An Introduction
National Centre for Cold-chain Development

Autonomous Body to serve as a Think-tank for Cold-chain and Agri-logistics matters.
Operationalised in 2012 by Ministry of Agriculture & Farmers Welfare
About NCCD

- Autonomous body of the Government of India
- Objective to facilitate cold chain development
- Impacts across all user segments
- Guides cold-chain policy matters
- Intervenes in capacity building
- Recommends standards

Sanctioned by Cabinet to function as autonomous body for cold-chain development. Provided one time grant as corpus, no recurring funding.
Cold-chain justifies productivity, adds to socio-economic growth and environmental sustainability.

Cold-chain, as a physical conduit, is the intervention that empowers the producers to overcome perishability and to link across distance with multiple markets.
Chairperson: Secretary AC&FW

Director: Joint Secy (DAC)

CEO: Chief Advisor

Finance Advisor

Admin Cadre

Technical Cadre

Nodal Officers for Cold-chain Development (NOCDs) by State Govts
## Industry Participation

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category G</td>
<td>Groups (Grower Associations, Cooperatives, FPOs, NPOs, Students, etc)</td>
</tr>
<tr>
<td>Category C</td>
<td>All Companies, Investors and Researchers.</td>
</tr>
<tr>
<td>Category I</td>
<td>Industry Bodies (Associations / Chambers), PSUs &amp; Apex Institutes.</td>
</tr>
<tr>
<td>Category P</td>
<td>Patron Members.</td>
</tr>
<tr>
<td>Category R</td>
<td>Resource Institutes: Educational Centres of Excellence, Regulatory Authorities.</td>
</tr>
<tr>
<td>Category A</td>
<td>Associate Member (Individuals).</td>
</tr>
<tr>
<td>Category F</td>
<td>Fellow of NCCD.</td>
</tr>
</tbody>
</table>
19 States have nominated NOCDs (Nodal Officers for Cold-chain Development)

Capacity building for Government & Private industry

- 3 day Residential Training program at Chennai on advanced technologies, energy efficiency.
- 5 day course at Cemafroid on cold-chain.
  - Co-funded by Govt of France
Entrepreneur & skill building – ripening units
  Pan-India through members of NCCD
  4379 trainees, district level participation
Student chapter, academic institutes
Professional stakeholders
**Vision**
Reduce cost of Food Delivery across India.

**How**
- Promote Stakeholder participation in remedial measures.
- Fast track the movement of perishable cargoes.
- Reduce Risk to Inventory in-transit
- Provide technical viability to surface distribution of perishables.
- Improve monitoring & governance of perishable movement.

The first ‘Bhagidaari’ (inclusive) e-governance intervention in cold-chain.
Developed Guidelines & Minimum System Standards

Malda Mango to Delhi
- 24 tons: 1500 kms, weekly

BEE-Cool, a bee migration unit
- Refurbished truck body with cooling
- Racks to transport bee hives

ICAP for harmonising data (NeGP)

North South off-season connectivity

Definitions and concepts
Round tables, IC & JWGs
State Action Plans
International Journal on cold-chain management planned
Information Bulletin

(Ministry of Agriculture)

"Centrally Sponsored Scheme for Cold-chain Projects"

Cold chain logistics is a thrust area for development, and considered as part of the second green revolution. Cold chain is viewed as an end to end logistics bridge, providing uninterrupted custody of value harvested at farm gate to the end consumer. The Government of India supports the development of cold chain and through the Ministry of Integrated Development of Horticulture under the Ministry of Agriculture provides several incentives to interested participants. Financial assistance of 35% to 50% of admissible cost is granted.

Who can apply: Private Industry, Entrepreneurs, Cooperatives, Farmer groups, PSUs.

When to apply: Scheme is demand driven and can be availed all through the year.

Where to apply: Offices of Local Horticulture Mission or National Horticulture Board.

Eligible Components: Modern Pack-houses, with Pre-coolers, Cold Rooms, Cold Stores, Reefer Vehicles, Reefer Containers, Ripening Units, Alternate Energy, Retail shelves, Vending carts.

Requirements: Fully funded project with loan sanctioned from a nationalized bank. Subsidy is credit linked to incentivize investors by reducing their credit burden. Supported components are explained in the scheme Guidelines, should abide minimum System Standards. You can create market links & reduce food losses!

Guidelines & Standards: See www.MHIDC.gov.in or www.NCCD.gov.in | For more information: Contact the closest State Horticulture Department or your State’s Nodal Officer for Cold chain Development (NODC).

Benefits of investing in Cold-chain

- Investment linked 150% Tax Deduction (Section 32 AD of IT Act)
- Low interest loan from Warehousing Infrastructure Fund (WAFIRF)
- Credit linked Subsidy at projects @ 35% to 50% of admissible costs (MHIDC)
- Services Tax exemption for pre-conditioning, storing, transporting agricultural produce
- Services Tax exempted for ‘Erection, Commissioning, Installation’ of Cold storage & transport
- Rewards of endless Demand, Smart bridge between rural & urban, reduced Food Losses
- Growing market for Fresh Fruits and Vegetables, domestic and international
- Option to avail of Negotiable Warehousing Receipts as per WDRA norms
- 100% FDI through automatic approval route, and ECB route open

Five Steps from Farm-gate to Consumers

1. Collect and pre-condition after harvest
2. Pack & Send for travel
3. Transport
4. Ship to destinations
5. Front-end - back-end

Cold chain opens new market avenues for Indian Agriculture
Recentions

- New Concepts - Waste (stranded cold) energy recovery from LNG regasification, port gateways.
- APO session recommends an NCCD in every SE Asian nation (2013).
- Recognised with first Agribusiness Leadership Award (2014).
- Invited to debate on Food Crisis at UK House of Lords (2015).
- Expert witness to UK Policy Commission on cold economy (2015).
- Chair on Food Loss and Waste at Global Summit in Hague (2015).
- Certified as General Public Utility u/s 12AA of the IT Act (2015).
- Study with inverse approach, linking consumption to cold-chain (2015).
- NCCD exempted from service tax, in Union Budget (2016).
Disruptive THINKING!

Farm-gate to consumer
Pack-houses and reefers
Safe ripening & gainful productivity

Transfer heat, not generate heat
Thermal Banks to reutilise

Different strokes
Magnets, Sound
Peltier, VAM
Geothermal

Hybridised solutions
Waste recovery
Energy reuses
Clean options

“We’ve got the fuel. We’ve got the technology... It’s what’s in between that’s the challenge.”
Roadmap NCCD

Roadmap – Phase I

- Roadmap developed with private sector suggestions at first NCCD conclave in 2012.

**Admin**
Organisational structuring. Constitute technical Committees

**Web**
Open Communication lines with public
- Web site and ITC interface.
- Monthly reach out programmes.

**Map**
Map Existing enabling Infrastructure – storage & fleet
Register existing asset base, record future builds.
Assess viability gaps & asset base assessment.

**Pilot**
Build Platform to create enabling environment.

**Market Research & Case Studies**
Integrate sharing, promote collaborative base with govt knowledge houses & commercial organisations.

Develop skill resources, promote HRD with other govt bodies. Sponsor excellence awards.

Commercial collaboration to promote technologies & curriculum.

Collaborate and coordinate national & international efforts.

Testing, capacity building, norms.

Knowledge Repository national & international. Industry participation to undertake pilot projects.

Policy recommendations to GoI.

Technology, Standards, Laboratories, Guidelines
Skill / HRD, Innovation
Investments, Growth
Additionally NCCD was assigned as NLA of MIDH:

- First Action Plan as NLA in 2013-14 (Nov-2013)

**Mandate: as National Level Agency of MIDH**

- To update technical standards and adherence protocols as necessary when improved technologies & efficiencies are introduced/understood/approved.
- Guide policy and standards for development of integrated cold-chain in the country, for perishable fruits, vegetables and other allied agricultural commodities to link with markets.

- MoU on knowledge sharing with Cemafroid of France (as part of Indo-France JWG) – organization similar to NCCD since 1956.

- Represent India at ‘Institut International du Froid’ - independent intergovernmental science and technology based body (from 1908) to promote knowledge in all fields of refrigeration. Addresses key issues that include food safety, health, energy saving and energy efficiency, global warming and ozone depletion.
Key Interventions by NCCD

All India Cold Storage Survey  *Implemented by NHB*
- Capacity created = 32.95 mMT (6586 nos)
  (survey data upto June 2014)
- Closed permanently = 1219 nos
  (includes 254 units not located on site)
- Operating Capacity = 26.85 mMT (5367 nos)

Demand Driven Study  *Implemented by NCCD*
- Inverse approach to infrastructure requirement

Guiding Rationalising of support programs
- System Standards for cold-chain infrastructure.
Think tank to Govt on the subject of cold-chain and agribusiness. Engage with its members to translate industry needs into policy recommendation.

Manned by technocrats (industry leaders) and functions through member stakeholder consultation.

Provides an enabling environment and facilitates private investment in cold-chain sector.

Assist in developing and promoting future ready, energy efficient technologies and its adaption.

Capacity building and training activities to reduce the gap in skilled human resources.

Awareness on best practices, indigenised for specific requirements and conditions.

Revisit & guide policies, approve new technologies, efficiencies when developed/understood.

Research and Monitor impact of policies and recommend any changes, if needed.

Design assistance patterns, Capacity building, Institutional Workshops and Conclaves, Field Studies, Appraisals, Redressals, Policy guidance.

Stakeholder Members:

Groups (Self Help Associations)
- Farmer Groups, Consumer Groups, Cooperatives, students

Resource (Academic Institutes)
- Research, Academic & Training centres

Associates (Individuals)
- Individual associate members

Bodies (Industry or Government)
- Industry Chambers, PSU, Apex Bodies

Company (Commercial)
- Food sector, equipment sector, Investors, Consultants, Logistics, etc.

Fellow (Individuals)
- Senior Individuals as Fellows of NCCD
Thank You

End Deck-1

Deck-2

“All India Cold-chain Infrastructure Capacity” study

... follows Intermission – the need for a study
• 23 million hectares (off 16% of arable land)

• Contributes 38% to Gross Net Value of Agriculture

Horticulture Production
Million Metric Tons

<table>
<thead>
<tr>
<th>Year</th>
<th>Fruits</th>
<th>Vegetables</th>
<th>Plantation Crops</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-02</td>
<td>43.001</td>
<td>88.622</td>
<td>9.697</td>
<td>4.464</td>
</tr>
<tr>
<td>2004-05</td>
<td>50.867</td>
<td>101.25</td>
<td>9.835</td>
<td>4.985</td>
</tr>
<tr>
<td>2007-08</td>
<td>65.587</td>
<td>128.45</td>
<td>11.3</td>
<td>5.9</td>
</tr>
<tr>
<td>2008-09</td>
<td>68.465</td>
<td>129.08</td>
<td>11.336</td>
<td>5.837</td>
</tr>
<tr>
<td>2009-10</td>
<td>71.516</td>
<td>134.1</td>
<td>11.947</td>
<td>5.908</td>
</tr>
<tr>
<td>2010-11</td>
<td>74.878</td>
<td>146.55</td>
<td>12.007</td>
<td>6.986</td>
</tr>
<tr>
<td>2011-12</td>
<td>76.424</td>
<td>156.33</td>
<td>12.993</td>
<td>7.414</td>
</tr>
<tr>
<td>2013-14</td>
<td>88.977</td>
<td>169.48</td>
<td>16.301</td>
<td>9.177</td>
</tr>
<tr>
<td>2014-15</td>
<td>86.602</td>
<td>168.51</td>
<td>15.575</td>
<td>9.331</td>
</tr>
<tr>
<td>2015-16e</td>
<td>89.018</td>
<td>168.51</td>
<td>15.48</td>
<td>9.484</td>
</tr>
</tbody>
</table>

Others: includes Spices, Loose Flowers, Nuts, Mushroom, Aromatic/medicinal and Honey.

Source: Horticulture Division, Ministry of Agriculture and Analysis
WPI Inflation trends (40 years):

- Despite **producers** showing **robust response** by increasing supply, **yet inflationary pressure exists**.
- Food, is now the prime driver with perishables contributing highest.
- This may indicate that demand for perishable products continues to outstrip supply.
- Actually, a **lack of efficient supply systems indicated** - continues to feed inflation in food items.

Continual demand for food distribution and cold chain is foreseen over coming decades.

Trends - Annual Average WPI Inflation (from 1970 to 2012)

<table>
<thead>
<tr>
<th>Period</th>
<th>All Commodity</th>
<th>Primary Food</th>
<th>F &amp; V</th>
<th>Milk</th>
<th>Eggs, Meat, Fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971-72 to 1981</td>
<td>10.2</td>
<td>8.5</td>
<td>9.0</td>
<td>7.1</td>
<td>11.0</td>
</tr>
<tr>
<td>1982-83 to 1993</td>
<td>7.9</td>
<td>9.2</td>
<td>10.6</td>
<td>9.0</td>
<td>9.4</td>
</tr>
<tr>
<td>1995-96 to 2004</td>
<td>5.9</td>
<td>5.9</td>
<td>7.5</td>
<td>5.7</td>
<td>6.4</td>
</tr>
<tr>
<td>2005-06 to 2011</td>
<td>6.6</td>
<td>9.9</td>
<td>9.2</td>
<td>10.1</td>
<td>11.8</td>
</tr>
</tbody>
</table>

Source: RBI, Office of Economic Adviser, MoCI, Govt of India
Portland Cold Chain Symposium

As per NSEL Report (2010)
- Cold chain requirement = 61.13 mMT
- Existing cold chain capacity = 24.29 mMT
- Infrastructure gap = 36.83 mMT

As per ASSOCHAM Report (2012)
- Existing capacity = 30.11 mMT
- Additional requirement = 36.83 mMT

As per Emerson Climate Report (2013)
- Existing capacity = 30.11 mMT
- Infrastructure gap = 31.02 mMT

As per YES Bank Report (2014)
- Added Cold Stores required = 30.98 mMT

Each report snowballed from previous, w/o demand baseline

Commodity trading, collateral manager

Broad based Industry Chambers

Refrigeration Equipment Providers

Govt Relation Managers & Knowledge Bankers

Similar reports put forth by CII, FICCI PHDCCI, EXIM Bank, Consultants and many others… accepted by decision makers!

Incomplete solution: all previous efforts were focused on cold storage requirement.

The other components necessary for handling fruits and vegetables were not considered – such as Modern Pack-houses and transport requirements for fresh produce.

As a result, major Infrastructure created in form of refrigerated Storage, which did not bring impetus to better post-harvest handling of fresh produce, but helped develop marketing of certain processed foods and fresh imports coming in cold-chain.
World’s largest footprint in cold stores
- 134 million mtrs³ in refrigerated storage (33 mill tons)
  - USA has 115 and China 70 million cub. metres of refrigerated space.

Food loss remained high in the supply chain
- FAO HLPE of 2014 reported 126 kg FLW per capita per annum
- Industry reports indicated 30-40% production lost

Urbanisation high, population keen for high value foods
- Imports of fresh produce grew 15 to 30 times in 10 years
- Market grows for health conscious viz price conscious

Farmers socio-economic growth partial
- Production levels high, productivity going waste
- Farmers market access and range limited
## Other Counsels

<table>
<thead>
<tr>
<th>Date</th>
<th>Committee/Report Title</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 1999</td>
<td>JNL Srivastava Committee reported on Cold Storage – assessed a gap of 39 lakh tons and existing capacity of 103 lakh tons (3443 cold stores). Recommended central support for developing cold stores.</td>
<td></td>
</tr>
<tr>
<td>May 2012</td>
<td>Dr. S. Chaudhuri Committee reported that push to build cold storage in fruits and vegetables was not successful due to large deficiencies in the logistics system in between the farm to the final consumer.</td>
<td></td>
</tr>
<tr>
<td>Sept 2012</td>
<td>NCCD Committee on Supply Chain and Logistics recommended baseline survey of infrastructure to assess usable components across segments, and as a precursor to a need based evaluation.</td>
<td></td>
</tr>
<tr>
<td>May 2013</td>
<td>NCCD reported that pack-house and transport are key missing links and that future cold-chain development should holistically address the total activity chain, especially at farm-gate.</td>
<td></td>
</tr>
<tr>
<td>April 2014</td>
<td>CCEA approved new guidelines and norms, rationalised to address all relevant links in cold-chain, designed to develop and strengthen supply chain oriented, cold-chain logistics.</td>
<td></td>
</tr>
<tr>
<td>May 2014</td>
<td>All States advised that physical storage capacity should not be the sole measure of development and to focus on enabling throughput to markets so as to enhance revenue options for farmers.</td>
<td></td>
</tr>
</tbody>
</table>
Key Direction

- Task Force on Cold-chain Projects, MoFPI (TFCP) 2014
  - TFCP stated that NSEL 2010 report “was not aligned with infrastructure needs of a market linked supply chain”.
  - TFCP reported that “it emerged that the gap of cold storage capacity earlier assessed at 29 million tons, may not be required”.
  - TFCP proposed that, in view of consensus, for time being additional capacity of 7.5 million tonnes should be aimed over next five years.
  - It is understood, that this capacity does not solely refer to cold stores but includes other critical links so as to achieve end-to-end connectivity from farm-gate to consumer through cold-chain.

- After considering the report by TFCP, the direction after PMO meeting (13-Dec-2014)
  - “cold chain management should be considered as part of the second green revolution and the implementing agencies (NHB, NHM & MOPFI) should change their approach and address it “end-to-end” connecting farm gate to consumer in a seamless manner.”
  - In this background, a commitment to create 2.5 mill tons of cold-chain capacity by each of 3 implementing agencies (NHM, NHB, MOFPI) in next 3 years was made by then Secy MoFPI.
AICIC (2015) study was commissioned by DACFW and executed through NCCD and NABCONS (Nabard Consultancy).
## Time lines

<table>
<thead>
<tr>
<th>Date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>23-05-2014</td>
<td>NCCD proposed market linked assessment of cold-chain infrastructure</td>
</tr>
<tr>
<td>15-09-2014</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; meeting of TFCP, informed of study under process</td>
</tr>
<tr>
<td><strong>31-10-2014</strong></td>
<td><strong>Awarded study to NABCONS, after approval of Secy (DACFW)</strong></td>
</tr>
<tr>
<td>09-06-2015</td>
<td>EC of NCCD updated on draft report from NABCONS. EC directed to expedite and release in public domain within one month</td>
</tr>
<tr>
<td><strong>11-06-2015</strong></td>
<td><strong>Draft report forwarded to MoFPI, DAC, NHB, APEDA, ICAR with request to arrange comments and suggestions before 26-06-2015</strong></td>
</tr>
<tr>
<td>24-06-2014</td>
<td>All State Nodal Officers sent summary of draft report</td>
</tr>
<tr>
<td>30-06-2015</td>
<td>Reminders sent to provide comments, if any, before 6-7-2015</td>
</tr>
<tr>
<td>28-07-2015</td>
<td>MoFPI (and GoI agencies) provided revised table (with cold store capacity reduced basis inputs from DAC) for finalising.</td>
</tr>
<tr>
<td><strong>30-07-2015</strong></td>
<td><strong>First comments from MoFPI, stating requirement is under-estimated.</strong></td>
</tr>
<tr>
<td>31-07-2015</td>
<td>MoFPI comments forwarded to NABCONs for consideration. Tentative explanation provided by NCCD vide email on 03-08-2015</td>
</tr>
<tr>
<td>05-08-2015</td>
<td>Meeting held with JS-MoFPI &amp; NABCONs to clarify upon the findings.</td>
</tr>
</tbody>
</table>
### Time lines ...cont’d

<table>
<thead>
<tr>
<th>Date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-08-2015</td>
<td>Letter from Secy (MoFPI) confirming that earlier observations were clarified &amp; directed that the final document suitably reflect the scope of the study. Meeting with Secy was held on 14-08, earlier edition discarded, and edition dated 14-08-2015 finalised for print and release</td>
</tr>
<tr>
<td>03-09-2015</td>
<td><strong>The Study report accepted and released into public domain</strong></td>
</tr>
<tr>
<td></td>
<td><strong>In following 6 months-</strong> Study shared with all State Govts. for follow-up for developing their action plans for 2016-17.</td>
</tr>
<tr>
<td></td>
<td>PHD and CII have held special conferences and sessions to highlight the findings and concept.</td>
</tr>
<tr>
<td></td>
<td>Report asked for placing in library of 7 institutes. Amity Univ recommends study as compulsory reading for UG/PG students and researchers.</td>
</tr>
<tr>
<td>08.10.2015</td>
<td>Letter from MoFPI to Niti Aayog, with comments suggesting that the capacity requirement and gaps are grossly underestimated</td>
</tr>
<tr>
<td>12.10.2015</td>
<td>Point wise response given amplifying on the realistic evaluations.</td>
</tr>
</tbody>
</table>
Demand Driven Study (*consumption linked*)

- Infrastructure studied as a tool to deliver food.
- Domain specific segmentation of components.
- Requirements assessed for purpose of connectivity.
- Logistics chain evaluated, working backwards from consumption – an Inverse approach.

...Gainful Productivity the target...
Income security for farmers as the outcome

Focus on reducing Loss in the farm-to-consumer supply chain
Infrastructure assessment on realistic consumption patterns, not notional needs
TOR finalized with GoI implementing agencies
Food Loss

When harvested produce escapes its end use!

How does our food escape?
• By perishing before it can reach gainful use!
• Because markets are too inaccessible!

Why are markets inaccessible?
• Because food is perishable and needs post-harvest care!
• Because Post-harvest care is not market linked!
• Because such Care requires working tools!
• Because such Tools require skills to use!
• Because some stakeholders do not care!
### Strategic direction

**OBJECTIVE**

Reduce Loss incurred on perishable produce

**WHY**

- Improve value realisation, **Income security to farmers**
- Optimise the Nation’s **Resource Utilisation**
- Give producers & consumers **Stabilised Prices**

**HOW**

- Maximise the reach of produce to markets
- Supply chain technology as an intervention
- Optimise would-be-waste from perishables

The AICIC (2015) findings provide direction for developing cold-chains that are linked to consumption, aimed at “seamless farm to consumer” logistics.
### Primary Products & Cities

#### Primary Products

<table>
<thead>
<tr>
<th>Category (Temp. Range)</th>
<th>Produce/Products Considered</th>
</tr>
</thead>
</table>
| Chill (0°C to 10°C)     | 1. Apple  
                          2. Grapes  
                          3. Orange  
                          4. Strawberry 
                          5. Kiwi  
                          6. Potato  
                          7. Tomato  
                          8. Cauliflower  
                          9. Okra  
                         10. Carrot  
                          11. Cabbage |
| Mild-Chill (10°C to 20°C) | 12. Mango  
                          13. Banana  
                          14. Papaya |
| Frozen (below -18°C)    | 15. Processed Products  
                          16. Meats (Livestock, Dairy, Fish)  
                          17. Ice-Cream |
| Normal (20°C to 30°C)   | 18. Onion  
                          Other processed items |

#### Sample Cities

<table>
<thead>
<tr>
<th>Zone</th>
<th>Cluster of Cities</th>
<th>Selected Major Consumption Centres/Cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>Delhi</td>
<td>1. Delhi</td>
</tr>
</tbody>
</table>
| South      | Bangalore, Chennai & Hyderabad    | 2. Bangalore  
                          3. Hyderabad  
                          4. Chennai |
| East       | Kolkata, North-24 Pragana         | 5. Kolkata                                 |
| West       | Mumbai, Thane, Ahmedabad, Pune, Jaipur, Surat | 6. Mumbai  
                          7. Ahmedabad  
                          8. Jaipur |
| North- East| North Eastern States              | 9. Guwahati                               |

TOR finalised after discussions with stakeholder agencies (Sep-2014) under chairmanship of Addnl Secretary (DAC&FW) and published in the TFCP Report (Annexure-II).

The assessment of primary information was thereafter applied to the total urban population of India for a wider basket of food items, provided more than 300 kms distance in the case of fresh horticulture produce.

Assessment also extended to projecting requirements in 2020. However, cold-chain has a multiplier effect on markets, hence current consumption based needs would be more relevant than notional projections.
Domain specific appraisal

Supply Side

- Tons per batch precooling + small cold room
- Modern Pack-houses
  - Farm-gate
- Right sizing Capacity and Investments
- Load capacity per trip
- Storage space per annum
- Daily tons per unit
- Cold Store
  - Distribution Hubs
- Multi-product
  - Multi Temperature
  - Multi Chamber
  - Multi-technology

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VOLUMETRIC THROUGHPUT is a common metric.

Demand Side

- Handling size weekly/annum
- Daily tons per unit
- Merchandising Platform
- Food Processors
- Ripening Units
**Linking the Demand matrix**

### Integrated Cold-chain: Demand-time-volume Matrix "Solution Finder"

<table>
<thead>
<tr>
<th>A. Target Population</th>
<th>10,00,000</th>
<th>number</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Product to Handle</td>
<td>Banana</td>
<td>name</td>
</tr>
<tr>
<td>C. Product category</td>
<td>Mild-chill</td>
<td>category</td>
</tr>
<tr>
<td>D. Source (Origin)</td>
<td>Pack-house</td>
<td>type of origin</td>
</tr>
<tr>
<td>E. Holding at market</td>
<td>Yes</td>
<td>if &quot;Yes&quot;, give days</td>
</tr>
</tbody>
</table>

| F. Per capita consumption    | 0.85      | kg/capita/month of target population |
| G. Size of Reefer vehicle    | 10        | metric tons carried per transport unit |
| H. Distance from market      | 1200      | kms from origin to destination |
| I. Avg Speed of transport    | 450       | avg kms travelled per day |
| J. Reverse Logistics (Y/N)  | No        | Yes if getting return haulage |

| Monthly Load                  | 850       | Tons per month |
| Transit time                  | 2.7       | days or 64 hrs |
| Total Tonmiles                | 14913     | roundtrip used |
| Market Share                  | 100%      | percent of population |
| Daily market demand           | 28        | tons per day - Banana supply required |
| Number of Vehicles            | 3         | Transport units needed daily |
| Total Vehicles needed         | 16        | Total transport units for round trip |
| Buffer Space needed           | 57        | tons space at front-end storage |

### To fulfill your target market demand, you need:

- Production / Source
  - Monthly output (tons) equivalent to 2 packhouses
  - 850 tons per month

- Reefer Vehicles
  - 16 vehicles needed to fulfil the demand
  - 2.7 days is travel time from load point

- Space in MT
  - 57 MT at Cold store hub to maintain required 1 day buffer
  - 28 tons of space for daily merchandising

### Recommendations:

- Ensure transport and destination is capable of keeping 10-16°C range of temperature.
- You have selected a Mild-chill Product, hence it may be better to opt for insulation of 40 to 100mm PUF material.
- Always ensure that dispatch point has prepared the product at correct loading temperature. Avoid delays while loading.
- You may benefit economically and reduce the tonmiles by opting to carry other cargo on return trip.
- Your daily demand is less than 50MT, try and hold a minimum one day surplus in front-end cold storage hub.
- Space of 57 MT at Cold store (Hub), is indicative: dependant on packaging, type of product and last mile distances.
Demand driver needs

Nationwide Requirement (2015)

- 70,080 units
- 61,826 units
- 9,36,251 MT
- 9,131 chambers
- 341,64,411 MT
- ~1,90,000 MT

For unit definitions, refer to “NCCD. 2015. AICIC Study”
The gap is large in case of pre-cooling/pack-houses, reefer transport and ripening units.

Currently majority of infrastructure is in form of bulk cold stores. Currently, 75% capacity utilization on average is achieved.

Uneven distribution, Produce from one State finds storage capacity in neighboring States.

Mission is to develop integrated and synergistic infrastructure components, so that farmers and consumers will gain from supply chain.

Since this report, an additional 1+ million tons in cold stores has been created.

Estimated 4.8 mill ton storage may have shut down due to ageing, viability, etc.
## Throughput capacity

<table>
<thead>
<tr>
<th>#</th>
<th>Component</th>
<th>Numbers</th>
<th>Holding Size MT</th>
<th>Annual Handling capacity MT</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Integrated Pack-house</td>
<td>70080</td>
<td>11,21,280</td>
<td>13,45,53,600</td>
<td>Preconditioning 16 tons a day for transit. Includes a pre-cooler and staging cold room with dispatch area for trucks. Can have processing units depending on crop</td>
</tr>
<tr>
<td>2</td>
<td>Reefer Vehicles</td>
<td>62000</td>
<td>6,20,000</td>
<td>3,22,40,000</td>
<td>Basis trip times. Reefer requirement can be scaled 3 times basis various factors.</td>
</tr>
<tr>
<td>3</td>
<td>Cold Storage (Bulk)</td>
<td>6833</td>
<td>341,64,411</td>
<td>3,41,64,411</td>
<td>Cold store (Bulk) at average size of 5000 tons with average holding of 8 months.</td>
</tr>
<tr>
<td>4</td>
<td>Cold Storage (Hub)</td>
<td>375</td>
<td>9,36,251</td>
<td>3,79,18,166</td>
<td>Cold store (Hub) at average size of 2500 tons with holding period of 7 - 15 days.</td>
</tr>
<tr>
<td>5</td>
<td>Ripening Chamber</td>
<td>9131</td>
<td>91,306</td>
<td>68,47,950</td>
<td>Ripening Units of average throughput of 10 tons per day every 4 chambers</td>
</tr>
<tr>
<td>6</td>
<td>Last mile</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>POS retail, small vehicles for last-mile delivery &amp; street carts form this segment.</td>
</tr>
<tr>
<td></td>
<td>Totals</td>
<td>148,419</td>
<td>369,33,248</td>
<td>2457,24,127</td>
<td>* Cumulative total</td>
</tr>
</tbody>
</table>
# State-wise Infrastructure assessed

<table>
<thead>
<tr>
<th>State</th>
<th>Urban Population (2014-15)</th>
<th>% Share Population</th>
<th>Packhouse (No)</th>
<th>CS Bulk (MT)</th>
<th>CS Hub (MT)</th>
<th>Onion Storage (MT)</th>
<th>Ripening Chamber (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>18428602</td>
<td>4.46</td>
<td>3124</td>
<td>489195</td>
<td>41730</td>
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<tr>
<td>Arunachal</td>
<td>354419</td>
<td>0.09</td>
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<td>6705</td>
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<td>Assam</td>
<td>4774459</td>
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<td>809</td>
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<tr>
<td>Bihar</td>
<td>13008947</td>
<td>3.15</td>
<td>2205</td>
<td>5094524</td>
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<td>2873</td>
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<td>Chhattisgarh</td>
<td>6670958</td>
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<td>1131</td>
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<tr>
<td>Delhi</td>
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<tr>
<td>Goa</td>
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<td>170</td>
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<td>Gujarat</td>
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<td>6.90</td>
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<td>Haryana</td>
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<td>HP</td>
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<td>304511</td>
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<td>160</td>
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<tr>
<td>J&amp;K</td>
<td>3807726</td>
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<td>8622</td>
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<td>841</td>
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<td>Jharkhand</td>
<td>8710072</td>
<td>2.11</td>
<td>1476</td>
<td>5228</td>
<td>19723</td>
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<td>1923</td>
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<td>Karnataka</td>
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<td>34200</td>
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<td>3063522</td>
<td>12045</td>
</tr>
</tbody>
</table>

* Pack house estimations are for the states, however will be based at production centres
## State-wise Infrastructure assessed

<table>
<thead>
<tr>
<th>State</th>
<th>Urban Population (2014-15)</th>
<th>% Share Population</th>
<th>Packhouse (No)</th>
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<th>CS Hub (MT)</th>
<th>Onion Storage (MT)</th>
<th>Ripening Chamber (MT)</th>
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<tbody>
<tr>
<td>Manipur</td>
<td>943761</td>
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<td>2925</td>
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<td>Meghalaya</td>
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<td>110</td>
<td>17228</td>
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<tr>
<td>Mizoram</td>
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<td>Nagaland</td>
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<td>--</td>
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<td>Punjab</td>
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<td>2828</td>
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<td>Tripura</td>
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<tr>
<td>Uttar Pradesh</td>
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<td>109631</td>
<td>72945</td>
<td>10691</td>
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<td>Uttarakhand</td>
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<td>753</td>
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<td>West Bengal</td>
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<td>7888623</td>
<td>71848</td>
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<td>7007</td>
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<tr>
<td>UT &amp; Others</td>
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<td>--</td>
<td>4539</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<tr>
<td><strong>All-India</strong></td>
<td><strong>413461936</strong></td>
<td><strong>70080</strong></td>
<td><strong>42035195</strong></td>
<td><strong>936249</strong></td>
<td><strong>7448545</strong></td>
<td><strong>91305</strong></td>
<td></td>
</tr>
</tbody>
</table>
Procedures for Assessment

A. Ripening Chamber:
- Based on consumption demand of mango, banana and papaya, adjusted to ripening cycle (4 days)

B. Integrated Pack house:
- Consumption data from urban centres (city) considered as demand.
- For each demand centre, a source / production point at a distance of greater than 300 km is considered for cold-chain intervention.
- Unit Size: 16 MT throughput per day, working only in season of respective crop type.
C. Reefer unit:

- Carrying capacity of 10 MT assumed.
- Maximum distance per day is 450 km (with an average speed of 30 km/hr for 15 hr in a day).
- Direct round trip has been considered to evaluate reefer vehicle requirement.

D. Cold storage (hub):

- Consumption demand and holding cycle of each product considered for estimation (Fruits & Vegetables: 7 days, Frozen Products: 15 days)
E. Cold storage (bulk):
Assessed on basis of production for crops with 6 to 8 months holding cycle.
Consumption across 9 cities for selected products calculated using 10 years NSSO household data.
Regional consumption patterns assessed to apply to 414 million urban population.
Adjusted for consumption and holding periods and to apply to larger basket of food items.
Only Horticulture produce is considered and report is underestimated.

All relevant produce and products that benefit from using cold-chain have been covered.

Consumption demand for total 9 long term holding crops, 33 perishable items, milk products, meat products and frozen peas are included.

To allow for omissions, extra holding time in cold storage (hubs) were used.
Milk distribution is not covered.

The report clearly mentions that Milk in liquid form has unique distribution system, and not included for this study.

Almost 30-35000 milk tankers are reported in use for liquid distribution and is well established.

A daily (or twice daily) collection system makes this a fast moving item with high throughputs.

Aseptically packaged milk is not using cold-chain except after opening the packet at consumer end.

However, consumption of Milk by-products is considered (ice cream, butter, etc.)
Future potential is not explained.

The report was focused to be demand driven on the basis of current consumption of foods.

Estimate for 2020 have been projected.

However, consumption demographics are changing to various micro-factors and cold-chain will also impact such demand.

Large gaps exist in integrated cold-chain development and potential is self-evident.
Almost 15 million tons of meats and fish is not addressed for storage needs.

The report explains the supply chain of foods. Meat products (livestock, poultry, fish) is supplied in regularly - daily frequency of operations.

15 million tons translates into daily delivery of 41000 tons only.

This volume through cold store hubs is already factored by allowing for higher holding time of 15 days.
Food processing equipment such as IQF lines and Blast freezers are not reported.

The report focuses on cold-chain as a service that handles product to-market linkage.

Food processing units are covered under manufacturing aspect of food processing and not cold-chain.

The output from such equipment is covered under consumption and cold-chain requirements.

Further, there was no data available on current production of food processing from such lines.
NSEL reported a higher need for 61 mMT.

This study actually reports the need to create a much higher handling capacity, of 240 million MT in cold-chain.

The NSEL report was limited to estimating cold store capacity with purpose of seasonal price arbitrage.

AICIC report is more comprehensive and realistic as it is demand driven and supply chain oriented.

AICIC projects holistic infrastructure requirements to develop market linked integration in cold-chain.
Report seems overly ambitious.

This study is not based on notional estimations but bears out as per realistic consumption data.

Household data from NSSO surveys for 10 years were used to assess the demand.

The infrastructure has been evaluated thereafter on basis of domain specific assessments.

Time and distance matrices have been applied where relevant and as per holding life of produce.

The report caters to an annual throughput of approximately 50 million tons to market, in cold-chain.
The Statewise cold store gap totals to 9 million tons, but national level gap is only 3 million tons.

Cold store capacity can cater to production in adjoining regions. State boundaries do not restrict the catchment of cold stores.

Development may have regional variation due to availability of electricity, roads etc., but overall national need will not vary much.

Simplistic interpretation of Statewise data will not be relevant as will neglect other dynamics of this domain.
Considerations

- Report is restricted to urban consumption, on assessing that produce within 24 hrs of production areas can be serviced without cold-chain.
- Pack-house numbers are for a unit size of 16 tons a day. In actual practice, modular units of larger sizes could be created.
- Every pack-house should create conjoined small food processing units which has not been assessed in this study.
- Ripening unit numbers could change with increased awareness of safely ripened fruits and affluence, which increases demand for fruits.
- Reefer units are assessed for a assumed size of 10 tons. Various micro factors would change actual numbers. Last mile transport not factored.
- Cold store (Hubs) would handle multiples in size as throughputs. In efficient supply chains, far lower holding periods can be expected.
- Food processing factories may use refrigeration at production stage or for captive storage. This is exclusive to their subsequent need for cold-chain.
- Conceptual level ambiguity requires clarity in definitions to harmonise understanding. A National Cold-chain Policy is a necessary next step.
Deck 3: Nerve centre and next level development

Strategy options
Each end point brings gainful end-use
Cold-chain Insight

- **Modern Pack House**
  - 15 MT per day
  - Starts cold & normal chain

- **Long Haul Transport**
  - 10-15 MT loads
  - 2-6 days round trips

- **Distribution Hub (Cold store)**
  - 1000 MT capacity
  - Close to market storage

- **Retail distribution**
  - 1-4 MT loads
  - Daily Delivery service

- **Retail / Merchandising**
  - Temperature controlled outlets
  - Vending carts, cabinets

**Normally manned by Women**
Assorting, Cleaning, Packaging, preconditioning, stage, dispatch

**Rural Youth as reefer drivers**
Return trips assured, promote reverse trade and commerce

**Close to market Hubs that deconsolidate for retailers.**
Generate demand information for advance planning of farmers.

**Last mile buffer and serves on demand supply to consumer outlets. Street carts provide livelihood to urban poor.**
**Integrated – component value**

<table>
<thead>
<tr>
<th>Component</th>
<th>Units</th>
<th>Cost</th>
<th>% of cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packhouses</td>
<td>7</td>
<td>630</td>
<td>47%</td>
</tr>
<tr>
<td>Reefers units</td>
<td>20</td>
<td>600</td>
<td>45%</td>
</tr>
<tr>
<td>Cold Store (MT)</td>
<td>1000</td>
<td>100</td>
<td>8%</td>
</tr>
<tr>
<td><strong>TOTAL COST</strong></td>
<td></td>
<td><strong>1330 lakhs</strong></td>
<td></td>
</tr>
</tbody>
</table>

- **Modern Pack House**
  - 15 MT per day
  - Supplies cold & normal chain
  - 10 units at Rs. 90 lakh each = 630 lakhs

- **Long Haul Transport**
  - 10-15 MT loads
  - 2-3 days TAT
  - 20 units at Rs. 30 lakh each = 600 lakhs

- **Distribution Hub (Cold store)**
  - 1000 MT capacity
  - 10% or 100 MT for Horti
  - At Rs. 10,000 per ton = 100 lakhs

- **Retail distribution**
  - 2-4 MT loads
  - Daily Delivery

- **Retail / Merchandising**
  - Temperature controlled outlets
  - Vending carts, cabinets

Component Units Cost % of cost
Packhouses 7 630 47%
Reefers units 20 600 45%
Cold Store (MT) 1000 100 8%
TOTAL COST 1330 lakhs
## Target Beneficiaries

<table>
<thead>
<tr>
<th>Type of Infrastructure</th>
<th>Beneficiaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern Pack-house</td>
<td>FPOs, Cooperatives, Traders, Retailers, Logistics Service Providers, Mega Food Park promoters, agri-produce exporters</td>
</tr>
<tr>
<td>Cold Storage (Bulk)</td>
<td>Traders, Wholesalers, Logistics Service Providers</td>
</tr>
<tr>
<td>Cold Storage (Hub)</td>
<td></td>
</tr>
<tr>
<td>Reefer Transport</td>
<td>Rural Youth, Logistics Service Providers, Pack-house and cold storage owners</td>
</tr>
<tr>
<td>Ripening Chamber</td>
<td>Retailers, Cold store Hubs, Logistics Service Providers</td>
</tr>
</tbody>
</table>

- Approach prospective beneficiaries with concept to promote ‘end-to-end’ seamless connectivity from farm to wholesale.
- Empower existing asset owners with ability to extend into other aspects of agri-business value chain.
## Strategy for Development

<table>
<thead>
<tr>
<th>Category</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity building on need assessment</td>
<td>• Develop implementing agencies</td>
</tr>
<tr>
<td>Program awareness</td>
<td>• Implementing agencies to promote awareness, projectise needs</td>
</tr>
<tr>
<td>Fast track applications</td>
<td>• Speed up assistance process</td>
</tr>
<tr>
<td>Feedback on activities</td>
<td>• Harmonise database and feedback</td>
</tr>
<tr>
<td>Expansion and scale up of existing</td>
<td>• Modernisation and upgradation</td>
</tr>
<tr>
<td>Application based research</td>
<td>• Management and handling protocols for indigenous crops</td>
</tr>
</tbody>
</table>
Industry, PSUs, Government, Investors, Entrepreneurs, Farming Associations & Knowledge Houses - All Working Together!

- Training, HRD and R&D Committee.
- Committee for Application of non-Conventional Energy Sources in Cold Chain Infrastructure.
- Committee for Supply Chain & Logistics.
- Liaison with other NLAs and States.
- NCCD Members, other cold chain sectors.
Defining - Rationalising - Harmonising
Making India’s Cold-chains Smarter

Thank You
धन्यवाद

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www.FB.com/NCCD.India