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Addressing Cross-Sectoral Cold Chain Challenges in India's F&B Industry

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India produces over 400 million metric tonne (MT) of perishable food annually, yet 30–40 per cent of fruits and vegetables and up to 16 per cent of marine products spoil before reaching consumers. This massive loss stems from a fragile cold chain system burdened by outdated infrastructure, energy inefficiency, fragmented logistics, and inconsistent safety protocols. As India's food and beverage sector evolves, addressing these cold chain challenges is crucial for reducing waste, improving sustainability, and boosting the profitability and global competitiveness of the industry. Let's dig deeper.

In June 2025, Bengaluru-based cold chain logistics startup Citrus Freight reported a worrying figure: nearly 40 per cent of India's perishable food exports, particularly fruits and vegetables, are compromised or spoiled en route due to fragile temperature-controlled systems. Operating with roughly 37 million MT of cold storage capacity against an estimated requirement of over 60 million MT, India is struggling to build an infrastructure capable of sustaining high-value exports. Meanwhile, energy costs consume 35–45 per cent of operational expenditures, and more than 70 per cent of cold storage facilities are concentrated in just four states, which include Uttar Pradesh, West Bengal, Punjab and Gujarat. This creates regional disparities that stymie efficiency and margin reliability.

These systemic weaknesses are hauntingly reflected closer to home. In a June 2025 workshop at **Rajendra Prasad Central Agricultural University (RPCAU), Vice-Chancellor P S Pandey** stated that India loses about 20 per cent of its agricultural produce post-harvest, largely due to "inadequate storage, poor transportation and lack of processing facilities," with fruits and vegetables bearing the brunt. This persistent waste contributes not only to farmer distress and shrinking incomes but also undercuts broader food security efforts, even as growers work to meet rising domestic and export demand.

Against the backdrop of estimated annual food-chain losses reaching Rs 1.5 lakh crore, and 30–40 per cent spoilage in key horticultural segments, the Indian cold chain is at a turning point. Government programmes, such as the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) and new solar-powered cold room norms, are stepping in to plug capacity gaps, while innovative solutions like AI, IoT trackers, and liquid-CO_2 pre-cooling service platforms are emerging. Yet, with operational inefficiencies, regional inequities, and rising energy costs

persisting, the road to an integrated, transparent, and resilient cold chain remains long, a journey critical to preserving India's agricultural wealth and realising its global food ambitions.

Sustainability Dilemma

One of the most pressing challenges plaguing India's cold chain logistics segment is its environmental inefficiency. With power-intensive refrigeration systems and diesel-based transport still dominating the sector, sustainability often takes a backseat. As cold chain networks expand to meet the surging demands of the food and beverage (F&B) sector, the carbon footprint of these operations has grown significantly. The lack of adoption of energy-efficient technologies has not only impacted environmental outcomes but also contributed to high operational costs, putting further strain on logistics players.

Food wastage is a direct consequence of these inefficiencies. The impact is particularly severe for perishable products such as dairy, seafood, meat, and frozen foods. These losses affect the entire value chain, from farmers to retailers, and ultimately undermine the goal of food security.

As **Mansi Mahansaria, Founder of JustDeliveries,** explained, "India’s cold chain logistics is at a critical juncture, grappling with inefficiencies that lead to high food wastage and environmental strain, especially for perishables like dairy, seafood, and fresh produce. A key challenge in driving sustainability is the significant capital investment required for solar infrastructure, energy-efficient refrigeration, and temperature-controlled transport. For many players, the long payback period makes such investments daunting. At JustDeliveries, we’ve built an asset-light, tech-enabled model that allows us to remain agile and cost-effective while staying focused on sustainability. We work closely with like-minded vendors and logistics partners who share our commitment to greener operations. In Hyderabad, 50 per cent of our fleet is already electric, and we continue to explore EV expansion across cities. Our routing is optimised to reduce empty runs and fuel usage, improving both efficiency and environmental outcomes. Looking ahead, we are eager to collaborate with vendors offering solar-powered cold storage and energy-efficient solutions. We believe that the future of cold chain logistics lies in collaboration, innovation, and sustainability, and we’re committed to being a catalyst for that transformation."

Other players are experimenting with similar innovations. Sahyadri Farms, for instance, implemented decentralised solar-powered cold rooms to support smallholder fruit growers, reducing wastage by nearly 20 per cent and cutting energy costs. Meanwhile, Snowman Logistics upgraded to energy-efficient reefer trucks with real-time monitoring to maintain temperature integrity and reduce spoilage. However, companies acknowledge the steep capital costs and the challenge of scaling such solutions in areas with unreliable power infrastructure.

Coldman Logistics, operating large cold storage warehouses, has integrated green building principles and insulation systems to lower energy consumption. But they've found that many F&B clients remain reluctant to pay the premium for greener logistics, which hinders widespread adoption of sustainable practices.

Flexibility Gap

Many cold chain logistics companies in India continue to rely on inflexible frameworks and manual coordination that struggle to respond to real-time disruptions. From vehicle breakdowns and sudden temperature deviations to roadblocks and inventory mismatches, even minor delays can result in entire consignments being rejected, leading to both financial losses and food wastage. Traditional cold chain models often lack the digital backbone necessary for agility. With static routing, limited tracking capabilities, and siloed operations, companies are frequently unable to adjust logistics on the fly. This rigidity is particularly damaging in India's fragmented supply chain environment, where delays and uncertainties are common. The problem is not just one of efficiency but of survival, especially for startups, exporters, and high-volume F&B processors catering to urban markets.

While underscoring this issue, **Dr Ashish Agarwal, Co-founder & CTO at WRMS Global,** said, "In cold chain logistics, responsiveness is not just good to have; it is a must-have. Perishable goods such as dairy products and fresh produce require real-time visibility and responsiveness to delays, equipment failure, and demand shifts. Most of our current systems are so rigid that they cannot react to these dynamic conditions. At Ingen Technologies (a subsidiary of WRMS Global), we fill the gap with IoT-enabled sensors, AI dashboards, and real-time analytics that track the health of cargo and anticipate disruptions before the quality is affected. This allows us to manage multi-temp zones in one trip and to completely change

shipment direction on the fly when a disruption occurs. The future of cold chain logistics lies in adaptive, tech-enabled systems that can think and respond in real time; these will be the defining standard for the F&B industry moving forward."

A concrete example lies in Ingen Technologies' Dairy Logistics Suite, which integrates vehicle trackers, refrigerated van sensors, and smart locks (SecuLocks) to secure dairy shipments and ensure quality integrity. Their system is actively deployed with cooperatives and major dairy players like Mother Dairy, enabling dynamic rerouting when delays occur on the original plan, saving hours in transit and maintaining milk freshness, automated temperature alerts, triggering instantaneous corrective action in the event of cold-chain deviations, and multi-temperature management, allowing mixed temperature goods to be shipped in a single vehicle. These technologies, deeply integrated into dairy cooperative operations across North India, not only preserve product quality in summer heat but also help small-scale farmers access distant urban markets without increased spoilage risk.

Similarly, Ninjacart, a major agri-supply chain startup, has built flexibility into its cold chain by leveraging predictive analytics that allows it to match supply to demand more dynamically and redirect produce based on consumption trends. Their fleet operations are coordinated through AI algorithms that optimise routes in real time, improving both delivery timelines and shelf life. However, such responsive systems are still the exception, not the norm. Smaller logistics players, especially in Tier-II and rural belts, struggle with the cost and complexity of deploying IoT and AI. For India's cold chain to evolve, especially in the dynamic F&B sector, it must shift toward digital-first, responsive systems.

Safety Shortfall

While India's cold chain logistics industry has made strides in expanding capacity, a glaring gap remains in the realm of food safety and quality assurance. Many logistics players, particularly small- and mid-scale operators, lack the protocols, infrastructure, and trained manpower to consistently meet safety standards across the value chain. This poses a serious risk to the integrity of perishable products. The absence of real-time quality control mechanisms such as temperature logs, humidity sensors, and contamination alert systems means even minor deviations in handling or transport conditions can compromise entire shipments. Issues such as

mixing of raw and processed items, lack of sanitisation, or thermal abuse during loading/unloading are surprisingly common in unorganised segments. Inconsistent staff training and the absence of enforceable Standard Operating Procedures (SOPs) further compound these challenges.

“Maintaining food safety in cold chain logistics requires strict adherence to SOPs like real-time temperature and humidity monitoring, segregation of raw and processed items, periodic sanitisation, and staff training on hygienic handling. Quality assurance must include routine audits, digital tracking, and contamination controls to prevent spoilage. A sector-wide push is essential—mandatory compliance audits, government-backed cold chain standards, and investment in tech-driven infrastructure are key to raising industry benchmarks. Rockwell Industries Limited stands out in this landscape. As a leader in commercial refrigeration, it integrates IoT-based temperature control, energy-efficient systems, and durable, food-grade interiors into its equipment. With a sharp focus on reliability and regulatory compliance, Rockwell partners with leading F&B brands to ensure end-to-end cold chain integrity, positioning itself as a cornerstone of India’s safe and efficient food logistics ecosystem,” **Prateek Gupta, Director at Rockwell Industries Limited,** puts the issue in perspective.

Despite such advances by a few players like Rockwell, the broader cold chain ecosystem still faces roadblocks: only a small fraction of India's cold storages are certified by the Food Safety and Standards Authority of India (FSSAI), and routine third-party audits remain rare.

A quieter yet equally disruptive issue is the lack of trained personnel and limited awareness of food handling protocols. Many cold chain failures begin not in the warehouse or truck, but at the human interface, during loading, unloading, storage, or transit. In India, large portions of cold chain operations, especially in Tier-II and Tier-III regions, are still managed by staff with minimal formal training in hygiene, temperature sensitivity, or documentation protocols. Perishables like dairy, seafood, poultry, and fresh produce require careful segregation, appropriate stacking, clean handling surfaces, and continuous monitoring. However, lapses are frequent due to ignorance of SOPs (Standard Operating Procedures) or a lack of accessible compliance training for ground-level staff.

The fragmented nature of regulations and limited outreach from authorities further widens the knowledge gap. While FSSAI and the Ministry of Food Processing Industries (MoFPI) have published cold chain guidelines, awareness remains low among smaller players who aren't part of organised retail or export clusters. Many don't realise the importance of record-keeping Hazard Analysis and Critical Control Points (HACCP) principles, or even the requirement of temperature logbooks during transport.

Another layer of complexity is the lack of language-specific training material, especially in Hindi, Tamil, Marathi, and other regional languages. Most SOPs and manuals are published in English, making them inaccessible to frontline logistics staff who are responsible for maintaining food quality on the ground. To bridge this gap, startups and refrigeration OEMs have begun integrating onboard SOP systems into their equipment, including step-by-step cleaning guides, QR-code checklists, and app-based alert mechanisms for incorrect handling. However, these innovations remain limited to a handful of forward-thinking players and pilot programmes.

Inadequate Infrastructure & Insight

Glaring gaps in physical infrastructure, digital tracking, and data-driven decision-making are some more aspects making the scenario even more critical for Indian cold chain logistics. While investments in cold storage and refrigerated vehicles have increased over the years, these improvements are concentrated in urban or export zones, leaving hinterlands, smallholder producers, and decentralised supply chains vulnerable to breakdowns in quality control.

While highlighting this issue, **Sanjay Jain, Director, Elanpro** said, "Cold chain gaps are directly leading to food wastage. Perishables like bananas, mangoes, tomatoes, onions, or chillies get wasted due to a lack of adequate cold chain infrastructure. And our farmers bear the brunt, as produce often rots or loses weight before it reaches markets. The high costs of cold infrastructure make it inaccessible for a majority of farmers, and as seen in the past, produce like tomatoes is discarded because transport is not viable. While government schemes like PMKSY and AIF have initiated progress, interventions like mobile cold rooms in trains and wider credit access can improve reach and reliability. Private bodies like CII and APEDA are also playing an active role in addressing cold chain challenges."

Elanpro, while not directly involved in cold chain transport, is working to fill crucial gaps at the production and retail ends of the supply chain. Their battery-operated portable refrigeration device for two-wheelers has helped F&B brands maintain temperature control during last-mile delivery, a pain point for online dairy, dessert, and frozen food players. Additionally, their blast freezers and POS (point-of-sale) refrigeration equipment, such as chest freezers and visi coolers, are improving cold reliability at critical nodes like restaurants, cafes, and cloud kitchens. The company is now developing advanced temperature monitoring devices to enhance traceability and quality assurance.

The problem is equally visible in India's dairy supply chain, which, though the largest in the world, is primarily driven by smallholder farmers, each producing a few litres daily. **Ranjith Mukundan, CEO of Stellapps,** explained, "India's dairy industry is unique, driven by 80 million smallholder farmers and yet expected to meet the quality standards of organised, global-scale food systems. The biggest constraint isn't milk availability; it's the infrastructure and data gaps between farm and factory. At Stellapps, we are building a new kind of dairy supply chain platform: digitally connected, financially inclusive, and operationally efficient. By modernising each node, from village collection to chilling, transport, processing, and distribution to the end consumer, we are bringing transparency to the entire supply chain. This is not just about technology; it's about trust, transparency, and long-term sustainability. The future of Indian dairy lies in making every litre traceable, and every product world-class, ready for exports."

Stellapps has deployed IoT-based sensors, cloud-connected chilling units, and digital payment solutions across hundreds of dairy villages, allowing real-time visibility into milk volumes, temperature fluctuations, and payment histories. Their MooPay and MooOn platforms help both farmers and processors close the loop on traceability and quality control, especially critical in export-driven dairy segments like ghee, paneer, and milk powder.

In most cases, even when infrastructure exists, poor interoperability between systems, manual data logging, and the absence of analytics platforms lead to inefficiencies that ripple across the value chain.

Cold Chains for Critical Gains

India’s cold chain logistics sector stands at a defining threshold. As the country pursues ambitious goals in food processing, exports, and nutrition security, the efficiency and integrity of its cold supply networks will shape not only economic outcomes but also public health and sustainability.

Despite targeted reforms, tech-led innovations, and growing private-sector participation, systemic challenges persist, from inadequate infrastructure and limited digital integration to gaps in safety compliance and last-mile cold reliability. The fragmented nature of India's cold chain, coupled with high operating costs and uneven regional development, continues to compromise food quality, increase wastage, and undercut farmer earnings. “Insufficient facility resources were considered as the biggest challenge continued by limited handling practices and then deficient safety measures; these factors were followed by inefficient response mechanisms, poor tracking capabilities, and environmental efficiency,” concluded **Dr Krithika J., Associate Professor, RV Institute Of Management, Bangalore,** in her recent study titled "A Study On Challenges Faced By The Cold Chain Service Providers With Reference To Frozen Food Products".

Yet, the path forward is clear. A unified cold chain ecosystem, one that is digitally connected, environmentally conscious, and inclusive of all stakeholders, from smallholder farmers to global exporters, is no longer a luxury but a necessity. It will require not just capital investments but also policy coordination, public-private partnerships, grassroots training, and sustained R&D.

If India can successfully transform its cold chain logistics from a reactive system to a resilient, intelligent, and transparent backbone, it won’t just preserve perishable commodities; it will unlock billions in value, uplift rural economies, and position the country as a trusted global supplier of high-quality food. In the refrigerated corridors of this transformation lies the future of India's food economy.

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Read online: https://nuffoodsspectrum.in/features/27/22516/addressing-cross-sectoral-cold-chain-challenges-in-indias-fb-industry.html

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