When The Milk Runs Dry

Mapping India's Dairy Risk Landscape-From Disease to Trade to Institutional Failure

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India is the world's largest milk producer. It's also managing disease outbreaks, feed shocks, cold chain collapse, and looming trade deadlines with infrastructure built for a smaller era. This is the comprehensive risk story nobody is telling.

On a September morning in 2022, a cattle farmer in Rajasthan noticed lumps forming on the skin of his best milch cow. Within a week, three more animals showed symptoms. Within a month, the disease had crossed into six neighbouring states. By the time India's dairy belt understood what it was dealing with, Lumpy Skin Disease - a virus India's cattle had no immunity to, for which no domestic vaccine existed at scale - had infected over three million animals across 30 states and killed 180,000 of them.

The final economic bill, calculated in a 2025 study published in *Nature Scientific Reports*, came to ₹20,254 crore. In a single year. From one disease.

India is the world's largest milk producer - 24% of global output, 80 million rural households, and more women employed than in any other agricultural sub-sector. The sector's fundamentals are strong, its growth trajectory is credible, and its importance to rural India is irreplaceable. But what 2022 exposed, with a clarity that should have unsettled every boardroom and cooperative office in the country, is that Indian dairy is managing enormous, deeply interconnected risks with infrastructure and institutions designed for a much smaller, simpler version of itself.

What follows is an honest account of every dimension of that risk - external, operational, and structural.

Part One: Threats From Outside the Farm Gate

The Disease Economy

LSD was the headline. The quiet crisis is larger.

Foot and Mouth Disease is not news in India. It has been endemic for decades, circulating in four viral serotypes simultaneously, with vaccination coverage rarely exceeding 60% effective protection across the national herd. ICAR estimates it costs the sector ₹20,897 crore every year. Mastitis - frequently subclinical, meaning the cow shows no visible symptoms while yield silently declines - affects more than one in four of India's dairy cows and costs ₹7,165 crore annually. Brucellosis has a seroprevalence of 5-7% and poses a zoonotic public health risk to farmers and veterinarians who handle infected animals.

Table 1: Animal Disease Risk - Annual Economic Loss and Severity

Disease	Nature	Annual Economic Loss	Likelihood (1-5)	Severity (1-5)
Foot & Mouth Disease	Viral, endemic	₹20,897 Cr	5	4
Lumpy Skin Disease	Viral, epidemic	₹20,254 Cr (2022 alone)	4	5
Mastitis (subclinical)	Bacterial, chronic	₹7,165 Cr	5	3
Brucellosis	Bacterial, zoonotic	₹4,800 Cr	4	3
PPR	Viral, ruminants	~₹1,200 Cr	3	3
AGGREGATE		**₹34,000+ Cr/year**		

Source: Nature Scientific Reports (2025); ICAR-NDRI Disease Loss Reports; DAHD Animal Disease Control Programme

That aggregate - ₹34,000+ crore annually - equals approximately 25% of the organized dairy sector's entire annual revenue, lost before a single litre reaches a processor or retailer. Every year. Not in a crisis year. In a normal year. This figure excludes extraordinary losses from epidemic events like LSD 2022.

The human infrastructure behind disease response is critically thin. India's veterinary doctor-to-animal ratio is worse than 1:10,000, compared with the internationally recommended 1:5,000. When an outbreak begins, diagnosis is delayed, containment advice arrives late, and mortality extends for weeks beyond what adequate coverage would permit. India had its 'COVID moment' for dairy in 2022 - a novel pathogen, no herd immunity, no domestic vaccine. The unanswered question is what preparation exists for the next one.

The Price Trap

If disease is the acute risk, price volatility is the chronic one - and it operates on every stakeholder simultaneously. India's milk prices rose 15% between FY2021 and FY2023. Consumer-facing CPI milk inflation peaked at 7.91% in 2023 - the highest in a decade - before moderating to 2.50% in 2025. That moderation is the down-phase of a cycle that will rise again.

Table 2: CPI Milk Inflation - Annual Trend (Rural Average, Base 2012=100)

Year	Rural CPI Inflation (%)	What Was Driving It
2019	1.25%	Benign - stable feed costs
2020	5.64%	COVID supply disruption
2021	2.23%	Partial recovery
2022	6.23%	Feed spike + LSD pressure
2023	7.91%	Peak - post-LSD supply tightness
2024	3.10%	Procurement recovery
2025	2.50%	Normalization

Source: MoSPI Monthly CPI Database; DAHD Statistical Publication

The structural driver is feed cost, which in Indian dairy is anything but a domestic variable. Maize and soybean meals are simultaneously linked to global commodity markets, monsoon outcomes, and MSP policy. In 2021, soybean meal prices spiked from ₹35,100 to ₹90,000 per tonne - a 156% increase in one year. Since feed costs represent 60-65% of total milk production costs, a 10% rise in feed prices directly compresses farmers' margins by 6-7 percentage points. Layered on top is India's permanent flush-lean seasonal cycle, creating a 10-20% annual price swing, and global SMP prices set by the New Zealand-based Global Dairy Trade auction, which collapsed 40% in 2023, destroying the value of Indian processor inventories in exactly the season when margins were supposed to recover.

The Regulatory Maze and the FTA Time Bomb

India's dairy sector operates inside a regulatory architecture spanning 28 state governments, multiple central ministries, an evolving food safety regulator, and trade negotiations whose outcomes will be determined by diplomats, not dairy farmers.

Table 3: Regulatory and Political Risk - Priority Assessment

Risk	Description	Likelihood	Severity	Priority
State milk price orders	Below-market procurement price mandates in election years - UP, Maharashtra, Punjab	4	4	**HIGH**
SMP export restrictions	GoI has imposed SMP export bans in 2011, 2012, partial 2022 to stabilize domestic prices	3	4	**HIGH**
FSSAI standards tightening	Continuous tightening of SNF/fat standards, antibiotic MRLs - compliance cost risk for small processors	5	3	MEDIUM
FTA dairy import liberalization	India-Australia ECTA (2022) + possible India-EU/NZ FTA; zero-tariff scenario by 2027	3	5	**CRITICAL**
GST exemption status change	Liquid milk is GST-exempt; any change cascades through consumer prices and demand	2	4	MEDIUM

Source: Ministry of Commerce; FSSAI; APEDA; CRISIL

The FTA risk warrants careful reading. New Zealand dairy farmers graze year-round on pastoral land, with production costs that Indian processors cannot match. European processors operate with decades of export infrastructure and quality certification systems built for global competition. If Indian import barriers on butter, cheese, whey, and infant formula fall to zero, the products most exposed are precisely the value-added categories where Indian cooperatives and private processors are making their biggest long-term growth investments. The sector is climbing the value chain to escape liquid milk's thin margins - and the trade policy environment may remove the protection that makes that climb viable before it is complete.

Table 4: Currency and Financial Risk - Mechanisms and Impact

Risk	Mechanism	Quantified Impact	Likelihood	Severity
INR depreciation (export upside)	Makes SMP/ghee exports more competitive	+6-8% export margin per 10% INR fall	3	2
INR depreciation (import cost)	Raises imported equipment, packaging, and specialty feed costs	+5-8% equipment CAPEX per 10% INR fall	3	3
Interest rate rise	New plants require ₹50-200 Cr financing; RBI hiked 250 bps (2022-24)	+₹2-4 Cr annual interest per ₹50 Cr plant	3	2
Working capital gap	Processors pay farmers in 7-10 days; extend 45-60 days credit to distributors	Structural liquidity gap ~₹500-1,500 Cr industry-wide	4	3

Source: RBI; CII/ICAR Industry Analysis

Currency, Interest Rate, and Counterparty Risk

Less dramatic than disease or FTA exposure, but persistent and material in how they compound other pressures.

The working capital gap deserves specific attention. Processors are structurally short on cash - paying farmers quickly while waiting months for distributor payments. In a rising-interest-rate environment, this gap becomes expensive to bridge. For smaller regional dairy companies, it is existential. Counterparty risks compound the picture: 30%+ of dairy cooperatives carry overdue farmer loans, export counterparties may renegotiate contracts during commodity downturns, and contract farmers routinely divert milk to competing buyers during periods of higher spot prices - breaking procurement commitments in the season when processors most need supply predictability.

PART TWO: RISKS INSIDE THE OPERATION

The Cold Chain Illusion and the Procurement Crisis

India produces the world's largest volume of milk. It also loses 20-25% of it between the farm and the consumer. Only 35% of India's cold chain requirement is actually met.

A farmer milks at dawn. If the village chilling center is far away, the power supply is unreliable, or the collection vehicle is late, the milk begins to deteriorate before it leaves the farm gate. The FSSAI National Milk Quality Survey found widespread non-compliance across the procurement chain. A study by the Center for Science and Environment documented antibiotic residues in 77% of tested samples. Water, urea, starch, and detergent are not isolated adulterants - they are systematic features of a procurement system with insufficient traceability.

Table 5: Procurement Chain Risk - Operational Assessment

Risk	Description	Likelihood	Severity	Priority
Milk adulteration	Widespread non-compliance found in FSSAI surveys; antibiotic residues in 77% of samples (CSE 2018); reduces processor yield and brand value	5	4	**CRITICAL**
Cold chain failure	Only 35% of requirements met; power outages cause temperature excursions; 20-25% milk lost farm to consumer	5	4	**CRITICAL**
Seasonal procurement swing	Flush-lean variation of 15-20% creates a processor capacity mismatch; plants sized for peak often run below 50% in the lean season	5	3	**HIGH**
Farmer attrition	Net decline in dairy animals in peri-urban regions as younger generations exit farming, erodes procurement base	4	3	**HIGH**

Source: FSSAI; NDDB/CMI; DAHD; CSE (2018)

The seasonal capacity mismatch is a hidden destroyer of profitability. Indian dairy plants average 60-65% utilization annually, falling to 40-45% in the lean season. A plant built to handle peak flush procurement bears the full fixed cost burden of that capacity for the six months when volumes are insufficient to fill it. This is not a management failure. It is a structural consequence of the milk production calendar. But it means that profitability calculations based on annualized utilization are systematically misleading about the actual cost of the lean season.

Processing, Technology, and Energy Risk

The infrastructure inside the plant has its own vulnerabilities - and they are compounding over time.

Table 6: Processing and Technology Risk

Risk	Description	Likelihood	Severity
Capacity utilization mismatch	Average 60-65% utilization; falling to 40-45% in lean season; fixed costs amplify earnings volatility	5	3
Technology obsolescence	Significant portion of processing infrastructure >20 years old; higher contamination risk, lower energy efficiency	4	3
Energy cost exposure	Dairy processing is energy-intensive; a 10% energy cost increase reduces EBITDA margins by ~1.5-2.0%	4	2
IT/ERP system failure	System downtime disrupts payment to thousands of farmers simultaneously, triggering trust crises	3	3

Source: CII/ICAR Industry Analysis; NDDB

A 10% increase in energy costs, reducing EBITDA margins by 1.5-2.0 percentage points, may sound modest in isolation. In an industry already operating on thin margins - where the gap between a profitable and an unprofitable year is often 2-3 percentage points - it is not modest at all.

The Human Capital Deficit

Behind every risk in this analysis sits a human capability problem - and the numbers are sobering.

The women workforce figure deserves to stand alone. Women perform approximately 70% of dairy labour in India - milking, feeding, cleaning, managing the herd through calving and illness. Fewer than 10% have received formal training in any of these activities. The productivity gap that results - in yield quality, animal health management, and feeding efficiency - is not being measured, which means it is not being addressed. It is the largest hidden human capital loss in India's dairy sector.

Part Three: The Structural and Global Threats

Disintermediation, Governance Failure, and the D2C Challenge

Three forces are quietly reshaping Indian dairy's competitive architecture - and all three converge on the same pressure point: the cooperative system that has held the sector together for five decades.

Table 7: Human Capital Indicators - Gap Analysis

Indicator	Current Value	What It Means in Practice
Veterinary doctor-to-animal ratio	1:10,000+ (recommended: 1:5,000)	Delayed outbreak diagnosis; extended mortality in disease events
Qualified dairy technologists	<5,000 for 300+ major plants	Technology and quality risk throughout processing operations
Scientific feeding practice adoption	<5% of farmers	15-20% preventable yield gap; invisible on any production chart
Women workforce with formal training	<10% (despite 70% of dairy labour being women)	The highest-participation group receives the least institutional support

Source: DAHD; ICAR; NDDB Human Resource Studies

Table 8: Strategic Disintermediation and Governance Risks

Risk	Mechanism	Likelihood	Severity
D2C brand disintermediation	Country Delight, Akshayakalpa, Sid's Farm pay 3-5x farm-gate prices, pulling quality milk from cooperative channels	4	3
VAP transition failure	48% of cooperative revenue is still from low-margin liquid milk; failure to move up the value chain exposes itself to structural margin erosion	4	4
Cooperative governance failure	30%+ of district co-ops in financial stress; political board capture; aging farmer base; systemic procurement fragility	4	4
Plant-based alternative growth	Oat/almond/soy milk <2% of urban dairy market but growing at 25%+ CAGR; long-run urban demand destruction	2	2
ESG/Carbon regulation	Dairy cattle = 6-8% of India's GHG; carbon pricing expansion may introduce trade barriers or domestic cost mandates	2	3

Source: NDDB; CRISIL; Industry Reports

D2C disintermediation is sometimes framed as a positive development for farmer welfare - and for the individual farmer receiving 3-5x the cooperative price, it clearly is. The systemic risk operates at a different level. Cooperatives are not simply one procurement channel among many. They are the cross-subsidization infrastructure that has made affordable liquid milk viable for India's urban poor. When the highest-quality milk is available in cooperative channels at premium prices, the cooperative's ability to maintain that cross-subsidization weakens. The farmers who benefit from D2C are not the ones the cooperative system was primarily designed to serve - and the farmers it was designed to serve may end up paying the cost of its weakening.

"30% of India's district-level cooperatives are in financial stress. The cooperative system is not just a business model. It is the infrastructure of Indian rural dairying. Its weakness is the sector's weakness."

The Global Risk Horizon

Climate change is the longest horizon risk but may carry the largest cumulative damage. A 15% milk yield loss per animal from heat stress by 2050, projected by ICAR

under business-as-usual scenarios, applied to India's current herd of approximately 300 million cattle and buffaloes, would represent a staggering production loss. Recurrent El Niño events are not a projection of the future. They are already shrinking green fodder windows, extending lean seasons, and increasing the severity of procurement swings year on year. The sector that waits for 2050 to begin adapting will discover that adaptation cannot be compressed into a decade.

Table 9: Global and Macro Risks - Priority Assessment

Risk	Mechanism	Likelihood	Severity	Priority
FTA liberalization	India-Australia ECTA + possible India-EU/NZ FTA; zero tariff on cheese/butter/whey by 2027	3	5	**CRITICAL**
Climate change/heat stress	ICAR projects 15% milk yield loss per animal by 2050; El Niño is already shrinking fodder windows	5	4	**CRITICAL**
Novel biosecurity threat	LSD 2022 was India's first novel pathogen dairy event; future novel zoonotic threats = fat-tail risk	3	5	**CRITICAL**
Global SMP/butter price collapse	GDT auction collapsed 40% in 2023; concurrent global oversupply crashes Indian margins and export viability	3	4	**HIGH**
Methane/ESG regulation	Dairy cattle = significant methane emitters; ESG-linked trade barriers or domestic carbon mandates are emerging	2	3	MEDIUM

Source: ICAR Climate Change Reports; WTO Trade Policy Review; Global Dairy Trade Data

THE RECKONING

Laid out in full, India's dairy risk landscape has a coherent structure. Disease and feed costs operate on the farmer. Cold chain failure and adulteration operate on the processor. Regulatory complexity and FTA exposure operate on the sector's long-term competitive position. Cooperative governance failure and D2C disintermediation operate on the institutional infrastructure that connects farmers to the market. Climate change and novel biosecurity threats operate on the physical foundations on which everything else rests.

None of these risks is individually unsurvivable. The Indian dairy sector has demonstrated, through repeated shocks, that it can absorb, adapt, and continue to grow. What it has not yet demonstrated is the capacity to manage all of these risks simultaneously, systematically, and before they become crises rather than after. Four investments would do more than any other to change that:

Disease surveillance infrastructure - IoT-enabled cattle health monitoring, a veterinary first-responder network, and a domestic vaccine pipeline for novel pathogens - is the highest-return investment available to the sector. The 2022 LSD year cost ₹20,254 crore. Prevention costs a fraction of that.

Cold chain completion is a solvable engineering problem with well-understood economics. The constraint is capital prioritization and state-level execution. The sector loses 20-25% of its milk every year because this problem has not been treated as an emergency.

Cooperative governance reform - professional board management, transparent financial reporting, and political insulation - is the least glamorous but most consequential structural fix. The procurement backbone of the Indian dairy sector cannot be both politically captured and financially stressed without eventually failing under the load.

Climate adaptation investment - heat-tolerant breed development, improved fodder management, covered housing systems - cannot wait for 2040. The yield losses from heat stress are already visible in India's high-stress summer months. They will intensify before any mitigation intervention takes effect.

India will remain the world's largest milk producer through 2030 and beyond. The question is not whether the milk will keep flowing - it will. The question is how much of it reaches the consumer, at what cost to the farmer who produces it, through institutions strong enough to be trusted with the sector's next fifty years.

The risks are known. The solutions are known. What remains is the institutional will to act on them before the next September morning brings another disease that nobody planned for.

Sources: Nature Scientific Reports (2025) - Economic Losses of Lumpy Skin Disease in India | ICAR-NDRI Disease Loss Reports | MoSPI Monthly CPI Database | DAHD Statistical Publications | FSSAI National Milk Quality Survey | Centre for Science and Environment (2018) | Ministry of Commerce; APEDA; CRISIL | NDDB Annual Report | USDA FAS India Dairy Report 2024 | ICAR Climate Change and Indian Agriculture Report | RBI Monetary Policy Reports | CII/ICAR Dairy Industry Analysis

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