THE MISSING LINK: BUILDING PAKISTAN'S COLD CHAIN

POLICY BRIEF

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Executive Summary

Cold chain infrastructure is a critical missing link in Pakistan's agricultural transformation. Agriculture contributes around 24% to GDP and employs 37% of the labour force, while livestock alone accounts for nearly 60% of agricultural GDP. Within this system, horticulture (fruits and vegetables) represents a strategically important but underdeveloped segment, with a market size of approximately USD 15 billion and strong export potential. Despite this scale, Pakistan continues to export low-value, raw commodities due to severe post-harvest inefficiencies and the absence of an integrated cold chain system.

Post-harvest losses (PHL) are the most significant constraint in the horticulture value chain. Estimates suggest that 30–40% of fruits and vegetables are lost annually, equivalent to $700 million to over $1 billion in economic value. Losses are especially severe for mangoes, kinnow, tomatoes, and potatoes, while dairy losses reach 15–20% of total production, amounting to 10–12 billion litres of milk wasted annually. These losses directly reduce farmer incomes, who typically capture only 15–20% of final retail value, and contribute to recurrent market gluts and distress sales. The absence of cold storage is therefore both a food security challenge and a structural driver of rural poverty.

Pakistan's cold chain infrastructure remains highly underdeveloped. Total cold storage capacity is below 1 million tons against annual fruit and vegetable production of 13–14 million tons, resulting in coverage of less than 8%. Existing infrastructure is uneven and largely commodity-specific: potato-optimized cold rooms dominate, controlled atmosphere (CA) facilities are extremely limited, and farm-gate cold storage is virtually absent. Transport infrastructure is similarly weak, with minimal penetration of refrigerated trucks and heavy reliance on open transport systems that compromise product quality. Dairy cold chain coverage is also fragmented, with only around 5% of milk entering formal, temperature-controlled supply chains.

Three structural constraints explain persistent underinvestment. First, fragmented value chains prevent any single actor from capturing sufficient returns to justify cold chain investment. Second, cyclical price volatility discourages storage investment, as actors sell during high-price periods and avoid storage despite its long-term benefits. Third, investment patterns are geographically concentrated and imitation-driven, leading to clustering in a few commodities (notably potatoes) while high-value crops remain underserved. Policy failures, including ad hoc import responses and weak market coordination, further exacerbate volatility.

International evidence, particularly Morocco's Plan Maroc Vert, demonstrates that coordinated public investment, aggregation mechanisms, and anchor buyers can successfully trigger private cold chain expansion. Pakistan's own potato and dairy sectors confirm this dynamic, where integrated processors have enabled the development of functioning storage networks.

The brief proposes a National Cold Chain Development Program anchored by a dedicated financing facility, fiscal incentives, and

geographically targeted agri-clusters. Priority interventions include farm-gate solar cold rooms, controlled atmosphere storage expansion, milk chilling coverage targets, and a demonstration CA facility for horticulture. Critically, the strategy emphasizes attracting anchor investors and enabling first-mover projects that can trigger wider private sector participation.

Cold chain investment is among the highest-return opportunities for Pakistan's agricultural economy, with the potential to significantly reduce losses, stabilize prices, improve farmer incomes, and unlock export diversification.

Why Cold Chain Matters

Agriculture in Pakistan's Economy

Agriculture contributes approximately 24% to Pakistan's GDP and provides livelihoods for 37% of the labour force. Livestock alone contributes nearly 60% of agricultural GDP and roughly 15% of national GDP.[1] The horticultural sector (fruits and vegetables) is smaller by area but strategically critical for export diversification, rural incomes, and agricultural transformation. Pakistan's fruit and vegetable market was valued at approximately USD 15 billion in 2025, growing at a compound annual rate of around 6%.[2]

Despite this scale, Pakistan's agricultural export performance remains well below potential. Fruit and vegetable exports are concentrated in a handful of commodities, namely, citrus (kinnow), mangoes, dates, onions, and potatoes, and the country earns a fraction of the value that comparable producers capture because it exports primarily raw, unprocessed goods rather than higher-value, extended-shelf-life products.

1 Pakistan Economic Survey 2024-25 https://www.finance.gov.pk/survey/chapter_25/2_Agriculture.pdf
2 https://www.mordorintelligence.com/industry-reports/pakistan-fruits-and-vegetables-market

The Post-Harvest Loss Problem

Post-harvest losses (PHL) are the defining constraint on Pakistan's agricultural value chains. The Asian Development Bank estimates annual PHL of fruits and vegetables at 30-40% of total production which is among the highest in Asia. In absolute terms, studies have valued PHL at $700 million to $934 million annually at 2016 provincial wholesale prices, with ADB estimates suggesting Pakistan could save $1.13 billion per year by reducing losses by up to 75%.[3]

At more current price levels, these losses are substantially higher. For mangoes alone, the Pakistan Horticulture Development and Export Company (PHDEC) estimated annual PHL at nearly USD 150 million in forgone export earnings. Dairy losses are similarly severe, with an estimated 12 billion litres of milk wasted annually due to inadequate cold chain and poor handling.[4]

The consequences of these losses fall disproportionately on farmers. Producers typically receive as low as 15-20% of the final retail price,[5] and in the absence of storage options, bumper harvests create immediate market gluts that force distress sales. The lack of cold infrastructure is not only a food security issue, but also a rural poverty trap.

3 Asian Development Bank (2019) *Dysfunctional Horticulture Value Chains and the Need for Modern Marketing Infrastructure*.
4 https://www.pacra.com/view/storage/app/Dairy%20-%20PACRA%20Research%20-%20Aug'24_1722865366.pdf
5 Asian Development Bank (2019)

Current State of Cold Chain Infrastructure

Cold Storages

Pakistan's total cold storage capacity is estimated at under 1 million tons against annual fruit and vegetable production of approximately 13 million tons. This means that the coverage ratio is below 8%, which is one of the lowest in South Asia. Beyond the main urban centres, cold storage is almost non-existent and the vast majority of production areas have no temperature-controlled infrastructure within viable distance of the farm gate.

Pakistan's cold storage infrastructure can be characterized broadly as follows:

- Basic single-temperature cold rooms: The majority of facilities are designed primarily for potatoes, the commodity that historically drove cold storage investment in Punjab, operating at 2-8 degrees Celsius and largely unsuitable for the storage requirements of other fruits.
- Controlled atmosphere (CA) storage: A very small number of facilities, largely export-oriented, provide controlled atmosphere storage which is essential for extending the shelf life of apples, kinnow, and mangoes. Controlled atmosphere storages maintain specific concentrations of oxygen (reduced) and carbon dioxide (elevated) in a gas-tight room, suppressing respiration and delaying ripening. CA storage can extend shelf life significantly compared to conventional cold storage keeping kinnow for 3-4 months, apples for 6-12 months, and enabling tomato surplus to carry forward through seasonal price gaps.
- Refrigerated containers (reefer): Export-oriented cold chain relies heavily on refrigerated containers powered by generator sets, concentrated around Karachi port and used primarily for meat, citrus, and mango exports.
- Pack houses: A limited number of export-oriented pack houses with pre-cooling facilities have been developed, primarily in the citrus belt of Punjab and mango-growing areas of Punjab and Sindh.
- Milk chilling centres (MCCs): In recent years, large milk processors, including Nestlé, Engro FrieslandCampina, and Gourmet, have established a network of approximately 5,000 MCCs equipped to international quality standards. However, this network is contracting rather than expanding because rising setup costs and electricity tariffs are squeezing margins and processors are shifting procurement towards large commercial dairy farms, thus reducing reliance on MCCs in the smallholder-dominated unorganized sector. As a result, the majority of small dairy farmers sell

through informal middlemen (dodhis), whose collection centres (some with chillers) typically use non-food-grade containers and operate without regulatory oversight. Milk is frequently distributed onward in unrefrigerated vehicles.[6]

Cold Transport Infrastructure

- **Reefer trucks:** Reefer truck penetration in Pakistan remains very low. Fruits and vegetables are predominantly transported on open trucks or shared vehicles, often alongside other goods. The main barriers include the high capital cost of reefer trucks, financing constraints, and fuel costs for running refrigeration units.
- **Reefer containers and sea freight:** Pakistan's export cold chain is anchored by reefer containers at Karachi Port. International shipping lines provide reefer container services from Karachi to key markets in the Middle East, Europe, China, and Southeast Asia. In 2024, Pakistan shipped over 5,000 containers of mangoes alone (140,000 tons) to various export destinations.[7] However, the challenge is the 'first mile', i.e., getting produce from farm to port in cold condition. Reefer container services at the port are available, but the uncooled journey from orchard to pack house to port affects the overall quality of the product.
- **Air freight:** Air freight is used for premium, short-shelf-life exports, particularly high-grade mangoes destined for the UAE, UK, and increasingly China. Dedicated cold-chain facilities at Pakistan's major airports remain limited, and cargo terminals lack the cold storage infrastructure needed for multi-day handling of temperature-sensitive products.

The Electricity and Capital Constraints

The single biggest operational constraint on cold chain infrastructure in Pakistan is unreliable electricity. Load shedding of several hours per day, more so in rural areas, makes fixed cold storage facilities economically and operationally challenging with electricity estimated to account for approximately 80% of cold storage operating costs.[8] Some commercial operators have responded by installing solar systems to reduce this burden, but the capital outlay required puts this option out of reach for most smaller investors. Farm-gate cold storage is the most critical missing link in Pakistan's horticultural cold chain and is virtually non-existent. Investing in solar-powered modular cold rooms at or near the farm gate, particularly in off-grid production areas, represents one of the most impactful interventions available.

Moreover, the capital cost premium for controlled atmosphere (CA) storage over conventional storage is significant. Turkish research data puts the fixed investment cost roughly 23% higher for CA than for conventional storage at comparable capacity.[9] In the Pakistani context, industry sources suggest a ratio closer to 2x the cost of conventional cold storages. A conventional 1,000-ton cold room may cost PKR 150 million to build, while a CA facility of the same capacity can reach PKR 300 million or more.[10]

6 https://www.pbc.org.pk/wp-content/uploads/Pakistans-Dairy-Sector-and-the-Role-of-Milk-Collection-Centers-Policy-Brief-June-2024.pdf
7 Trade Development Authority Pakistan trade data (2024)
8 Industry interviews conducted for this brief
9 https://www.researchgate.net/publication/286945429_Analysis_of_investment_cost_of_apple_cold_storage_facilities
10 SMEDA CA Cold Storage 1000 MT Pre-feasibility Report (2023)

Cold Chain Across Key Commodity Value Chains

Horticulture: Fruits and Vegetables

Pakistan's total fruit and vegetable production is approximately 13-14 million tons. The country's diverse agro-climatic zones allow production of a wide range of commodities:

- **Punjab:** Kinnow/citrus (Sargodha belt), mangoes (southern Punjab), potatoes, onions, and a range of vegetables.
- **Sindh:** Mangoes(Mirpurkhas, Tando Allahyar), dates, bananas, tomatoes, and chilies.
- **Balochistan:** Apples (approximately 80% of national production), apricots, grapes, pomegranates, and off-season vegetables.
- **KPK:** Peaches, plums, cherries, and temperate vegetables.

Key commodities and cold chain requirements

Citrus (kinnow) is Pakistan's most important fruit in terms of export value and volume, with annual production of approximately 2 million tons, most of which is from Punjab. Roughly 10-12% of production is exported after value addition.[11] This share is constrained not only by cold chain deficiencies but also by the fact that the kinnow variety grown in Pakistan, developed at UC Riverside and introduced in Pakistan in the 1960s[12] and largely unchanged since, is with seed at a time when global citrus markets have shifted decisively toward seedless varieties.

Mangoes represent Pakistan's highest-profile export fruit. Annual production is approximately

11 https://www.intechopen.com/chapters/56485
12 https://citrusvariety.ucr.edu/crc4236

1.8 million tons, with Punjab accounting for 70% and Sindh 29%. Pakistan is the world's fourth-largest mango producer. Post-harvest losses for mangoes are among the highest of any commodity, as the fruit is extremely temperature-sensitive in the first 24 to 48 hours after harvest. Without prompt pre-cooling and refrigerated transport to the port, significant browning, softening, and decay occur en route.

Potatoes are the dominant cold-stored vegetable in Pakistan, and most of the country's cold storage infrastructure has historically been built around potato storage. Potato-optimized cold rooms (which typically maintain 2-4°C) are largely unsuitable for tropical fruits requiring different temperature and humidity regimes. Onions, tomatoes, and other perishable vegetables collectively suffer the highest absolute losses of any commodity category.

Dairy

Pakistan is the world's fourth-largest milk producer, with annual output of approximately 65-70 million tons. Despite this scale, the dairy value chain is deeply informal. Only around 5% of milk produced is marketed through formal channels, while the remaining 95% moves through informal networks that mostly bypass chilling, pasteurization, and quality control.[13]

The cold chain deficiencies in Pakistan's dairy sector operate at three levels:

- At the farm gate, milk is typically collected manually in containers and transported without any chilling. In summer temperatures exceeding 40°C, raw milk can become unsafe within 2-4 hours of collection without cooling.
- At the collection level where large milk processors have established a network of approximately 5,000 collection centres equipped to international quality standards.
- At the distribution level where the packaged milk sector requires cold chain from processing plant to retailer. This requirement is partially met in urban centres but breaks down at the last mile in smaller cities and rural retail.

Annual milk losses due to supply chain inadequacies are estimated at 15-20% of production, equivalent to approximately 10-12 billion litres wasted per year. A 2023 nationwide study by the University of Veterinary and Animal Sciences (UVAS) found that most loose milk in Pakistan fails basic food safety standards, with over half deemed unfit for consumption.[14]

13 Pakistan Business Council (June 2024). Dairy and Milk Collection Centers Policy Brief
14 https://web.uvas.edu.pk/uvas-press-release/92-of-loose-milk-in-pakistan-failed-to-comply-with-regulatory-criteria/

Meat

Pakistan's livestock herd is among the largest in the world with approximately 230 million animals. Annual meat production is approximately 6 million tons across all species. Total meat exports reached over $500 million in FY2024, representing approximately 20% year-on-year growth.[15]

However, most of the meat is processed through unregistered, informal slaughterhouses and traditional butcher shops that lack refrigeration, modern sanitation, or any cold chain infrastructure.

The export meat sector represents a growing exception. Pakistan currently has 35 FS-certified export abattoirs with combined annual capacity of approximately 247,500 tons of beef and 82,500 tons of mutton.[16] Key players include Al-Shaheer Corporation, The Organic Meat Company, PK Livestock Company, Fauji Meat Limited, Quick Food Industries, etc. The primary export markets are GCC countries and China, which together absorb approximately 80% of Pakistan's halal meat exports.

15 https://www.arabnews.com/node/2626710/amp
16 https://www.brecorder.com/news/40372983/accelerating-pakistans-livestock-exports-in-global-halal-markets

The Investment Problem: Why Cold Chain Remains Underfunded

High financing costs and unreliable electricity are real and material barriers to cold chain investment in Pakistan. But they are not the complete explanation. Even if both were resolved tomorrow, deeper structural problems would remain in how the value chain is organized, how investment decisions are made, and how policy failures compound both.

The fragmented value chain

In Pakistan's dominant horticulture value chain, produce moves through a chain of market transactions from farmer to arhthi (pre-harvest financier) to commission agent to wholesaler to retailer. Each link extracts a margin and passes the product on. In this structure, the trader who might invest in cold transport has no guarantee that the quality premium it creates will be captured by them rather than absorbed elsewhere in the chain. The rational response is to accept losses rather than invest, and an estimated 10-20% losses are simply built into traders' planning assumptions as a cost of doing business rather than a problem to be solved.

The counter-cyclical investment trap

Cold chain investment decisions are also subject to a particularly damaging counter-cyclical dynamic that has no easy market solution. When prices are high, farmers and traders have no incentive to store, so they sell immediately and bank the returns. When prices crash, everyone suddenly needs cold storage but the infrastructure isn't there. The potato sector illustrates this precisely. In 2024-25, with border crossings to Afghanistan open and export demand strong, a 120 kg sack of potato fetched PKR 5,000-5,300. Farmers sold everything immediately and had no interest in cold storage. In the subsequent year, high area under cultivation coupled with border closures to Afghanistan collapsed the same sack to PKR 1,200-1,500, which is barely above the PKR 1,000 cost of six months' cold storage. Now every farmer wants cold storage, but supply is insufficient.

This dynamic also explains the mindset barrier that runs through the sector. Cold chain investment is perceived the way people perceive health insurance: if the season goes well and prices hold, the investment appears to have been wasted. Only when prices collapse does its value become apparent, by which point it is too late.

The copy-cat problem and geographic over-concentration

When cold chain investment does happen in Pakistan, it tends to happen in waves driven by imitation rather than planning. Once the potato cold chain showed commercial returns, cold stores proliferated, but they concentrated geographically near urban centres and around a single commodity, rather than dispersing toward production zones or diversifying across crops. The result is a cold storage sector with reasonable potato coverage in parts of Punjab and almost nothing for tomatoes,

mangoes, or onions anywhere in the country. One successful demonstration drives a rush of copy-cat investment in the same place for the same commodity while other commodities and geographies remain entirely unserved.

The policy failure dimension: the tomato case

The consequences of this absence are visible every few years in Pakistan's tomato market. In 2019-20, a combination of a poor domestic harvest and a ban on trade with India sent tomato prices to PKR 400-450 per kilogram. The government's response was to issue import permits for tomatoes from Iran and Turkey, but with no cold chain infrastructure to buffer domestic supply through the season gap, the ministry had no reliable read on how much was needed or when. Importers, seeing prices at PKR 400-450, marked up their own supply accordingly. When the new domestic crop arrived, imports were still coming in, thus flooding the market. Farmers who had grown tomatoes found prices had crashed so severely they could not cover transport costs to the mandi. Most farmers didn't even bother harvesting the crop. The root cause was not the price spike, and not even the import decision, but the absence of cold storage in Sindh and Balochistan's tomato growing areas that would have allowed domestic supply to be buffered through the seasonal gap in the first place, avoiding the crisis that triggered the chaotic import response.

When integration happens, cold chain follows

The international evidence, and Pakistan's own experience, is clear that cold chain investment flows most readily when a vertically integrated or anchor buyer player with consistent volume requirements and quality standards internalizes enough of the value chain to make the infrastructure commercially necessary. The clearest example in Pakistan is the potato cold chain. PepsiCo's Lay's snack business (working with approximately 160 contracted Pakistani growers) introduced the Lady Rosetta potato variety, specified the cold storage protocols required to maintain its quality, and directly enabled the development of a commercial cold storage sector around its procurement needs.[17] The result is a functioning potato cold chain with capacity distributed across Punjab and excess capacity that operators now rent commercially to other users including other food processors.

The dairy cold chain shows the same dynamic. Pakistan's milk chilling centre network was built primarily by organized processors, i.e., Nestlé, FrieslandCampina Engro Pakistan, and Fauji Foods who needed chilled raw milk to produce packaged dairy products. Their entry created the demand certainty needed to justify investment in milk collection centres that no individual farmer or trader could have financed alone.

For tomatoes, fresh leafy vegetables, onions, and most horticultural commodities, this anchor is absent. There is no domestic processor or international buyer with sufficient volume and quality specificity to pull cold chain investment into those value chains. The first-mover economics are viable: buying tomatoes at PKR 30/kg at harvest, absorbing cold storage costs, and selling at PKR 100-120 when supply tightens generates a meaningful return. However, no actor has yet demonstrated this at scale, and without a demonstration, the copy-cat dynamic that drives investment in Pakistan means nobody moves first. This is precisely where companies such as Del Monte or Dole, or domestic food

17 https://www.pbc.org.pk/research/value-added-processing-of-potato-in-pakistan/

processors focused on sauces, purees, and juices, could play a transformative role. They can not only create demand certainty for cold chain investment, but also trigger the imitative investment wave that follows any visible success in this market.

The lesson from Pakistan's own potato and dairy sectors, and from international experience, is that cold chain investment follows integration and demonstrated returns. Financing subsidies and duty waivers are necessary but not sufficient. The policy agenda must equally focus on creating the conditions of anchor investor incentives, contract farming frameworks, and demonstration facilities under which the first mover emerges and others follow.

Policy and Investment Environment

Existing policy instruments

At the federal level, the State Bank of Pakistan's Financing Facility for Storage of Agriculture Produce offers concessional agricultural financing of up to PKR 500 million at up to 6% markup with a maximum financing tenor of 7 years (10 years for SMEs) and up to a 6-month grace period through commercial banks.[18] Cold chain machinery and refrigeration equipment meant for agriculture fall under the Fifth Schedule to the Customs Act whereby its import does not attract import duties (0% on controlled stores and 2% on milk chillers), however, sales tax of 18%, additional sales tax of 3%, and withholding tax are still applicable. This adds significantly to investment costs.

18 State Bank of Pakistan https://www.sbp.org.pk/Incen-others/sme-3.asp

International Experience: Morocco's Plan Maroc Vert

Morocco is the most instructive international case study for Pakistan. At the start of its Plan Maroc Vert (PMV) in 2008 (Morocco's plan to modernize agricultural value chains), Morocco faced conditions closely parallel to Pakistan's today with a smallholder-dominated agricultural sector, high post-harvest losses, fragmented cold chain infrastructure, and export markets concentrated in a single destination, i.e., the European Union. Over the following decade, through a combination of targeted public investment and private aggregation incentives, Morocco transformed its horticultural export capacity.[19]

The results were significant. Between 2008 and 2020, the value of Morocco's agricultural exports multiplied 2.7 times, citrus production grew at 6% annually, fresh fruit exports at 13% per year, and fresh vegetable exports at 8.5% per year over the same period.[20]

The policy architecture behind this had four elements directly applicable to Pakistan. First, rather than dispersing investment nationally, the PMV concentrated it geographically by **developing agri clusters** in key production regions that **co-located farmers, pack houses, cold chain facilities, processors**, and exporters in shared infrastructure zones. This directly

19 https://maroc.ma/en/news/green-morocco-plan-profoundly-transformed-moroccan-agriculture
20 https://africaprojectsmagazine.com/moroccos-green-morocco-plan-infrastructure-for-agri-exports/

addressed the first-mover problem because by providing shared cold chain infrastructure as a public good, the government reduced the capital barrier for private operators to the point where individual investment became viable. Second, **aggregation schemes and contract farming** were used to bring smallholder producers into organized supply chains, creating the off-take certainty that drives cold chain investment. It is the same dynamic that Lay's/PepsiCo created in Pakistan's potato sector, but delivered here through deliberate policy. Third, the **EU's phytosanitary and quality standards functioned as an external quality pull**. Its market access requirements forced the sector to invest in pack houses, cold chain, and traceability that no domestic regulation had managed to mandate. Fourth, **Morocco's national export promotion body coordinated strategy across value chains**, preventing the fragmented, commodity-by-commodity approach that has characterized Pakistan's horticulture export efforts.[21]

Morocco's experience is not without caveats directly relevant to Pakistan. The PMV's benefits were unevenly distributed: large, export-oriented farms captured most of the gains, while rain-fed smallholders saw limited improvement. Access to subsidies required formal land titles and capital that many small farmers lacked.[22] Pakistan must design any equivalent program explicitly to avoid replicating the exclusion of small farmers, particularly given that the cold chain gap is most severe in areas dominated by small landholders in Sindh, Balochistan, and KPK.

The core lesson is that the program used public infrastructure and aggregation incentives to make the first move commercially viable for private actors, after which private investment followed at scale. Pakistan's cold chain challenge is the same coordination failure and requires the same solution logic, calibrated to Pakistan's specific commodity priorities and geographic constraints.

21 https://africaprojectsmagazine.com/moroccos-green-morocco-plan-infrastructure-for-agri-exports/
22 https://www.freiheit.org/morocco/agriculture-under-pressure-climate-change-and-moroccos-food-security

Recommendations

The analysis in this brief points to a cold chain challenge with several distinct but interconnected dimensions. It includes a physical infrastructure deficit, a financing and cost structure that makes investment difficult, and a value chain organization that suppresses the incentive to invest even when financing is available. The recommendations below address all three dimensions, structured across several pillars.

Establish a National Cold Chain Development Program

- The absence of a dedicated, integrated cold chain policy is the root cause of the fragmented response to date. Pakistan needs a multi-year cold chain development program that sets targets and provides the financing architecture.
- Set a national target of a minimum of 4 million tons of new cold storage capacity over ten years, with sub-targets by commodity and geography, prioritizing Controlled Atmosphere storage for mangoes, kinnow, and tomatoes, pre-cooling and pack house infrastructure in production zones, and MCC expansion in unserved dairy areas.
- A dedicated financing facility, seeded with government capital and open to co-investment from multilateral organizations, providing concessional long-tenure loans (10-15 years at 6-8%) for cold chain construction with cold chain assets as collateral.

Remove Fiscal and Regulatory Barriers

- Provide income tax holidays: A 5 to 7-year income tax holiday for new cold chain investments, with longer grace periods for investments in Balochistan, KPK, and interior Sindh. This directly addresses the first-mover hesitancy thus reducing the risk of the initial investment that, once demonstrated, triggers the imitative investment wave.
- Provide government land on long-term lease (25-50 years) for cold chain facilities established in designated production zones. Land availability in growing areas is a barrier often quoted by the sector, therefore, a land lease mechanism removes it without requiring outright land acquisition by investors.

Prioritize Farm-Gate and Production-Zone Infrastructure

- The most critical missing link in Pakistan's cold chain is not storage near cities, it is pre-cooling and storage at or near the farm gate, in production zones, where field heat accumulates in the hours after harvest. This is where the largest losses occur and where investment is most absent.
- Deploy a target of 5,000 solar-powered modular cold rooms at village and farm-gate level in priority horticulture districts over five years.
- Invest in mandi cold infrastructure: Allocate capital grants for refrigerated unloading bays and short-term holding rooms at the ten largest fruit and vegetable wholesale markets in Pakistan.
- Following Morocco's model, develop public-private agri clusters providing shared

pack house, pre-cooling, and cold storage infrastructure on lease to private operators in Sargodha (kinnow), South Punjab and Sindh (mango), and Balochistan and KP (apple and apricot).

Strengthen the Dairy Cold Chain

- Set a milk chilling coverage target: Establish a national target of chilling 50% of milk at source within five years. Map current Milk Chilling Centre (MCC) coverage gaps by district and use the Cold Chain Development Fund to co-finance new MCCs in unserved areas.
- Enforce pasteurization progressively: Support provincial food authorities in staged enforcement of pasteurization requirements, with a clear compliance timeline and transition support for the informal sector. Punjab Food Authority's enforcement activity is already functioning as a cold chain investment driver,[23] and replicating this across Sindh and KPK would extend the effect.

Catalyze Anchor Investment and Value Chain Integration

General cold chain subsidies alone will not resolve the investment gap. The deeper problem, that no single actor in a fragmented spot-market value chain captures enough of the return to justify cold chain investment, requires a targeted effort to bring anchor investors into the value chains where they are absent.

- Offer investors who commit to contract farming models with a minimum of 500 smallholder growers an enhanced package (e.g. concessional financing and land lease).
- Actively target both domestic and international agri-processors and retailers as anchor investors. International buyers have an additional role beyond capital: their procurement standards create a quality pull on the entire supply chain that domestic policy has so far been unable to replicate.
- Commission a single, publicly co-financed CA cold storage facility in a priority tomato-growing district, operated commercially on a cost-recovery basis, open to farmers and traders on a fee basis. The purpose is not the facility itself but the demonstration effect showing the seasonal price spread between harvest glut and when supply tightens produces a viable return.

23 https://cell.pfa.gop.pk/knowledge-base/minister-food-and-dg-punjab-food-authority-execution-of-pasteurization-policy

Conclusion

Pakistan's cold chain infrastructure gap is large, well-documented, and entirely addressable, yet it persists because the barriers to investment are structural rather than merely financial. This brief has argued that the problem has three distinct but connected dimensions: a physical infrastructure deficit that leaves less than 8% of fruit and vegetable production with access to any cold storage; a technology landscape dominated by single-temperature cold stores that are the wrong type of infrastructure for most of Pakistan's high-value commodities; and a value chain structuring in which no single actor captures enough of the return from cold chain investment to justify the outlay.

The economic cost of inaction is large and recurring. Post-harvest losses of fruits and vegetables alone are conservatively valued at $700 million to over $1 billion annually. Dairy losses account for a further 15–20% of production at roughly 10-12 billion litres of milk wasted every year. And as the cyclical tomato crises illustrate, the absence of cold chain does not just cause slow, chronic losses, it creates acute price crises that hurt farmers, consumers, and the government's food security management simultaneously. These are not acts of nature. They are the predictable consequence of an infrastructure gap.

The good news is that the conditions for change are more favourable today than at any previous point. Interest rates have fallen from their 2023 peak. Solar cold storage technology has become cost-competitive and is growing rapidly across South and Southeast Asia. Provincial food authorities are tightening enforcement of food safety standards. The CA reefer container (the technology that could open European and North American markets to Pakistani mango) is moving to commercial availability in Pakistan. And Pakistan's own experience with the potato cold chain and dairy MCC network shows that when

the investment conditions are right, the private sector moves.

What the market will not do on its own is move first. The coordination failure at the heart of Pakistan's cold chain investment problem where each actor waits for others to demonstrate viability before committing capital, requires a deliberate public sector response. The recommendations in this brief are designed around that logic. The National Cold Chain Development Program, the Cold Chain Development Fund, the agri cluster model, the CA demonstration facility for tomatoes, and the anchor investor model are all, at their core, first-mover interventions, i.e., instruments designed not to substitute for private investment but to de-risk it to the point where the private sector follows. Morocco's Plan Maroc Vert multiplied agricultural export value 2.7 times in twelve years using exactly this logic. India's MIDH program built a cold storage sector of 37 million tons over two decades using capital subsidies that made the first investment in each location commercially viable. The instruments are known. The investment case is clear. What has been missing is the deployment of instruments in a coordinated, adequately funded, and geographically targeted way.

Pakistan produces enough fruits, vegetables, milk, and meat to feed its population, supply its cities, and compete in export markets from China to the Gulf to Europe. It loses a third of that production between farm and consumer, not because the crops are poor, but because the infrastructure to preserve them does not exist. Closing that gap is among the highest-return investments available to Pakistan's economy, and among the most direct contributions that policy can make to rural incomes, food security, and export competitiveness in the decade ahead.

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