

UNLOCKING THE NEXT PHASE OF INDIA'S COLD CHAIN

From Infrastructure to
Integrated Growth

Knowledge Paper 2026





From Capacity to Capability: Assessment of India's Cold Chain Network

Foreword

“

India’s cold-chain sector is entering an important phase of growth, and the maritime sector will be central to this journey. As India expands its exports of pharmaceuticals, seafood, processed food and high-value agricultural products, ports and shipping lines are increasingly important in ensuring that temperature-sensitive cargo moves safely and efficiently from Indian producers to global markets. A strong maritime cold-chain network can strengthen India’s export competitiveness while opening new opportunities for trade.

India has made good progress in developing cold-chain and reefer infrastructure. The next step is to strengthen the connection between cold storage, transport, ports and shipping services. For the maritime industry, this means creating efficient systems for handling reefer cargo, improving availability of reefer plugs and supporting faster movement of temperature-sensitive consignments through terminals and port facilities.

Technology is also becoming an important part of this transformation. Modern reefer containers, real-time temperature monitoring, remote tracking and improved cargo-management systems are helping shipping lines, terminals and exporters maintain greater visibility over sensitive cargo. Wider adoption of these technologies can improve reliability, reduce risks during handling and transit, and provide greater confidence to exporters and international buyers.

India’s ports can therefore evolve into integrated cold-chain gateways rather than functioning only as points of cargo handling. Better coordination between port terminals, shipping lines, customs, railways, road transporters, warehouses and exporters can create smoother cargo flows between the hinterland and the vessel. Investments in port-side cold storage, reefer plug capacity, faster evacuation, multimodal connectivity and digital tracking will help build a more efficient maritime cold chain and further strengthen India’s position as a reliable global trade and logistics hub.



Saandip Wadhwa
Chairman, Logistics and Warehousing Council, ASSOCHAM
Group Director, JM Baxi

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India’s cold-chain ecosystem is evolving rapidly, with a growing focus on the safe, timely and reliable movement of temperature-sensitive goods across domestic and international markets. For pharmaceuticals, vaccines, fresh horticulture, floriculture and marine products, maintaining the right temperature throughout the journey is essential to preserving quality and value.

Air cargo plays an important role in supporting these time-sensitive supply chains. Its speed and global reach make it well suited for high-value and temperature-sensitive products. As India becomes more connected to global value chains, efficient and technology-enabled air logistics can give exporters the speed, reliability and market access they need.

For freight forwarders and air-logistics providers, the cold-chain journey begins well before cargo reaches the airport. Temperature-controlled shipments, airport-linked cold storage, specialised handling and efficient cargo movement, combined with close coordination among freight forwarders, airlines, airport operators and customs, help ensure a smooth journey from warehouse to aircraft. However, infrastructure for handling perishables, particularly at off-airport locations, remains a gap, while handling charges for such cargo also need to be rationalised to support competitive exports.

Technology is further improving visibility and reliability through real-time temperature monitoring, digital documentation and shipment tracking. When supported by temperature-controlled first- and last-mile transport, these solutions create a more connected journey between production centres, airports and global markets.

Ultimately, a strong air-cargo cold chain is about protecting the quality and value of every shipment. Whether it is a life-saving medicine, fresh produce or a high-value Indian product, getting it to the right place, at the right time and in the right condition is what matters. By working together, the industry can build a more connected and reliable cold-chain ecosystem and strengthen India’s ability to deliver to the world.



Vipin Vohra
Co-Chairman, Logistics and Warehousing Council, ASSOCHAM
Chairman, Continental Group

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Foreword

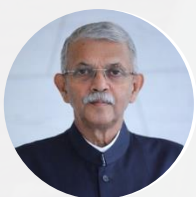
“India’s journey towards Viksit Bharat 2047 will depend not only on our ability to produce more, but equally on our ability to preserve, store and move what we produce efficiently. Cold chain and warehousing therefore represent far more than supporting infrastructure; they are critical enablers of food security, agricultural value addition, manufacturing, trade and consumer access.

India has made meaningful progress in strengthening this ecosystem. The next phase must focus on quality, integration and efficiency, rather than capacity alone. Modern warehouses and temperature-controlled facilities need to be better connected with processing centres, transport networks, markets and export gateways. Energy-efficient refrigeration, automation, real-time monitoring, scientific inventory management and better handling practices will increasingly determine the reliability and competitiveness of these supply chains. This is particularly important as India seeks to improve logistics efficiency further.

Ultimately, the success of cold chain and warehousing should not be measured only by the infrastructure created, but by the value preserved, wastage reduced, shelf life extended and market opportunities enabled. It is this shift, from capacity creation to value preservation and efficient supply-chain management, that can make the sector a stronger contributor to farmer incomes, food processing, exports and sustainable economic growth.

This Knowledge Report by ASCELA, in association with ASSOCHAM, is therefore timely. It brings together industry perspectives, emerging trends and practical insights at a crucial stage in the evolution of India’s cold chain and warehousing ecosystem.

I hope it serves as a useful reference for policymakers, industry leaders, investors and technology providers, and more importantly, encourages greater collaboration and investment towards building resilient, efficient, sustainable and future-ready cold chain and warehousing infrastructure for Viksit Bharat.”



Saurabh Sanyal
Secretary General, ASSOCHAM





Preface



India's cold chain has moved from a support function to a strategic asset. As rapid economic growth, technological change and rising sustainability expectations converge, temperature-controlled infrastructure now underpins food security, public health and export competitiveness. It determines how much of what the country produces reaches a market in sellable condition, and at what cost.

The past year marked a turning point for cold chain logistics in India, characterised by notable advancements in air cargo infrastructure, multimodal connectivity and digital visibility platforms. These developments were supported by policy enablers such as the PMKSY, Krishi Udaan 2.0 and the India Cooling Action Plan, alongside strong private sector participation. As these reforms mature, the year ahead will be decisive for building resilient, technology-driven and climate-conscious cold chains that serve both domestic and global markets.

The gaps that remain are structural rather than incidental. Pre-cooling is scarce within reach of the farm gate, the reefer fleet meets only a fraction of demand, storage capacity is concentrated in a single crop, and loss is still estimated rather than measured. Closing these gaps calls for investment tied to utilisation, clearer accountability for outcomes, and infrastructure planned around where produce is grown and where it is consumed.

As Knowledge Partner to the ASSOCHAM conference on cold chain, ASCELA is proud to contribute strategic insights and research on the evolving dynamics of cold chain infrastructure, packaging innovations and green supply chains. Our knowledge paper, "Next-Gen Cold Chain: India's Blueprint for Speed, Integrity & Sustainability", presents actionable frameworks for strengthening competitiveness while advancing sustainability goals.

At ASCELA, we believe that transforming India's cold chain requires foresight, innovation and collaboration. Our goal is to provide clarity in a complex ecosystem, connecting policy vision with operational realities and sustainability imperatives so that cold chain infrastructure becomes a true competitive advantage for India. We extend our gratitude to our team, collaborators and stakeholders whose contributions continue to shape this dialogue.



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Strategic Roadmap:
Strengthening the Domestic
Cold Chain

01 India's Cold Economy: Strategic Importance and Growth Outlook

~USD 18.5 Bn
Estimated annual post-harvest loss

Source: MoFPI (2022)

Strategic Importance of Cold Chain for India

Strengthening Agricultural Resilience

367.7 MT

Agriculture employs 43% of India's workforce and produces 367.7 MTPA of horticultural output annually (FY-25).

Source: PIB

Preserving Economic Value

5-15% F&V PHL

Reducing 5–15% post-harvest losses in F&V is a key opportunity for strengthening cold-chain efficiency.

Safeguarding Healthcare Supply Chains

~60% UNICEF Vaccines

India is world's 3rd-largest pharma industry by volume, supplying ~20% of global generics and ~60% of UNICEF's vaccines.

Leap Towards Cold Chain

Rising Consumption



Urbanisation & retail growth are lifting demand for packaged, frozen food.

Quick Commerce



India's e-commerce market is projected to cross ~USD 345 Bn by 2030.

Healthcare Formalisation



CDSCO's Revised Schedule M mandates upgraded, validated cold-chain storage across India's pharma manufacturing base.

Export Growth



Agriculture contributes nearly one-fifth of India's GVA, with exports reaching ~USD 52.55 Bn in FY-26.

Source: Economic Survey, 2024

Source: PIB

Source: PIB

KEY GROWTH DRIVERS

Government Schemes and Subsidies

408 projects

- PMKSY Integrated Cold Chain support, with ~USD 126.22 Mn funds utilised as of January 2026.
- Scheme cover extends across pack-houses, reefer transport and ripening chambers.

Expanding Feedstock Base

2nd largest globally

- India ranks second worldwide in fruit and vegetable production.
- Output is broadening beyond potato to fruit, dairy and fish.

Private-Sector Investment

~92% share

- Private players hold 92% of India's cold storage facilities out of 8,815 facilities and 40.21 MT capacity.
- Pharma and quick-commerce demand is pulling capital into multi-temperature capacity.

Source: PIB; MoFPI

Enablers To Watch

Policy and Capital

- PMKSY, viability gap funding and priority-sector credit are making new capacity bankable..

Standards

- Common operating standards and ready project templates can reduce compliance gaps and improve reliability.

Technology

- Energy-efficient refrigerants, solar-backed cold rooms and IoT monitoring lower operating cost per MT.

Skills

- Trained technicians and operators at scale are essential to sustain uptime and product integrity.

Growth Outlook To 2030

Capacity Mix and Quality



40.21 MT installed

- ✓ Installed base is dominated by single-commodity potato. Multi-temperature, multi-product capacity remains limited.
- ✓ Pack-houses, reefer vehicles and ripening chambers are the binding first-mile constraint, not bulk storage.

Regional Rebalancing



8,815 facilities

- ✓ Capacity is concentrated in a few surplus states, while consumption clusters and the north-east remain underserved.
- ✓ Corridor led build out near production belts shortens first-mile haulage and cuts handling loss.

New Demand Pools

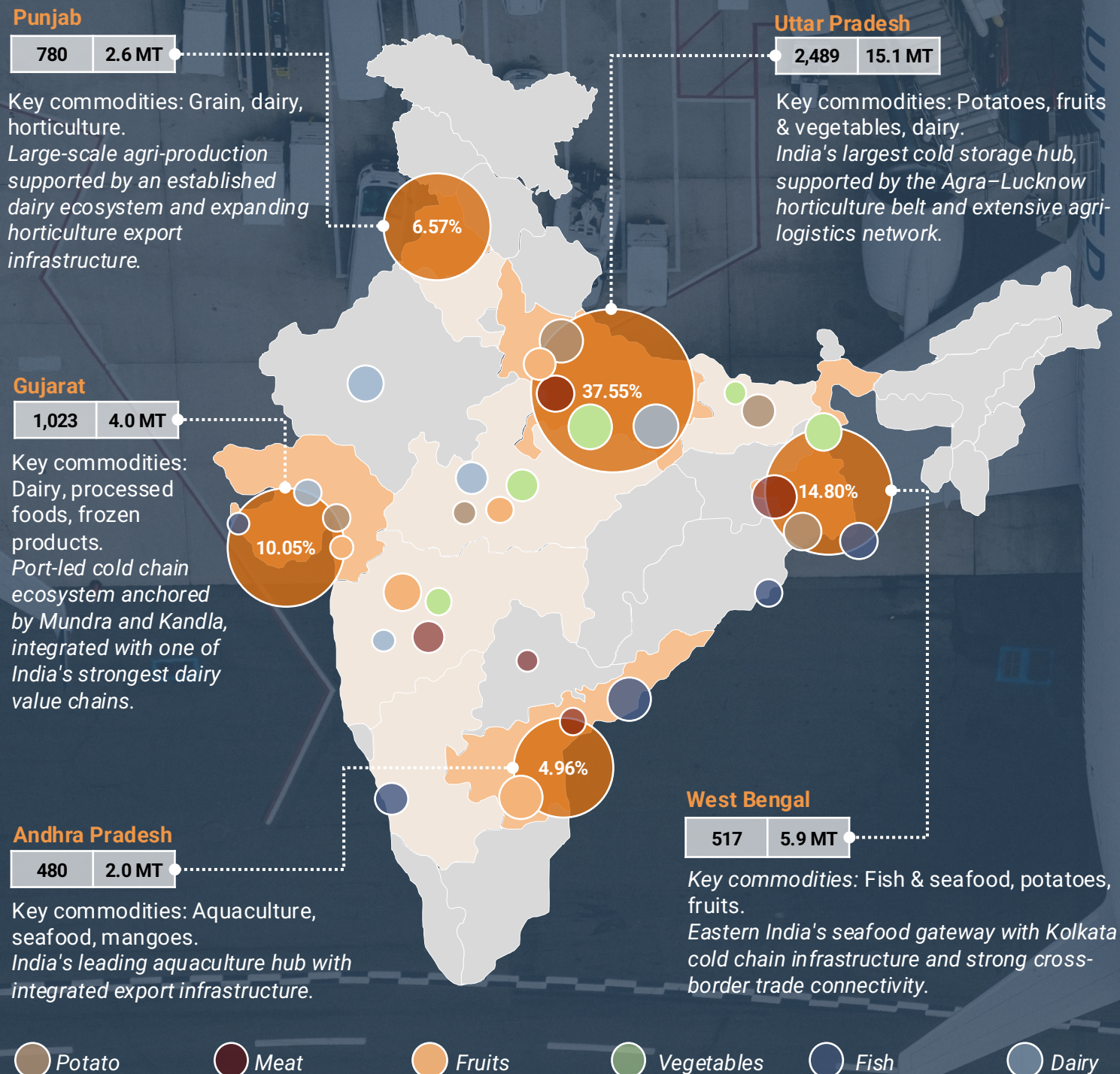


Pharma and quick commerce

- ✓ Vaccines, biologics and specialty drugs need validated 2-8°C chains with continuous temperature traceability.
- ✓ Quick commerce is pushing micro-fulfilment cold rooms and dark-store capacity into urban catchments.

02 The Domestic Market: Commodities, Infrastructure and Regional Dynamics

As of 2025, India's cold chain ecosystem comprises 8,815 cold storage facilities (40.21 MT capacity). It is further supported by 408 PMKSY-approved integrated cold chain projects (291 operational as of March 2026).



~40.21 MT

Cold storage capacity as of June 2025

8,815

Cold storage units as of June 2025

Commodity Focus

Potato

58.57 MTPA (produce)

Uttar Pradesh, West Bengal, Bihar

Multi-chamber cold storage required

Dairy

247.87 MTPA (produce)

Uttar Pradesh, Rajasthan, Madhya Pradesh

Milk chilling centres and reefer transport

Horticulture

367.7 MTPA (produce)

Uttar Pradesh, Maharashtra, West Bengal

Pre-cooling, packhouses and ripening chambers

Fish

19.5 MTPA (produce)

Andhra Pradesh, West Bengal, Karnataka

Blast freezing, IQF and reefer logistics

Pharma

~USD 60 Bn (domestic)

Gujarat, Telangana, Himachal Pradesh

Temperature-controlled storage and reefer transport



Opportunities

- ✓ **Unlock high-value horticulture & floriculture exports:** India's floriculture sector contributes only **0.6%** of global flower exports despite being the **world's second-largest** flower producer. Expanding pre-cooling, packhouses and airport-linked cold chains can unlock export growth, as demonstrated by Sikkim's orchid value chain.
- ✓ **Infrastructure Reduces Food Loss:** Maharashtra recorded lower **grape losses (6.73%)** than **Karnataka (8.02%)**, supported by 158 APEDA-approved packhouses, food-testing labs and export-oriented cold chain infrastructure. This demonstrates **how integrated infrastructure directly improves supply chain efficiency**.

%

State's share of India's total cold storage capacity (%)

Source: Ministry of Agriculture and Farmers Welfare, 2025

No. of Cold Storages

Capacity in Million Tonnes

Global Best Practice in Air and Sea Cold Chain Gateways

Brussels · BRU · AIR
Co-created IATA CEIV Pharma; first airport where the whole cargo community was certified, not one warehouse.
Source: IATA

Singapore · Changi · AIR
The first air cargo community in Asia Pacific to attain the IATA CEIV Pharma certification
Source: Asia Cargo News

Rotterdam · RTM · SEA
Cold storage sited at the container terminal, cutting handovers between quay and store.
Source: Container News, 2025

Commodity Flows and Destination Markets

Cold Chain Commodity	Leading Export Markets	Concentration Problem
Meat, poultry and seafood	UAE, Vietnam, China, Egypt, Malaysia	› The UAE and the USA appear in three of the four commodity groups. › India's cold chain exports depend heavily on meeting the import standards of few destination markets.
Plants, flowers, fruit and vegetables	UAE, China, Netherlands, Iraq, USA	
Bakery products	USA, UAE, UK, Canada, Kenya	
Pharmaceuticals	USA, Europe, Nigeria, Mexico, Tanzania, Brazil, Sri Lanka, Saudi Arabia	

Source: CAPEXIL, Temperature Sensitive Cargo: Infrastructure & Clearance Procedure Reform FY25

India's Trade Deals that Need Cold Chain Integration

India – United States
Interim Trade Agreement · Feb 2026

Goods: Marine products, fruits and vegetables
Implication: Improved market access could strengthen the competitiveness of Indian shrimp, fresh produce and other perishable exports in the US market.
Source: PIB, Ministry of Commerce, Feb 2026

India – European Union
FTA concluded · Jan 2026

Goods: Marine products, pharmaceuticals
Implication: EU marine duties of up to 26% fall to zero, plus enhanced access to an ~USD 573 Bn pharma and medtech market.
Source: PIB, Mar 2026; MoC India–EU FTA

India – Oman
CEPA signed · Dec 2025

Goods: Marine products, meat, pharmaceuticals
Implication: Duty-free from day one on 98.08% of tariff lines covering 99.38% of export value; marine duties of 0–5% removed.
Source: PIB, India–Oman CEPA, Jan 2026

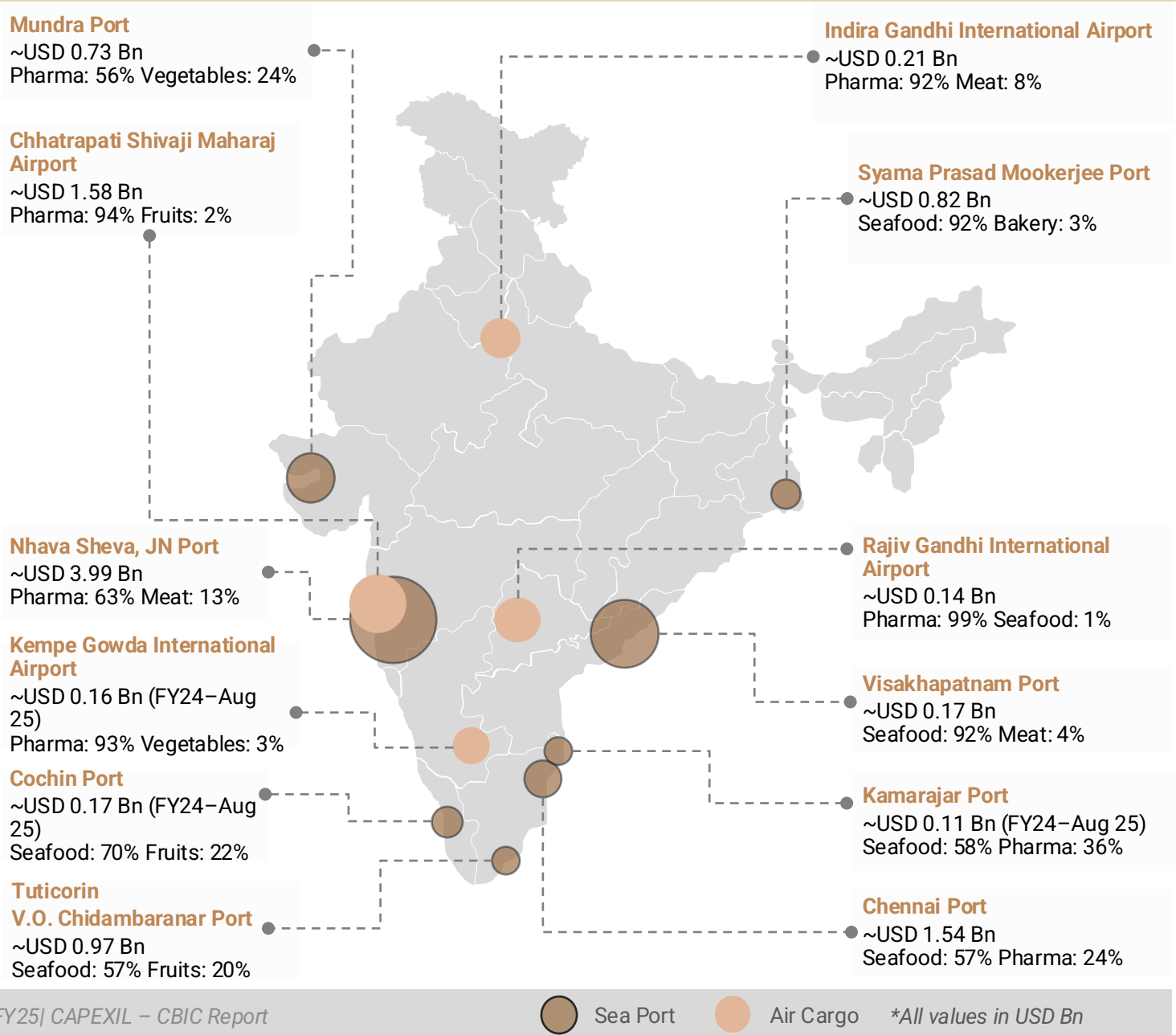
India – United Kingdom
CETA in force · 2026

Goods: Marine products, pharmaceuticals
Implication: Shrimp duties of 4.2–8.5% removed and 56 pharma tariff lines at zero duty. India holds 2.25% of the UK's ~USD 5.4 Bn seafood import market.
Source: PIB Pharma Paper, Mar 2026; UK CETA

03 Trade Dynamics: Exports, Trade Corridors and Competitiveness

Export Gateways

- ✓ Western gateways Nhava Sheva port, Chhatrapati Shivaji Maharaj airport and Mundra port account for ~46% of export value, including ~USD 21 Bn in pharmaceutical exports.
- ✓ Perishable exports are concentrated across air and container gateways, while seafood exports are primarily routed through east and south coast ports.



India's Port Performance

- › Container dwell time 3 days vs USA 7 days and Germany 10 days.
 - › Among the world's shortest import dwell times.
 - › Major-port turnaround down 49% in a decade.
- Source: World Bank LPI 2.0 (2023–24); PIB Sep 2025; Niti Ayog, PIB (2022)

Structural Capability Gaps

- › ~USD 110 Mn (2022) post-harvest losses from cold chain gaps.
- › Most reefer vehicles are concentrated in tier-1 and tier-2 regions.
- › Only ~4 % of perishables move through the cold chain.

04 Connecting the Cold Chain: Logistics and Multimodal Integration



Connectivity Gap Analysis

India's cold-chain market is expanding rapidly, yet infrastructure remains fragmented and unevenly connected, creating gaps across the system.

43.7 MT with 2.2% CAGR
Projected Cold-Storage Capacity by 2031
indicating slow expansion against needs

Source: NCCD; MoFPI

50% of PMKSY ripening chambers: Maharashtra
38% of cold storage capacity: Uttar Pradesh
highlighting the extensive concentration gaps.

Insufficient reefer plug points, inadequate cold storage at airports/ports, and slow transfer to warehouses expose cargo to ambient temperatures.

Gaps in end-to-end digital tracking and reliance on manual handling disrupt cold-chain visibility, increasing the risk of temperature excursions and spoilage.

Despite digital systems, multiple regulatory clearances and non-prioritisation of perishables reduces product shelf life and increases costs.

India's reefer fleet capacity is concentrated in major urban and export hubs, leaving hinterland and farm-gate connectivity underserved.

✓ Estimated Cold Storage Gap

3.2 MT: 2015

4.8 MT: 2025



50% increase showing the critical cold chain infrastructure limitation.

- ✓ Processing capacity under PMKSY is 4.4 times higher than preservation capacity, pointing to a relative shortage of storage and temperature-controlled infrastructure.
- ✓ Despite 35 airports having cold storage facilities in India, high cost and connectivity remain a critical gap.

Source: MoFPI



The Evolving Cold Chain

~USD 8.46 Bn

- › An all-time high record of seafood exports in FY 2025-26.
- › Demonstrates the evolving cold chain connectivity in India.

Source: MoCI



Roadways

- ✓ India's first **airside reefer truck** launched at RGIA with a 10-tonne payload capacity.
- ✓ Bobba Logistics is testing **cooling vests** and **mini-refrigerated backpacks** for temperature-controlled last-mile delivery.



Reefer Facilities

- ✓ Kuehne+Nagel launched a new temperature-controlled airfreight cross dock facility in Hyderabad.
- ✓ CONCOR Dadri is developing reefer facility with 2,440 MT capacity, 150 reefer plug points and 45 **dedicated power packs**.



Railways

- ✓ CONCOR launches the '**Aushadhi Express**' to link Hyderabad pharma hubs to JNPA.
- ✓ CONCOR demonstrated **double-stack reefer container** movement from MMLP Dadri to JNPA.

Major Industrial Corridors and their Connectivity to MMLPs and Ports

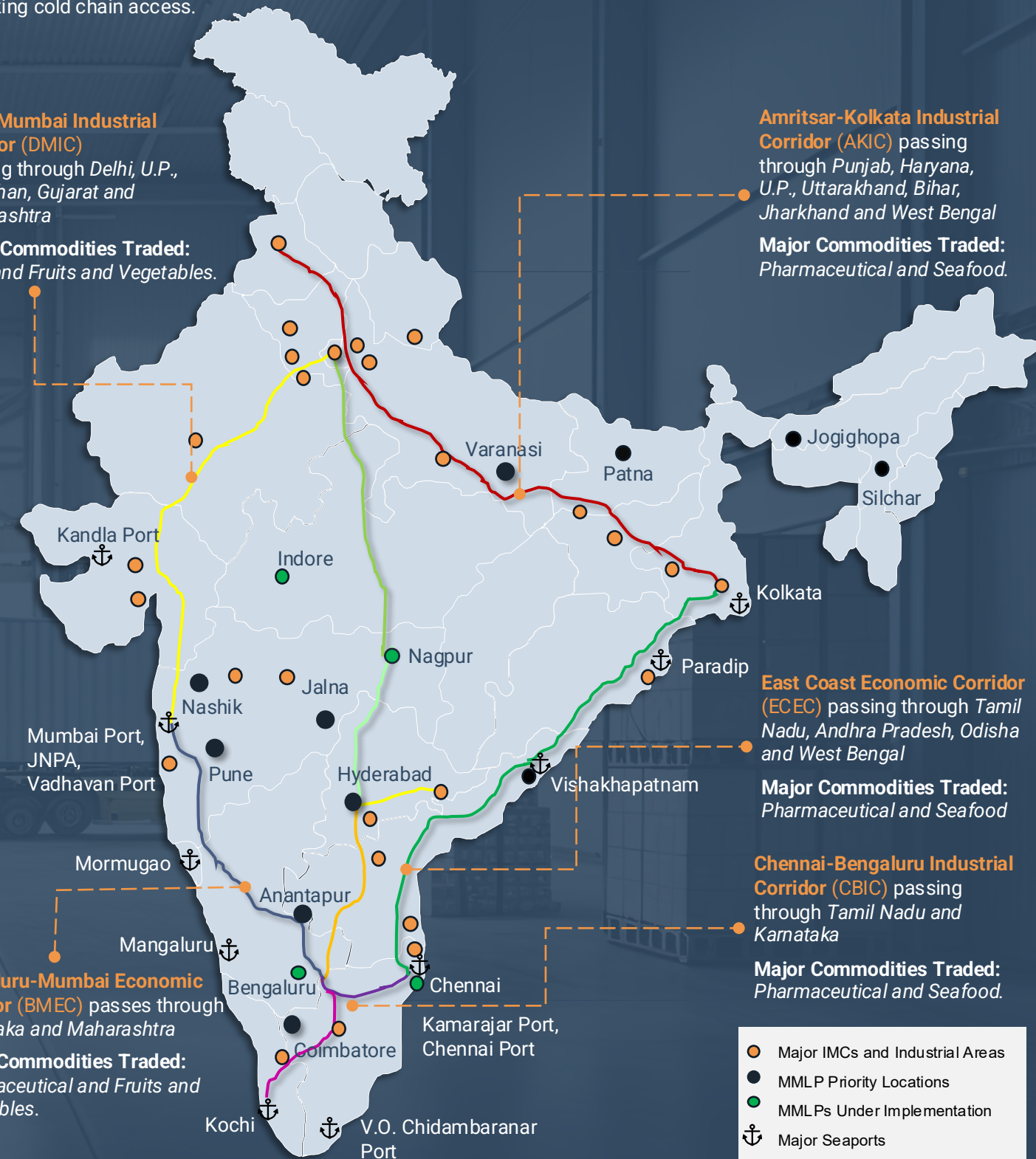
- ✓ All the MMLPs will have cold chain infrastructure facilitating production and logistics.
- ✓ Central and the Northeast are under-penetrated cold chain markets, part of the 34% of India's agricultural output still lacking cold chain access.

Delhi-Mumbai Industrial Corridor (DMIC)
passing through Delhi, U.P., Rajasthan, Gujarat and Maharashtra

Major Commodities Traded:
Dairy and Fruits and Vegetables.

Amritsar-Kolkata Industrial Corridor (AKIC) passing through Punjab, Haryana, U.P., Uttarakhand, Bihar, Jharkhand and West Bengal

Major Commodities Traded:
Pharmaceutical and Seafood.



East Coast Economic Corridor (ECEC) passing through Tamil Nadu, Andhra Pradesh, Odisha and West Bengal

Major Commodities Traded:
Pharmaceutical and Seafood

Chennai-Bengaluru Industrial Corridor (CBIC) passing through Tamil Nadu and Karnataka

Major Commodities Traded:
Pharmaceutical and Seafood.



Key initiatives by the Government of India

Cold Chain Infrastructure and Value Addition through PMKSY

Authority: Ministry of Agriculture & Farmers Welfare

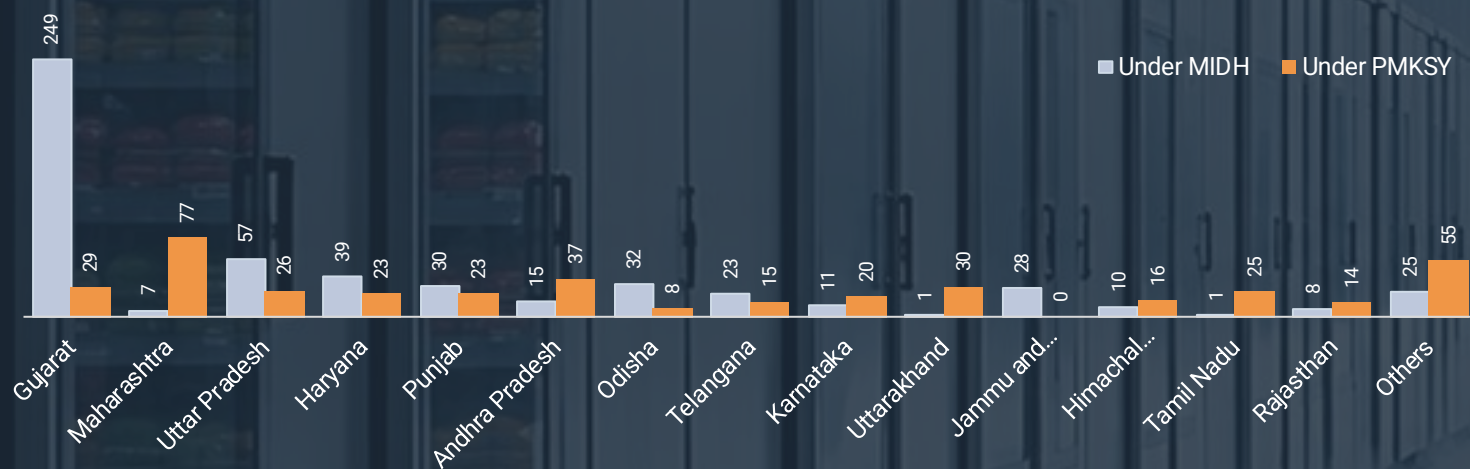
Focus on creating modern post-harvest and processing infrastructure with efficient supply chain management.

Mission for Integrated Development of Horticulture (MIDH)

Authority: Ministry of Agriculture & Farmers Welfare

The initiative focuses on post-harvest management infrastructure, including cold storage, pack houses and ripening chambers.

State-wise Cold Chain Projects approved under the PMKSY and MIDH



Source: Ministry of Food Processing Industries, Ministry of Agriculture and Farmers Welfare

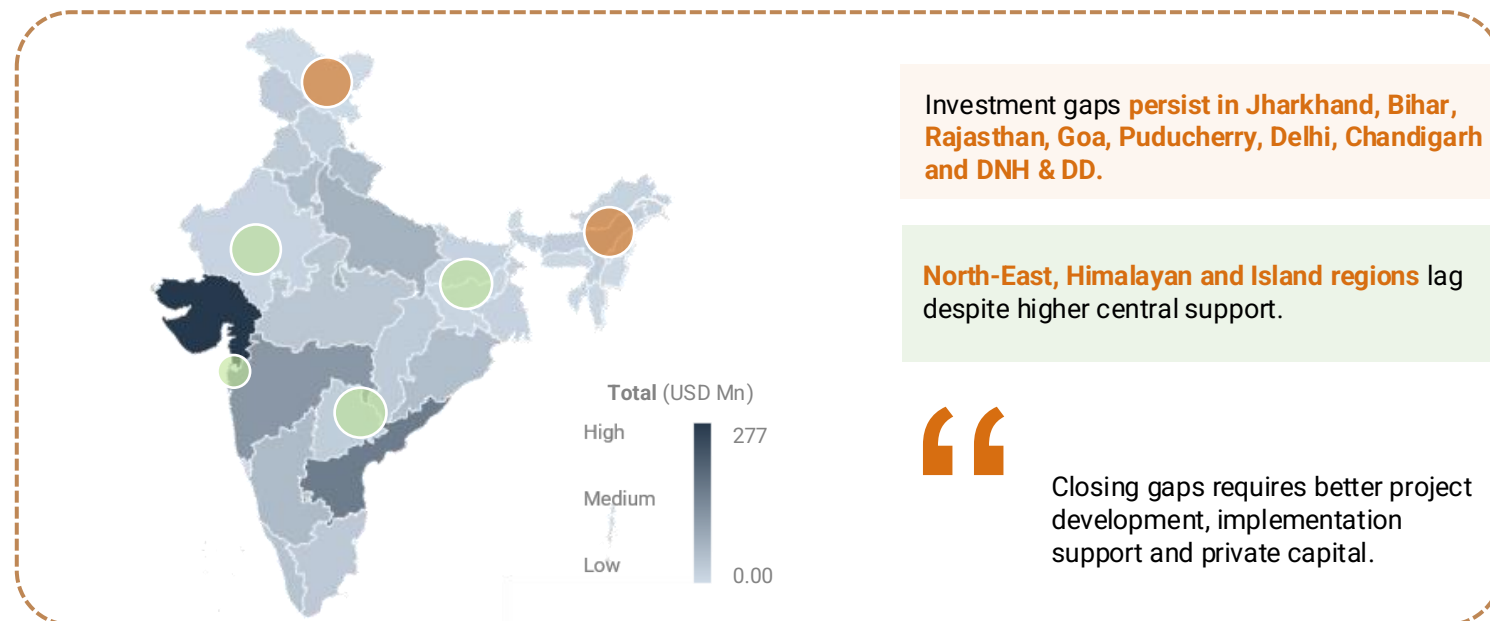


Incentives supporting cold chain development

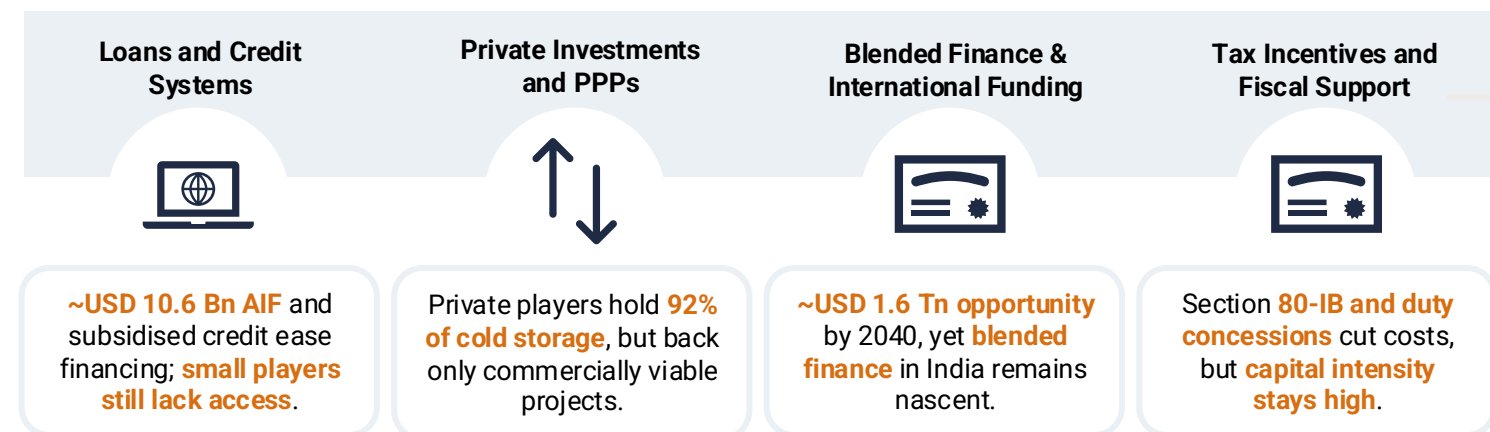
	Scheme	Category	Subsidy / Rate
01	PMKSY Integrated Cold Chain	Integrated cold chain, storage & transport infrastructure	35% (General Areas); 50% (NE/Himalayan/ITDP/Islands); Up to ~USD 1.05 Mn/project
02	MIDH NHM and HMNEH NHB – Capital Investment Subsidy	Cold storage & reefer transport (up to 5,000 MT) Cold storage (5,000–20,000 MT)	35% (General Areas); 50% (Hilly/NE/Scheduled Areas) 35% (General Areas); 50% (NE/Himalayan/Scheduled Areas)
03	AIF (Agriculture Infrastructure Fund)	Cold storage & post-harvest infrastructure	3% interest subvention (loans up to ~USD 0.21 Mn) + CGTMSE guarantee
04	PMMSY (PM Matsya Sampada Yojana)	Fisheries cold chain & post-harvest infrastructure	Capital grant: ~USD 2.09 Bn scheme outlay

05 Policy and Financing: The Investment Ecosystem

Investment Gaps



Financial Mechanisms



Enabling Reforms and Investment Opportunities

01 Scheme Convergence

- ✓ Align PMKSY, MIDH, PMMSY & other support around **integrated projects.**
- ✓ **Reduce overlap** across schemes and infrastructure components.
- ✓ Enable **coordinated project development** across the value chain.

02 Asset Utilisation

- ✓ **Link support with utilisation**, throughput and service performance.
- ✓ Promote **multi-user and multi-commodity** cold-chain facilities.
- ✓ Improve utilisation and **long-term commercial viability** of existing assets.

03 Regional Targeting

- ✓ **Prioritise persistent** cold-chain gaps across NE, Himalayan & island regions.
- ✓ Develop **cluster-based infrastructure** around production hubs.
- ✓ **Connect production clusters** with storage, distribution and transport networks.

06 Sustainability & Climate Resilience: Greening the Cold Chain



Greening the Cold Chain through Scalable Innovations, Smart Infrastructure, and Policy-backed Sustainable Logistics.

Potential Cold Chain Landscape

Policies Driving the Sustainable Push in Cold Chain

01 Green Innovations in Cold Storage



- ✓ Rooftop solar in cold stores – Snowman Logistics has **cut grid dependence** by ~30%, while premium PUF insulation **lowers thermal load** by up to 40%.

02 Reimagining Cold Storage



- ✓ In Dantewada (Chhattisgarh), ~USD 2.63 Mn, 2,500 MT cold store under PMKSY integrates blast freezers and transport support to **cut 7–20% wastage** and strengthen the “Bastar brand.”

03 Financing the Future



- ✓ Ecozen raised ~USD 13.15 Mn through debt financing to scale solar-powered **Ecofrost** cold rooms and IoT-linked cooling.



- ✓ Amul Solar Milk Chillers – Large-scale rollout in Gujarat, UP, and Rajasthan, **cutting diesel/grid reliance** and greening dairy cold chains.



- ✓ **Quick commerce** is driving dark-store cold rooms and electric reefers. For example - Delhivery tied up with EV start-up RIDEV to deploy 150 electric vehicles.



- ✓ Schmitz Cargobull’s strategic investment in **Sub Zero** bolsters its capabilities in India’s sustainable cold-chain logistics.

Challenges in Scaling Sustainable Cold Storage

Concentrated Capacity

~34% of cold chain revenue concentrated in UP, Maharashtra, West Bengal.

High Green Capital Costs

BEE 5-star gear and PUF panels cost more upfront, with 3–4 year payback period.

Energy & Refrigerants

Rising tariffs keep power the top uprating cost and low-GWP refrigerants uptake is slow.

PMKSY Cold Chain Scheme – Enhanced Outlay



An additional ~USD 202 Mn has taken the **PMKSY outlay to ~USD 690 Mn** for the 15th Finance Commission cycle, funding 35–50% grants for pre-cooling, cold stores, reefer transport and energy-efficient refrigeration.

BEE Star Labelling for Refrigeration – Mandatory from Jan 2026

BEE star labelling has been made mandatory **for chillers, deep freezers and commercial refrigeration**, barring sale of inefficient units and making efficiency a baseline design norm for new cold stores.



Rail & logistics measures – Kisan Rail and Perishable Cargo Centres



Indian Railways’ Kisan Rail and dedicated perishable cargo / temperature-controlled centres reduce transit time and losses (shifting freight from road to more efficient rail logistics) and create incentives for integrated cold transport.

Potential Opportunities

✓ Adoption of Low-GWP Refrigerants

Transition to ammonia, CO₂, hydrocarbons, and HFOs for sustainable operations.

✓ Decentralised Renewable Cold Storage

Solar farm-gate micro units can curb the annual production loss by ~40% from cold-chain gaps.

✓ Efficiency Gains through Digitisation

IoT and smart monitoring enabling energy savings and climate-resilient operations.

“

Digitalisation is no longer a back-office upgrade, it's the backbone of **Visibility**, **Traceability**, and **Trust** across India's cold chain

Future Technologies



Farm to Gate Innovation

Battery-less Solar Cold Room (Hydronic Thermal Storage)

- ✓ Maintain steady 2 to 4°C
- ✓ Reduction in operational cost by 40%

Hybrid Solar Room

- ✓ Heat transfer with **ICE CORE technology**
- ✓ Solar energy-based IoT-enabled, motor-controlled solutions with integrated data analytics



Processing Innovation

PCM Rapid-Chill Reactor

- ✓ Primary use in dairy and liquid processing
- ✓ Chill liquids from 35°C to 4°C in seconds using **Phase Change Materials** (PCM)

Last Mile Innovation

Passive Charge and Go Logistics

- ✓ Unlike diesel reefer trucks, **passive PCM Vending Units** use frozen thermal plates to maintain temperature and prevent thermal shock during delivery.

Digital Innovation

Edge AI Diagnostics

- ✓ **Edge AI-enabled** embedded systems predict motor failures days before they occur, enabling predictive maintenance.

07 Technology and Digitalisation: Enabling Supply Chain Visibility



Initiatives by the Government: Drive Towards Efficiency



Smart EXIM Warehouse System (introduced by AWC under Digital Transformation 2.0)

- ✓ System uses **AI, IoT, FASTag, OCR/ANPR, GNSS** and other technologies to automate warehouse operations
- ✓ Major components: Gate automation system, yard management with digital twin, smart inventory management

Bhandaran 360

- ✓ Built on **SAP S/4HANA**. Implemented ahead of schedule, the system integrates 41 modules covering HR, Finance, Marketing, Warehouse Management, and other core functions.
- ✓ Linked with 35 external systems, including ICEGATE, port systems, FCI, NAFED, NCCF and WDRA



Sheet Bharat Mission

- ✓ **One-stop digital platform** that connects cold-chain service providers with users seeking reliable cold storage and reefer vehicle solutions.



Initiatives by the Private Sector: Bringing Innovation to Life

Predictive Maintenance

- CMA CGM's **"Smart Reefer"** service integrates IoT with onboard control systems, ensuring optimal conditions
- Use of digital twin in cold chain infrastructure by Godrej

Digital Fleet

- TCS **DigiFleet™** enables stakeholders to monitor vaccine vials, predict excursions, track delivery ETAs
- Tech Mahindra has partnered with ParkourSC to offer AI-based digital supply chain tools

Blockchain

- IBM Food Trust partnered with Asia-Pacific seafood exporters to enable container-level **blockchain traceability**
- Walmart uses blockchain to trace contaminated fruit



Existing Challenges in the Cold Chain Sector in India



Fragmented Digital Infrastructure:

Lack of interoperability between platforms results in poor end-to-end visibility.



Poor Data Quality and Standardisation:

Different sensor manufacturers use proprietary protocols, complicating system integration.



Connectivity Constraints:

Unreliable network coverage in remote areas affects real-time monitoring.

Rebuilding the Future with Potential Opportunities

Development Opportunity

Scale IoT-enabled predictive maintenance across reefer fleets

Build integrated digital fleet platforms for real-time tracking

Leverage AI and blockchain for automated compliance and traceability

Investment Opportunity

Invest in AI-driven sensor analytics for real-time asset monitoring

Deploy digital twins and IoT-enabled cold storage monitoring

Invest in AI-powered demand forecasting and blockchain platforms

08 Strategic Roadmap: Strengthening the Domestic Cold Chain

Future Levers for Cold Chain Infrastructure in India

AI and Automation	- Automated grading and sorting with smart packaging to reduce handling losses. - Machine vision at pack-houses to standardise quality before dispatch.	Future Outlook Faster, Cheaper Handling Automation lifts throughput per shift and cuts damage in transit and storage. Auditable Cold Chains Digital records replace estimated loss data, making performance measurable. Lower Cost per Tonne Cleaner energy and return-load matching cut empty reefer running. Grants Tied to Utilisation Release linked to capacity used, not built.
Positive Outlook	- IoT and blockchain traceability. - Live temperature logging and digital records make every consignment auditable.	
Energy and Networks	- Solar-backed rural stores to cut running cost per tonne. - Refrigeration retrofits to lower the energy intensity of storage.	
Positive Outlook	- Integrated Networks and 3PL Growth - Multi-temperature 3PL hubs linking mandi supply with metro demand.	
Policy and Financing	- Grant release tied to capacity utilised, with viability funding for first-mile fleets. - Single-window clearance for cold chain projects across states.	
Positive Outlook	Published utilisation and loss baselines to benchmark performance across states.	

Positive Outlook Neutral Outlook

“Perishables are lost **before they ever leave the district**”

Enabling Conditions for Delivery

1 Site and Utility Readiness

- ✓ **Serviced plots** with assured power at mandis
- ✓ Plug-and-play **cold rooms on lease**

2 Enhancing Accountability

- ✓ Single **nodal agency** for cold chain
- ✓ Operating mandates at mandi level
- ✓ Pharma temperature records audited

3 Data-Driven Loss Assessment

- ✓ Losses based on **actual measurements**, not assumptions
- ✓ Storage utilisation tracked at the facility level

Phase 1: First-Mile Cooling and Haul Economics



Focus: Cluster pack-houses, field pre-cooling, return-load matching and energy cost at rural cold stores

Phase 2: Storage Depth and Market Pull



Focus: Multi-temperature storage beyond potato, Tier-2 hubs, mandi cold rooms and offtake-backed loading



Now · 0–18 months

2028

First-Mile Cooling



Cluster pack-houses with field pre-cooling to strip farm heat within hours.



Farmer collectives trained to harvest, sort and pack for the cold chain.



Standard crate and pallet protocols so loads move without repacking.

Cold Haul Economics



Return-load matching on agri corridors to cut empty reefer running.



Multi-temperature reefers carrying mixed produce on a single trip.



Reliable **grid plus rooftop solar** to cut running cost at rural cold stores.



Next · 18–42 months

2030

Storage Depth Beyond Potato



Storage capacity built for fruit, dairy and fish, not only potato.



Integrated **cold hubs in Tier-2 cities** close to consumption demand.



Use **ripening chambers at APMC** mandis to manage produce arrivals and stabilise prices.



Modular cold rooms sized for horticulture commodities near the farm gate.

Market Pull and Accountability



Grading standards priced into mandi trade, so quality earns a premium.



Advance offtake contracts from processors and retail keep cold stores full.

Reimagining India's Cold Chain: From Infrastructure Capacity to Supply Chain Capability

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State Bank of India (SBI) a Fortune 500 company, is an Indian Multinational, Public Sector Banking and Financial services statutory body headquartered in Mumbai. The rich heritage and legacy of over 200 years, accredits SBI as the most trusted Bank by Indians through generations.

We are the largest banking and financial services organization in India, with an asset base of over Rs. 61 trillion. We serve over 50 crore customers through our vast network of over 23,295 branches, 63,580 ATMs/ADWMs, 82,900 BC outlets, with an undeterred focus on innovation, and customer centricity, which stems from the core values of the Bank - Service, Transparency, Ethics, Politeness and Sustainability.

The Bank has successfully diversified businesses through its various subsidiaries i.e. SBI General Insurance, SBI Life Insurance, SBI Mutual Fund, SBI Card, etc. It has spread its presence globally and operates across time zones through 245 offices in 29 foreign countries.

Growing with times, SBI continues to redefine banking in India, as it aims to offer responsible and sustainable Banking solutions.



About ASSOCHAM

The Associated Chambers of Commerce & Industry of India (ASSOCHAM) is the country's oldest apex chamber. It brings in actionable insights to strengthen the Indian ecosystem, leveraging its network of more than 4,50,000 members, of which MSMEs represent a large segment. With a strong presence in states, and key cities globally, ASSOCHAM also has more than 400 associations, federations and regional chambers in its fold.

Aligned with the vision of creating a New India, ASSOCHAM works as a conduit between the industry and the Government. The Chamber is an agile and forward-looking institution, leading various initiatives to enhance the global competitiveness of the Indian industry, while strengthening the domestic ecosystem.

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

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

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

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



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About **ASCELA**

ASCELA is a professional service company providing advisory services to organisations to help them enhance efficiency by analysing market potential, competitive landscape, and operational, financial, economic, technical, and strategic challenges into Infrastructure and build environments.

About ASCELA Strategic Advisory – Mobility and Supply Chain

ASCELA's Strategic Advisory – Mobility and Supply Chain practice helps clients develop and leverage core competencies to deliver sustainable and tangible returns. We define strategies that help clients gain market share, enter new markets, regions, and products, improve the bottom line and reconfigure organisational/ operational structures.

ASCELA is well placed to provide strategic inputs and analysis for assessing potential development opportunities in Infrastructure design and development space. Our in-depth knowledge of our focus transportation sectors, backed by intensive research and analysis of our client's specific contexts, helps define superior strategies, frameworks, and implementable action plans.

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