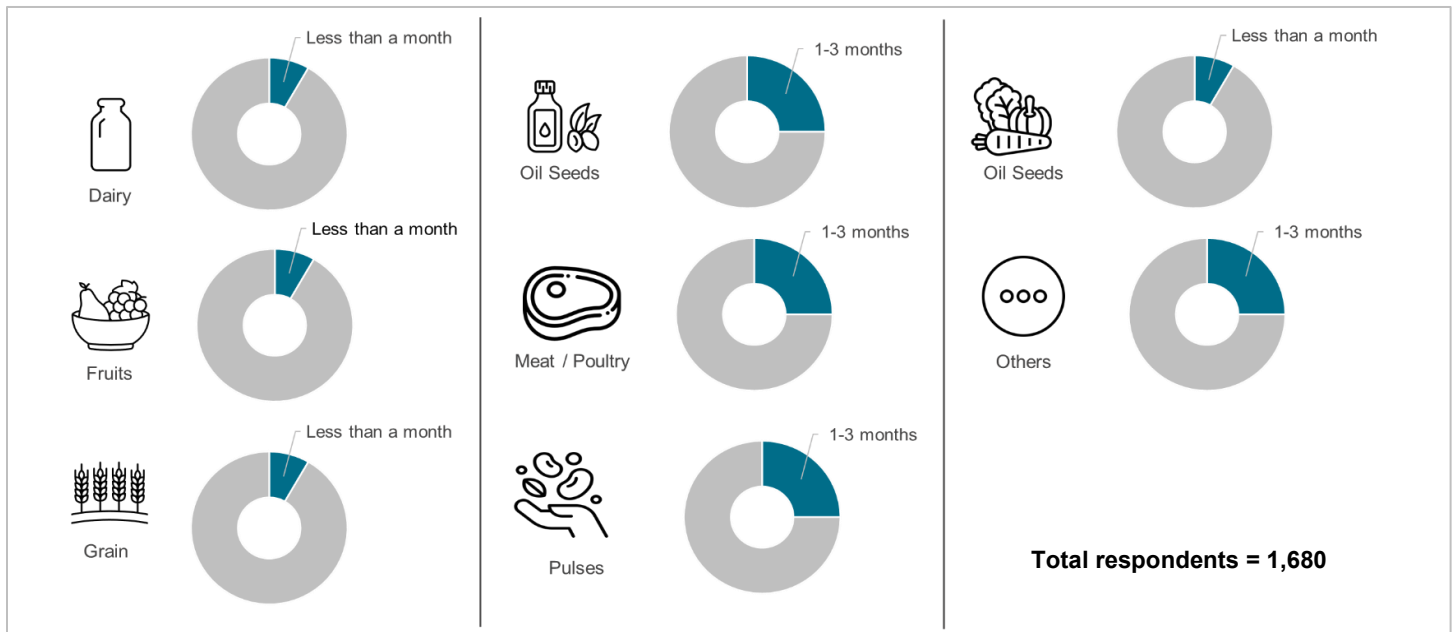
Note: Others include private and government processing units at mega food parks and others
Source: Crisil Intelligence

High cost and lack of government subsidies or schemes are key challenges faced while performing primary processing activities. Additional challenges include zero corresponding rise in the selling price post processing, inadequate transportation infrastructure, lack of processing centres during peak seasons, limited awareness about benefits and procedures of primary processing, prolonged waiting times and other logistical issues.

Majority farmers store their produce at home or open facilities in farms at varying duration

Farmers typically utilise various options to store their produce, with the majority storing it at their own residence or in an open facility or a shed located on the farm. Alternatively, some farmers store their produce at private warehouse facilities or third-party sheds, among others. The duration of storage varies depending on type of produce and market demand. As a result, farmers often store their produce for duration that is customised to the type of crop and prevailing market conditions. Further, these storage facilities are majorly located within a radius of 0-20 km.

Figure 35: Storage duration for different food categories

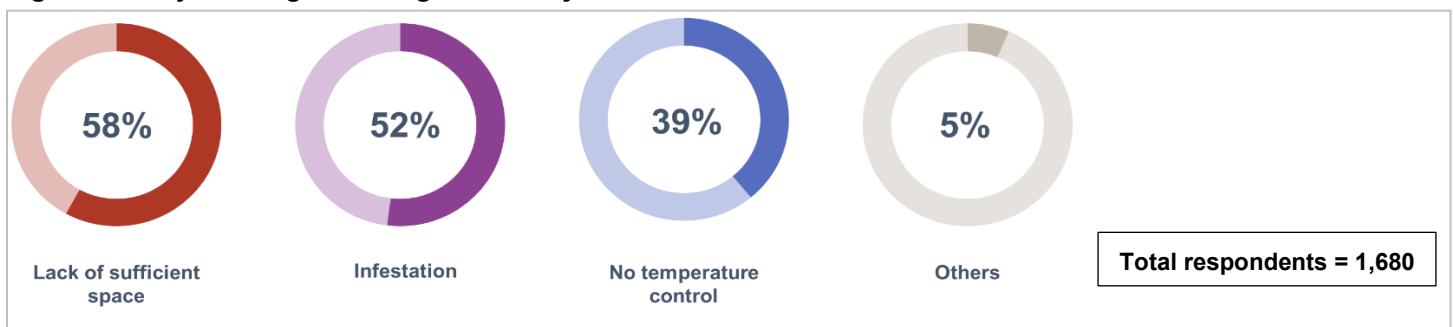


Others include bananas, fisheries, rubber and paddy
Source: Crisil Intelligence

Lack of sufficient storage a challenge

Among the multiple challenges faced by farmers, lack of sufficient space to store produce is a major one, followed by infestation and lack of temperature control.

Figure 36: Major storage challenges faced by farmers



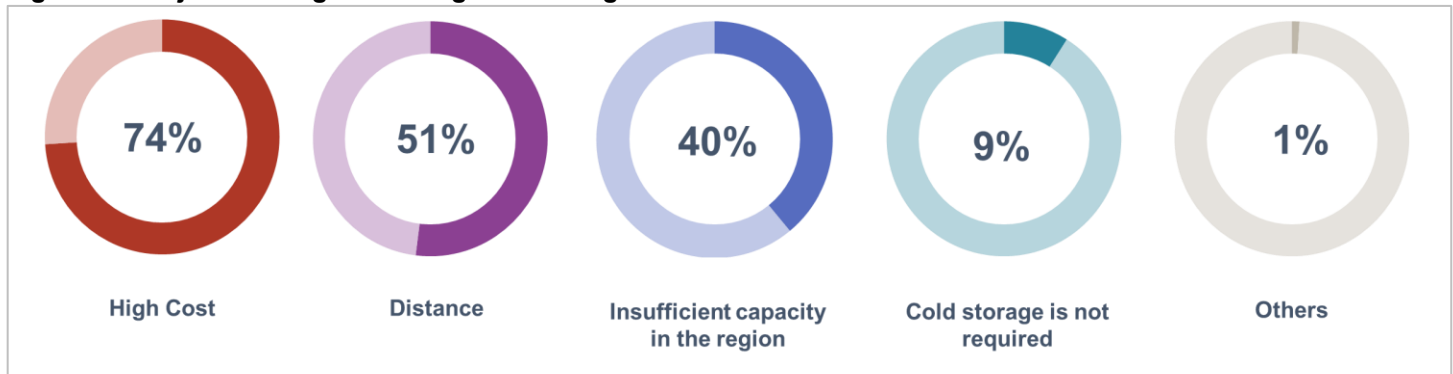
Note: The above is multiple-option question wherein the respondent can choose more than one option, hence the total may not add up to 100%
Other challenges include lack of proper maintenance of storage spaces and expensive rentals
Source: Crisil Intelligence

High costs are a major issue for the use of cold storage

Cold storage plays an important role in the preservation of perishable goods and maintenance of their quality over extended periods. By controlling the temperature and humidity levels, cold storage facilities help reduce spoilage and extend the shelf life. Effective cold storage solutions are essential for ensuring the safety and freshness of food products from farm to table.

One of the major hindrances in the widespread adoption of cold storage is the high cost associated with its usage. Another challenge includes the long distance to reach the cold storage facility, making it difficult for farmers to utilise the facility without incurring high transport costs.

Figure 37: Major challenges in using cold storage facilities

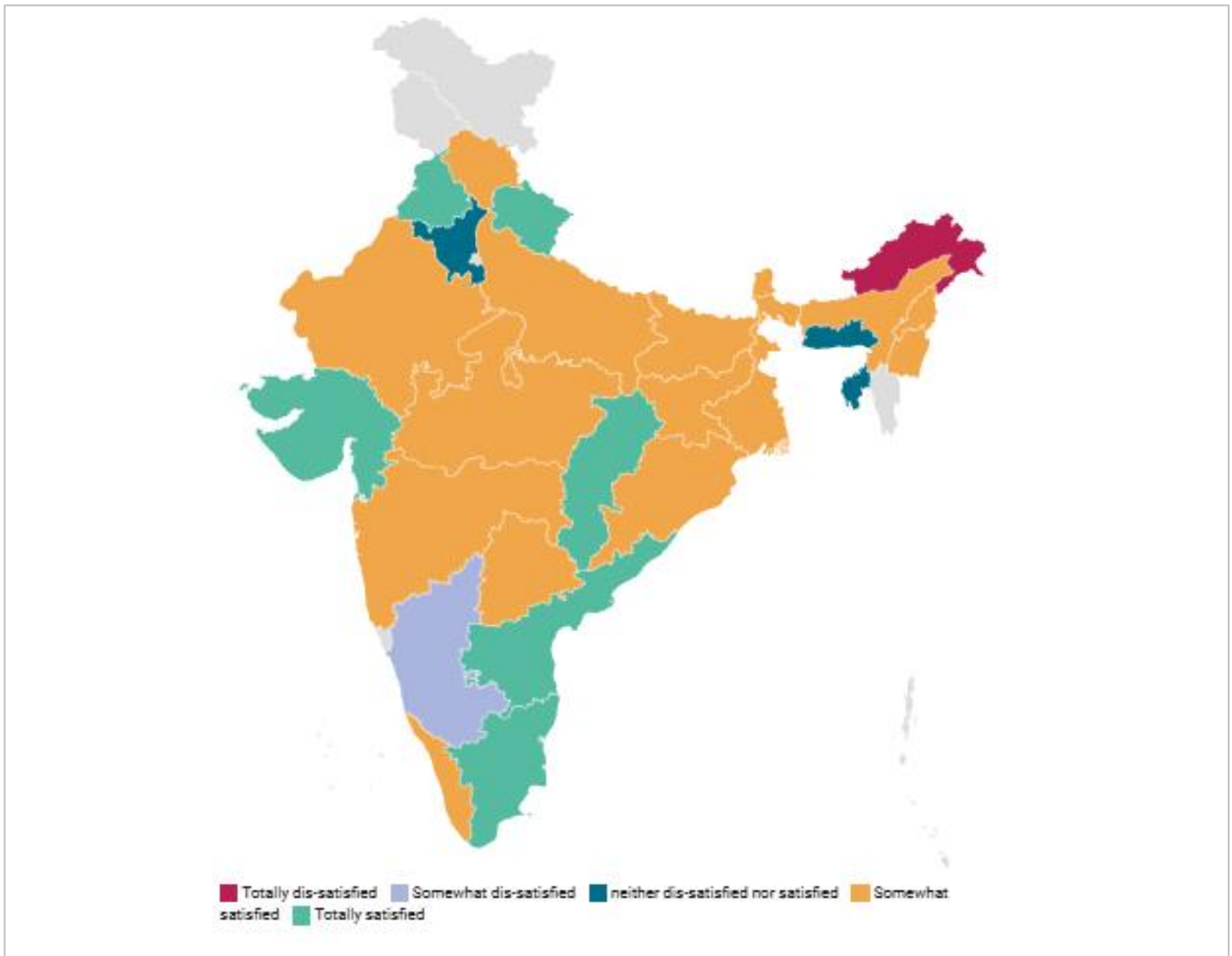


Note: The above is a multiple option-question wherein the respondent can choose more than one option, hence the total may not add up to 100%
Source: Crisil Intelligence

Logistics and transportation perception across various states

Substantial government capital expenditure and supportive policy initiatives over the years have significantly transformed the logistics and transportation scenario in India. The sector has witnessed steady growth, with the government's focus on developing infrastructure such as highways, ports and airports, facilitating the movement of goods and people. The implementation of policies such as the National Logistics Policy, GST and the Bharatmala Pariyojana has boosted the sector's growth, enhancing efficiency, reducing costs and increasing competitiveness. Additionally, the government's emphasis on multimodal transportation, including the development of inland waterways and dedicated freight corridors, has improved the sector's overall performance. The following chart highlights farmer satisfaction levels with regards to the logistics and transportation infrastructure facilities in their respective states.

Figure 38: Logistics and transportation scenario from the farmers' perspective



Note: For each state, the criteria with the most responses is considered

Source: Crisil Intelligence

7. Analysis of efficiency and capacity utilisation of logistics networks, key gaps and bottlenecks

Preliminary analysis suggests capacity utilisation of logistics players supporting the food processing industry is 70-80%

Crisil Intelligence spoke to over 40 logistics players across the country to understand the capacity utilisation of players supporting the food processing industry. These include a mix of cold-chain logistics, warehousing and ambient and refrigerated transport players.

Based on the analysis of these interactions, we gleaned the average capacity utilisation of facilities and fleets is 70-80%, with peak utilisation reaching 90-95% during harvest seasons and festivals. Demand remains steady throughout the year, with some fluctuation during off-peak seasons. Overall, the facilities and fleets have been operating at an above 70% capacity utilisation rate, reflecting strong demand for cold storage and transportation services in the sector.

Figure 39: Capacity utilisation of logistics players



Source: Crisil Intelligence

Key challenges to efficiency of the sector

Challenges to efficiency of the sector are fragmented supply chain, inadequate warehousing and storage, reduced flexibility by logistics players, and lack of coordination between stakeholders.

Fragmented supply chain

Multiple stakeholders: The food processing supply chain involves multiple stakeholders, including farmers, processors, distributors and retailers, which can lead to fragmentation and inefficiencies.

Lack of coordination: The lack of coordination and communication among stakeholders sometimes results in delays, miscommunication, and errors, leading to inefficiencies and waste.

Partial load reduces efficiency, but higher demand for smaller loads

Based on interaction with food processing players, most companies do not allow partial loads. Food product manufacturers and distributors are forced to pay for a full load, even if they do not have enough products to fill the entire truck or container. As the industry is dominated by smaller food processing players, the demand is more for smaller loads. The cost of transportation per unit of product increases when partial loads are not allowed, as the fixed costs of transportation are spread over a smaller number of units.

Inappropriate storage conditions lead to higher wait times at customer locations

The lack of adequate warehousing and storage facilities with customers often leads to a shortage of storage space for few food products, resulting in products being stored in inappropriate conditions, which affects their quality and safety. This leads to wastage and higher wait times for logistics companies.

Table 16: Key challenges to storage infrastructure

1	Uneven distribution of cold-storage facilities	Cold-storage facilities are distributed unevenly, with majority located in northern India and limited availability of modern warehousing facilities in tier 2 and 3 cities
2	Inconsistent power supply	Inconsistent power supply causes temperature fluctuations, which can affect the quality and safety of stored products. It also reduces the facility's efficiency since staff may need to spend more time monitoring the equipment
3	High energy costs	High electricity tariffs increase the operating cost and, in turn, hurt the profitability of facilities
4	Uneven demand patterns	High dependency on seasonal crops can result in uneven demand patterns for the facilities
5	Urban space constraints	Limited availability of cost-effective storage close to densely populated areas

Source: Crisil Intelligence

Ways to improve cold storage infrastructure

- Integration of technology: Temperature monitoring systems, digital monitoring tools and IoT-enabled solutions
- Investment in small reefer trucks: To cater to hyperlocal demands and improve last-mile connectivity
- Solar-powered storage units: Some large players have started using solar-powered cold storage units, which reduce both environmental impact and costs

Table 17: High land acquisition costs, import duties and complex licensing processes hinder private logistics growth

1	High land acquisition costs	Acquiring land for logistics facilities is expensive and involves dealing with bureaucratic processes, discouraging private investments
2	Complex and fragmented licensing process	Delays in project execution due to complex and fragmented licensing process, environmental clearances and inconsistent zoning policies create bottlenecks for setting up logistics parks and hubs
3	Inconsistent implementation of subsidies and tax benefits	Inconsistent implementation of subsidies and tax benefits for cold-storage infrastructure and logistics equipment and inadequate government incentives discourage private players from investing in high-cost cold chain infrastructure
4	High import duties	High import duties on specialised cold-chain equipment and GST on logistics equipment increase capital expenditure

Source: *Crisil Intelligence*

8. Overview of regulatory and policy barriers

Multiplicity of regulations, inconsistent food safety standards, multiple licensing and approvals and lack of integrated policy key barriers hindering sector growth

The food processing industry in India is a key contributor to the economy, connecting the agriculture sector with consumers. It plays a pivotal role in reducing food wastage, improving value addition and providing employment opportunities as well.

But despite its strategic importance, the sector’s development is hindered by several regulatory and policy challenges that obstruct the establishment and growth of essential infrastructure and logistics facilities.

This section analyses the barriers to identify actionable solutions.

Table 18: Regulatory barriers

<p>Multiplicity of regulations</p>	<p>The food processing sector is regulated by several laws, including the Food Safety and Standards Act, Essential Commodities Act and state-level regulations. These overlapping frameworks lead to compliance complexities and discourage investment in infrastructure development. For instance, while FSSAI sets safety and labelling standards, state governments have their own licensing and enforcement mechanisms, leading to inconsistencies.</p>
<p>Inconsistent food safety standards</p>	<p>The lack of harmonised food safety standards across states complicates operations for companies that operate nationally. For instance, variations in labelling requirements and quality certifications lead to inefficiencies and increased compliance costs. While a few states mandate that the label must include the name and address of the manufacturer, a few others want the label to include the name and address of the distributor.</p>
<p>Complex taxation policies</p>	<p>Although the implementation of GST has streamlined indirect taxes, it has introduced multiple tax rates for similar products. For instance, different tax rates for processed and unprocessed foods have created confusion and increased administrative burdens for food processing companies. Moreover, implementation of a ‘fat tax’ in certain regions has necessitated businesses to adjust their accounting and compliance processes, thereby increasing their operational costs.</p>
<p>Licensing and approvals</p>	<p>The food processing sector requires multiple licences, such as Pollution Control Board clearance, food safety certification and labour law compliances. These fragmented processes discourage startups and delay project execution. The World Bank’s Ease of Doing Business Report ranks India the 63rd globally in 2019, citing regulatory complexities as a major bottleneck.</p>

Source: Crisil Intelligence

Table 19: Policy barriers

Lack of integrated national policy	Absence of a unified policy for the food processing sector leads to fragmented development. Policies such as Mega Food Park Scheme and PMKSY operate in silos. In fact, as of October 2024, only 24 out of the 41 approved mega food parks were operational, with many projects delayed due to land acquisition issues and lack of coordination among stakeholders.
Land acquisition issues	Land acquisition for infrastructure projects faces delays due to legal disputes and resistance from local communities. The Right to Fair Compensation and Transparency in Land Acquisition Act, 2013, although aimed at safeguarding stakeholders, has made the process cumbersome. A study by the Confederation of Indian Industry found that over 40% of food processing projects are delayed due to land acquisition issues, leading to cost overruns of up to 30%. Of the 1,768 delayed central infrastructure projects totalling Rs 27.2 lakh crore analysed by the Ministry of Statistics and Planning Implementation up to September 2022, the highest time overrun, at 26%, was due to land acquisition, while 22% delays were due to pending clearances and approvals.

Source: Crisil Intelligence, National Bank for Agriculture and Rural Development, MoFPI

Table 20: Regulatory and policy issues lead to high operational costs, reduced investments and wastages

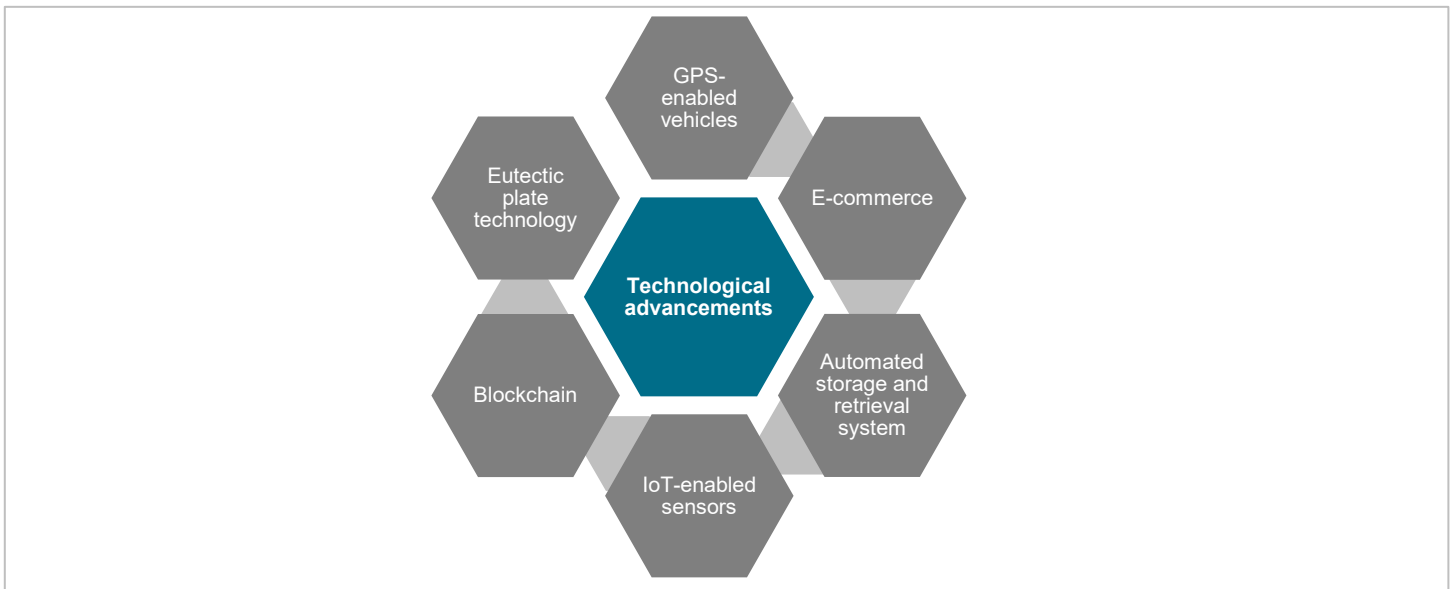
High operational costs	Businesses incur additional costs to comply with fragmented regulations and manage inefficiencies in logistics. For example, inefficiencies with regard to logistics alone add up to \$7 billion annually in costs, according to the Indian Council of Research on International Economic Relations
Reduced investments	Uncertainties in regulatory frameworks deter domestic as well as foreign investors, stifling innovation and modernisation in the sector
Significant wastage	Inadequate infrastructure leads to high post-harvest losses, particularly for perishable goods such as fruits, vegetables and dairy products. This also creates food security challenges, as a significant portion is lost before reaching consumers
Market inefficiencies	Poor infrastructure results in supply-chain inefficiencies, affecting farmers and consumers. Farmers often receive lower prices for their produce due to lack of direct market access while consumers face higher costs on account of middlemen in the supply chain

Source: Crisil Intelligence, Indian Council of Research on International Economic Relations

Overcoming regulatory and policy barriers is essential to unlocking the potential of India’s food processing sector. Addressing these challenges through streamlined regulations, cohesive policies and targeted investments can significantly improve infrastructure and logistics facilities. This, in turn, will enhance supply-chain efficiency, reduce food wastage and increase farmers’ incomes.

9. Assessment of investments in key identified gaps that support food processing industry

Figure 40: Technologies under implementation in the logistics and warehousing sector in India



Source: Crisil Intelligence

- **Global positioning system (GPS)-enabled vehicles:** These vehicles enable companies to monitor location, speed, route and other parameters in real time for better optimisation
- **IoT-enabled sensors:** They detect temperature fluctuations, humidity, movement and activity, pressure, location and real-time inventory
- **Blockchain:** It tracks and verifies movement of goods across the supply chain, providing a transparent and tamper-proof record of all transactions, thereby building trust and confidence
- **Automated storage and retrieval system (AS/RS):** It is a type of warehouse automation technology used in logistics to store and retrieve goods, products or inventory efficiently and accurately. AS/RS is designed to optimise the use of warehouse space, reduce labour costs and improve the speed and accuracy of inventory management. The system can be used for unit, micro and mini loads and automated guided vehicles to transfer goods within warehouses
- **Eutectic plate technology:** It is a type of refrigeration technology that uses a flat plate filled with a eutectic solution to store and release cold energy. The solution is a mixture of water and salt, such as ammonium or calcium chloride, that freezes and thaws at a consistent temperature. The technology is energy- and cost-effective and improves the shelf life of food and perishable goods
- **AI-driven demand forecasting:** The technology uses AI and machine learning algorithms to analyse historical data and seasonal trends to predict future demand for products and services

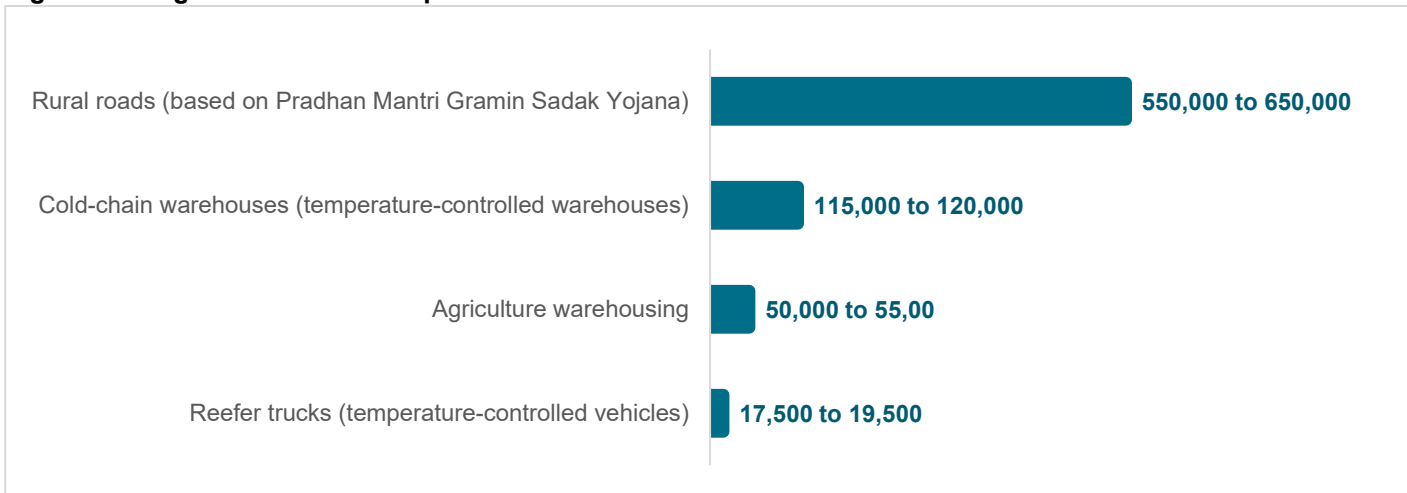
- E-commerce:** E-commerce platforms have pushed up demand for processed food products, particularly among urban consumers, who are looking for convenience and variety. E-commerce has opened new market opportunities for food processing companies, helping them expand their customer base. It has increased transparency in the food processing sector by enabling consumers to access information on products, ingredients and nutritional content online. It has created job opportunities in the food processing sector, particularly in logistics, packaging and customer service. On the flip side, e-commerce has increased competition from the unorganised sector, with many SMEs entering the market to compete with established players

Select major segments expected to see Rs 7.5-8.5 lakh crore investment between FY25 and FY47

Crisil Intelligence has identified the following key infrastructure and logistics gaps that support the food processing industry:

- Cold chain infrastructure:** The cold chain infrastructure in India faces several challenges, including scarcity of facilities, limited refrigerated transportation options and non-availability of chilled thermally insulated transportation for long distances. Complex licensing requirements for cold chain storage facilities create additional hurdles. The high operating cost of cold storage facilities, driven by high electricity cost, also poses a significant challenge.
- Limited warehousing capacity:** The limited warehousing capacity for storing raw materials and finished goods exacerbates the problem, as it hinders the ability to effectively store and manage inventory.
- Rural infrastructure:** Rural logistical challenges pose a significant obstacle to the development of food processing infrastructure in India, with infrastructure bottlenecks in rural sourcing regions remaining a major concern. The lack of adequate roads and other essential infrastructure in these areas reduces the efficiency of transportation and raw materials handling, making it difficult to maintain quality and cut losses. This, in turn, can increase the cost for food processing companies that rely on rural sourcing.

Figure 41: Segment-wise break-up of investments needed between FY25 and FY47 in INR crores



Source: Crisil Intelligence

Table 21: Investments supporting current level of infrastructure and volume and investments required by fiscal 2047



Infrastructure	Volume of infrastructure		Estimated investment in INR crores	
	Available in FY24	Needed by FY47	FY19-24	FY25-47
Cold chain warehousing or temperature-controlled warehousing	37 million metric tonnes (gap: ~10 million tonnes)	85 million metric tonnes	3,800-4,300	1.15-1.2 lakh
Temperature-controlled vehicles or reefer vehicles	0.126 million metric tonnes (24,000 vehicles)	~460,000 metric tonnes (72,500 vehicles)	2,800-3,300	17,500-19,500
Rural roads connectivity	~7,60,000 km	~12,43,500 km	1.4-1.5 lakh	5.5-6.5 lakh
Agricultural warehousing	~149-150 million metric tonnes	~260-265 million metric tonnes	6,500-7,000	50,000-55,000
Total				7.5-8.5 lakh



Source: Crisil Intelligence

Investment required for advanced infrastructure estimated to be significantly higher than Rs 7.5-8.5 lakh crore

Based on the comparison with infrastructure facilities in countries such as the United States, required investment in advanced infrastructure in the food processing sector expected to be much higher than Rs 7.5-8.5 lakh crore. A comparison of refrigerated warehousing and grain warehousing capacity in both the countries show that, India should have an estimated ~140-150 million tonnes of cold chain warehousing storage only for food as against 37 million tonnes it has as of now (which includes 10-15% for pharmaceutical products as well). The country should have an agricultural warehousing capacity of ~900-1,000 million tonnes vs ~150 million tonnes available as of now.

Table 22: Comparison of select infrastructure in the US and India

Parameter	Volume of current infrastructure available (FY24) in million tonnes		India's requirement based on comparison with the US
	 US	 India	
1 Cold chain warehousing or temperature-controlled warehousing	>30 (~3000 million cubic feet)	~37 to 40 (incl. 10-15% for pharma purposes)	<ul style="list-style-type: none"> India's primary fruit & vegetable production: 4.5 to 5 times of the US (FAO data) India's requirement: 4.5 to 5 times of the US, that is: ~140-150 million tonnes

Parameter	Volume of current infrastructure available (FY24) in million tonnes		India's requirement based on comparison with the US
	 US	 India	
2 Agricultural warehousing	553 (grain storage capacity)	~149 to 150	<ul style="list-style-type: none"> India's crop production: ~1.8 times of the US (FAO data) India's requirement: ~1.8 times of the US, that is: ~900-1,000 million tonnes

Source: *Crisil Intelligence*

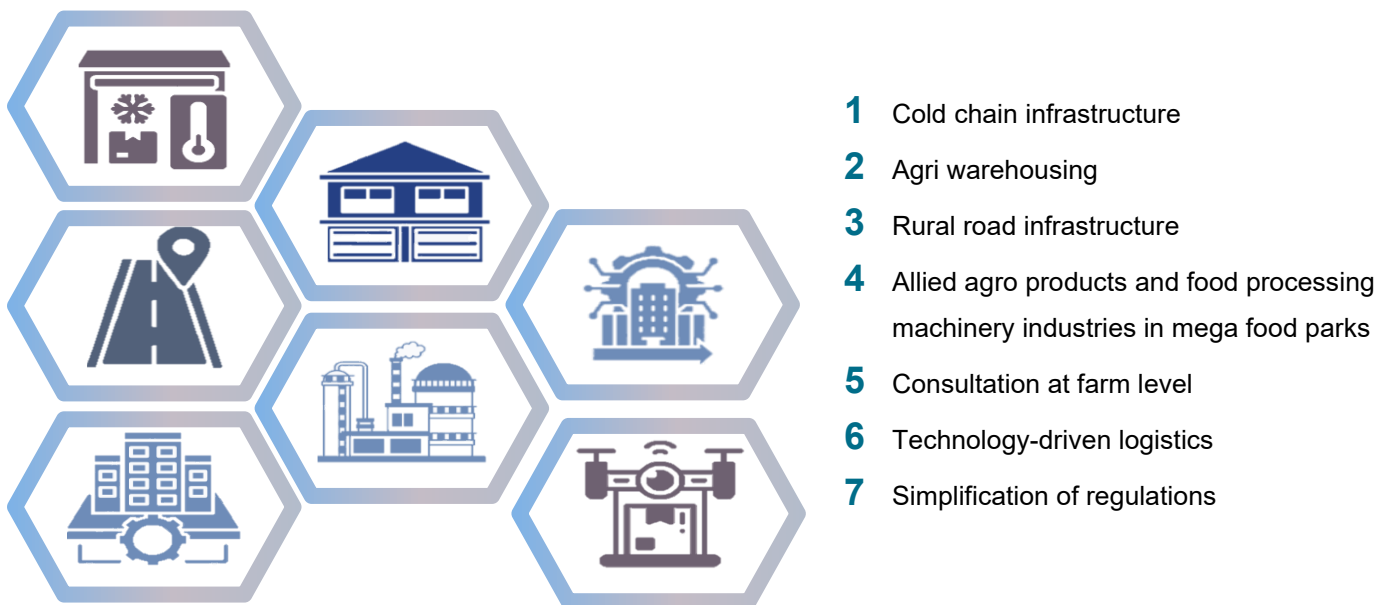
10. Recommendations

Strengthening cold chain infrastructure and rural connectivity and implementing technology key to growth of domestic food processing sector

India's food processing industry has immense potential, but infrastructure and logistic bottlenecks continue to hinder its growth. Addressing inefficiencies in cold-chain networks, agriculture-warehousing, rural connectivity and food processing clusters is crucial to reducing post-harvest losses and improving supply-chain integration. Additionally, implementing consultation at the farm level considering a particular region's requirements and advanced technology solutions can enhance efficiency, sustainability and global competitiveness.

To realise this, a multi-pronged strategy focusing on infrastructure expansion, digital integration and policy support is essential.

The following recommendations provide a roadmap for optimising India's food processing sector, ensuring seamless market access and long-term industry growth:



Source: Crisil Intelligence

1. Strengthening cold chain infrastructure: Ensuring temperature-optimised supply chains

Lack of extensive availability of efficient cold chains remains a critical bottleneck in domestic food processing industry, leading to significant post-harvest losses in perishable goods. To address this, a tech-driven cold chain infrastructure must be developed, integrating pre-cooling units at farm gates, temperature-controlled storage facilities and energy-efficient refrigerated transportation. Also, the adoption of solar-powered cold storage in rural areas can reduce dependency on erratic power supply, while cryogenic cooling and phase-change-material-based storage can enhance energy efficiency. Additionally, AI-powered predictive analytics can optimise cold chain routes, ensuring real-time temperature monitoring through IoT-enabled reefer trucks. PPPs should be encouraged to develop cold storage clusters near food processing hubs, with the government incentivising startups investing in sustainable cold logistics. Implementing blockchain for

temperature compliance tracking can ensure product integrity, improving both domestic and export market acceptance as well.

2. Agricultural warehouse modernisation: Enhancing storage efficiency with smart infrastructure

A fragmented and inadequate warehousing system disrupts supply chain efficiency in India's food processing sector. Modernising agricultural warehouses with automated storage and retrieval systems, robotic inventory management and climate-controlled bulk storage are essential for reducing spoilage and enhancing value retention. Grain silos with aeration systems should replace traditional godowns to maintain quality, while digital warehouse management systems can streamline operations, improving traceability. Also, investment in rural godowns under the National Bank for Agriculture and Rural Development's Rural Infrastructure Development Fund should be expanded, ensuring strategic warehouse placement close to production clusters. Integrated warehousing models, combining dry storage with cold chain solutions, can serve as multi-functional hubs for processors. Furthermore, commodity-based warehousing with collateral management services can empower farmers and processors with access to working capital through warehouse-receipt financing.

3. Strengthening rural road connectivity: Reducing transit time and enhancing market linkages

The efficiency of the food processing supply chain is directly linked to the quality of rural road infrastructure, as majority of the country's agricultural produce originates from remote regions. Strengthening rural roads under PMGSY must be accelerated, with a focus on all-weather connectivity to key processing hubs and major markets. Also, the use of geotextiles and fibre-reinforced concrete can enhance road durability in flood-prone regions. Implementing GIS-based route planning can optimise logistics networks, reducing transit costs and food wastage. Dedicated agri-transport corridors should be developed, connecting high-production zones to food processing clusters. Additionally, rural road maintenance contracts with performance-based incentives can ensure long-term sustainability. And the deployment of sensor-based road quality monitoring can help identify bottlenecks and enhance last-mile connectivity, ensuring smoother logistics operations.

4. Increasing utilisation of mega food parks with entry of food processing machinery players and allied agro-based product industries

The government's Mega Food Parks Scheme (MFPS) has the potential to transform India's food processing sector. But its full impact is limited as of now because of slow implementation. By allowing food processing machinery companies to set up operations within mega food parks, the occupancy rates of these parks can increase significantly. This can lead to better utilisation of infrastructure and resources, making the parks more viable and sustainable. The presence of food processing machinery companies can also create new job opportunities in the manufacturing, maintenance and operation of food processing equipment, contributing to the overall employment generation in the region. This can also enable just-in-time delivery of equipment and spare parts, improving the overall efficiency of the food processing operations.

Allowing allied agro-based product industries, such as organic hair oils, creams and other personal care products, to set up operations within mega food parks can be a great way to boost occupancy and create a more diverse and vibrant ecosystem. By offering a diverse range of products and services, mega food parks can differentiate themselves from other industrial parks and attract more businesses, investors and customers. Some examples of such products are organic hair oil and creams, cosmetics and personal care products made of natural ingredients, aromatherapy products made of natural ingredients etc.

5. Agriculture consultants based on regional requirements: Empowering rural value addition

Agri consultants and solution providers can be appointed for specific regions to provide region-specific guidance and training to farmers. These consultants can help farmers adopt best practices, improve crop yields and reduce post-harvest losses. To implement this model, agri-graduates can be engaged and funded to work with farmers, providing them the

necessary skills and knowledge. Reaching out to agricultural universities, colleges and research institutions across India to explore potential partnerships can be looked at. Institutions with strong educational programmes in agriculture, horticulture and related fields should be selected. Training programmes should be developed for agri-graduates and students to equip them with the necessary skills and knowledge to work as consultants at the farmer level. They should then be deployed ensuring that they are familiar with the local language, culture and agricultural practices. A technology-enabled platform to facilitate communication, data collection and knowledge sharing between consultants, farmers and other stakeholders should be developed. Additionally, regional hubs or centres of excellence should be set up. These can serve as a base for consultants, providing them access to resources, expertise and infrastructure.

To strengthen the agriculture value chain, safe storage methods can be introduced for farmers through local collection centres, where farmers can come together to store and manage their produce by aggregating supply locally. Another major challenge faced by farmers is high transportation costs. Cooperatives or farmer producer organisations (FPOs) can pool their resources to negotiate better transportation rates, reducing costs for individual farmers. Helping farmers create rural transportation hubs can provide a centralised location for farmers to store and transport their produce, reducing costs and improving efficiency.

6. Implementing technology-driven smart logistics: Leveraging AI, IoT and blockchain for supply chain optimisation

Adoption of AI, IoT and blockchain in logistics can transform India's food processing supply chain, reduce inefficiencies and improve traceability. AI-driven demand forecasting models can optimise inventory planning, thereby minimising supply-demand mismatches. IoT-enabled sensors in warehouses and cold chain logistics can provide real-time monitoring of temperature and humidity, reducing spoilage. Blockchain-based traceability systems can ensure food safety compliance by tracking products from farm to fork, boosting export credibility. Automated guided vehicles and robotic process automation in warehouses can enhance logistics speed and accuracy. Additionally, integrating RFID tagging and GPS-based fleet management can streamline transportation, ensuring just-in-time deliveries. To support widespread adoption, the government should provide financial incentives for technology-driven logistics modernisation and promote industry collaborations for smart logistics infrastructure development.

7. Removing regulatory hurdles: Simplification of regulations and strict implementation of food safety standards

There is a need to establish a single window clearance system to reduce bureaucratic hurdles and improve the speed of clearances for food exports or even the setting up of a food processing unit. In terms of implementation of food safety regulations, enforcement is often inadequate, leading to widespread non-compliance. Many food processing units, especially SMEs, lack the necessary infrastructure, equipment and trained personnel to ensure food safety. Also, Stricter food safety regulations can reduce the incidence of foodborne illnesses and improve consumer health. In fact, effective enforcement of food safety regulations can increase consumer trust in the food industry, leading to increased sales and revenue.

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Crisil Limited: Lightbridge IT Park, Saki Vihar Road, Andheri East, Mumbai 400 072, India

Phone: +91 22 6137 3000 | <https://Intelligence.Crisil.com>

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