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Are clean cold-chains the panacea to manage food loss, eliminate hunger, minimize farmer distress and mitigate GHG emissions?

International conference on Energy Efficient Cooling

12-13 December 2019

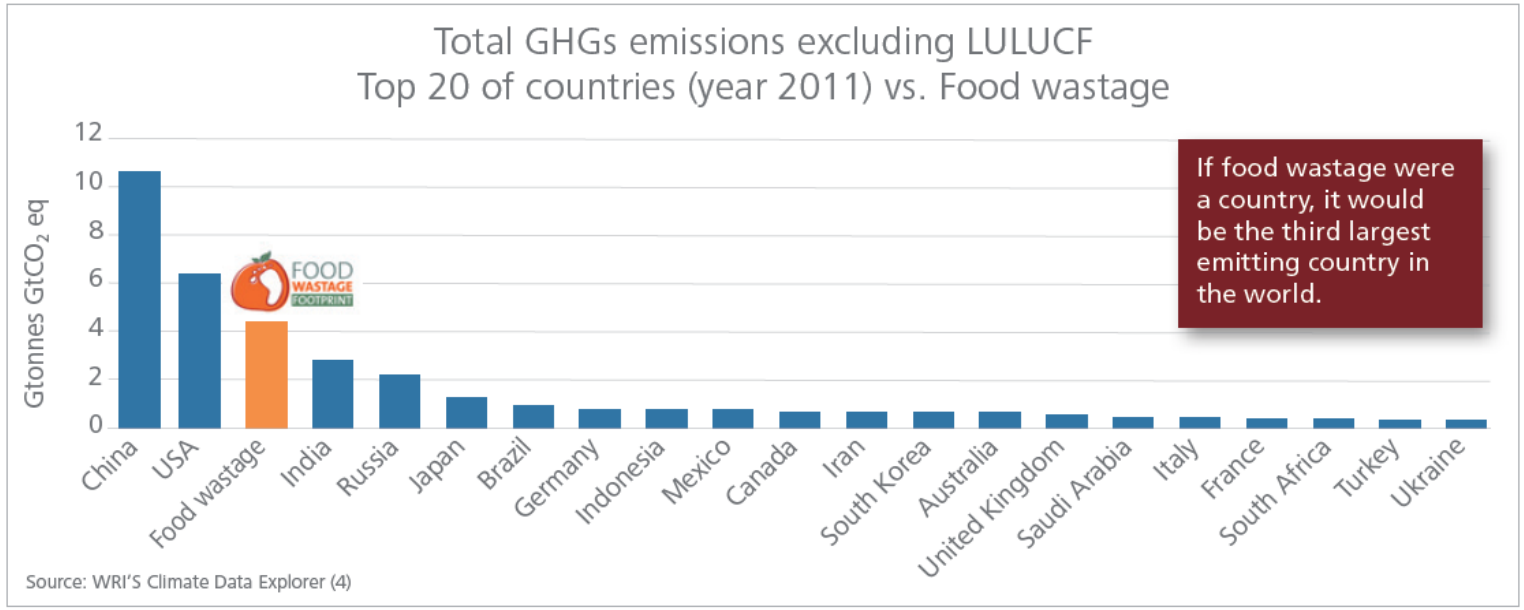
New Delhi

Global food loss and waste contributes to about **8%** of total global anthropogenic Greenhouse Gas (GHG) emissions.

The **per capita greenhouse gas** emission due to food loss and waste in South & South-east Asia (including India) is **350 kgCO2e/ year**).

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Source: UN's Food & Agriculture Organization, 2011



About 30 percent of food is wasted globally across the supply chain (storage, handling and distribution).

In developed economies, the maximum food wastage occurs at the consumer level, but in developing economies, food produce is lost before it even reaches the consumers.

It is estimated that better handling, storage and processing of food produce can feed around 11% of the global population additionally.



Food Loss & Waste by Region

Source: HLPE, Food losses and waste in the context of sustainable food systems. (High Level Panel of Experts on Food Security & Nutrition of the Committee on World Food Security, Rome.), 2014

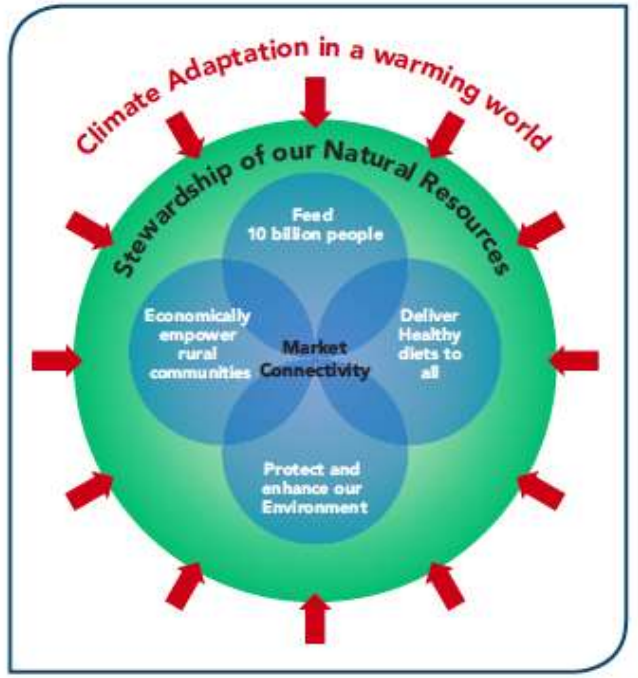
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Food Loss and Society

- 750M globally people in extreme poverty dependent on agricultural for economic well-being
- 50% of the workforce in India is directly employed by agriculture



The Exam Question

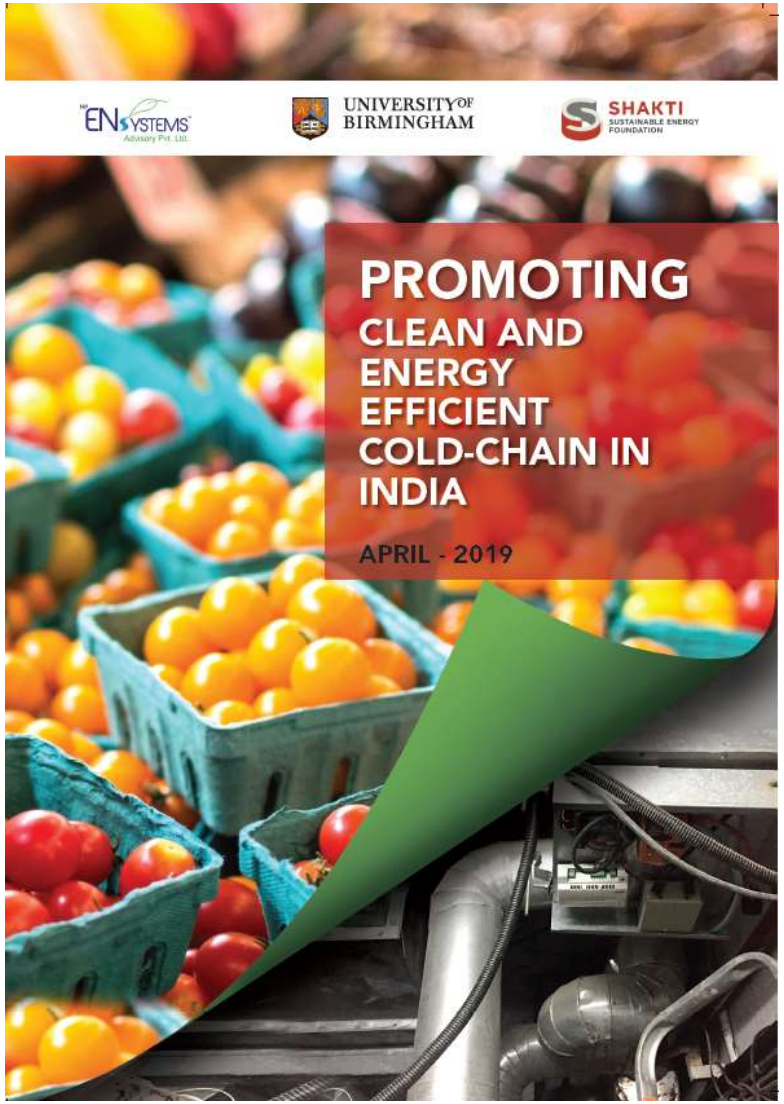


University of Birmingham

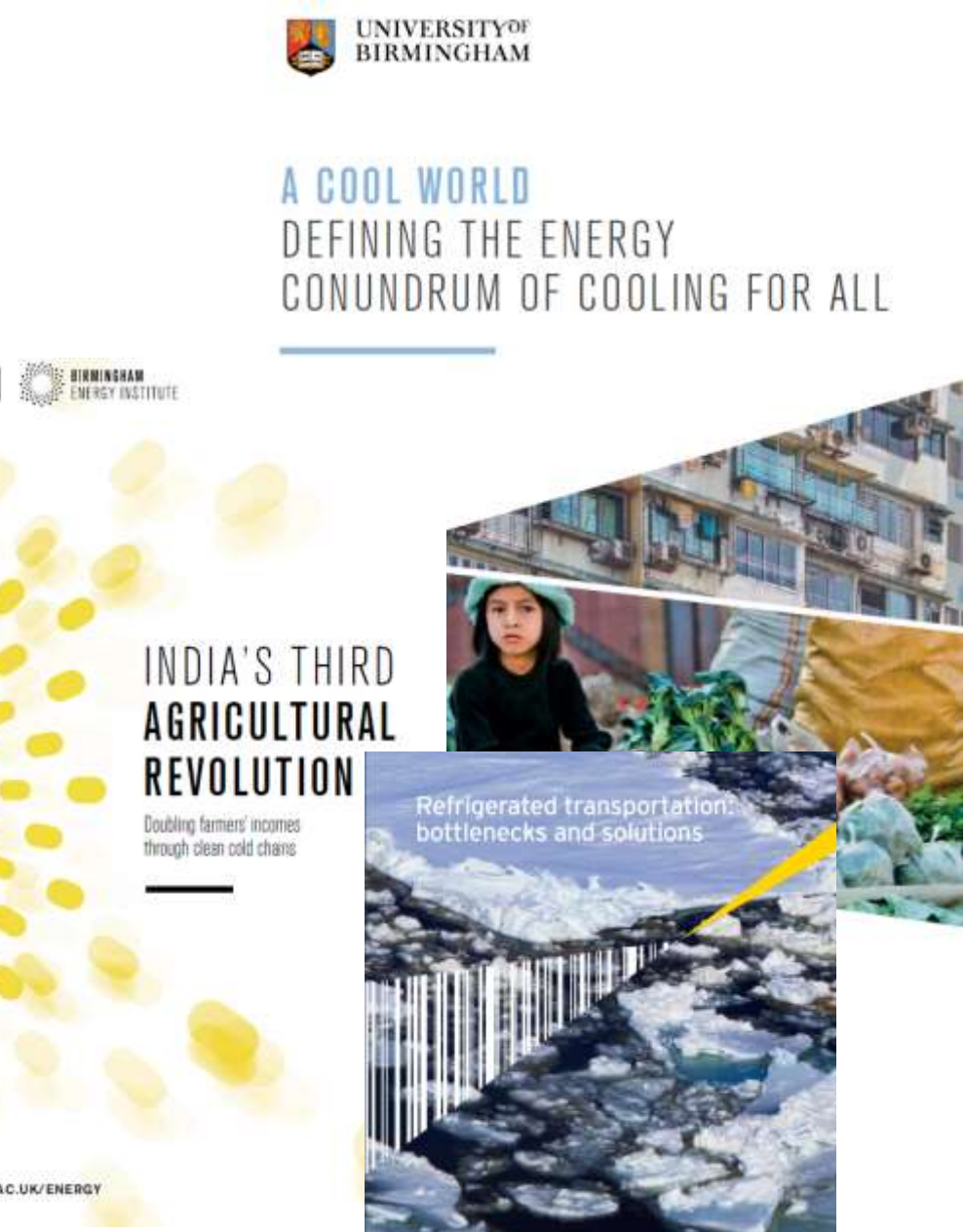
BIG Q: "How do you create the local and global, temperature controlled "field to fork" connectivity to feed 10bn people in future sustainably from hundreds of millions of small-scale farmers whose livelihoods and well-being are often dependent on only 1-2 hectares, as well as ensure they are climate change adaptation ready and resilient …. all without using fossil fuels?

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Our understanding





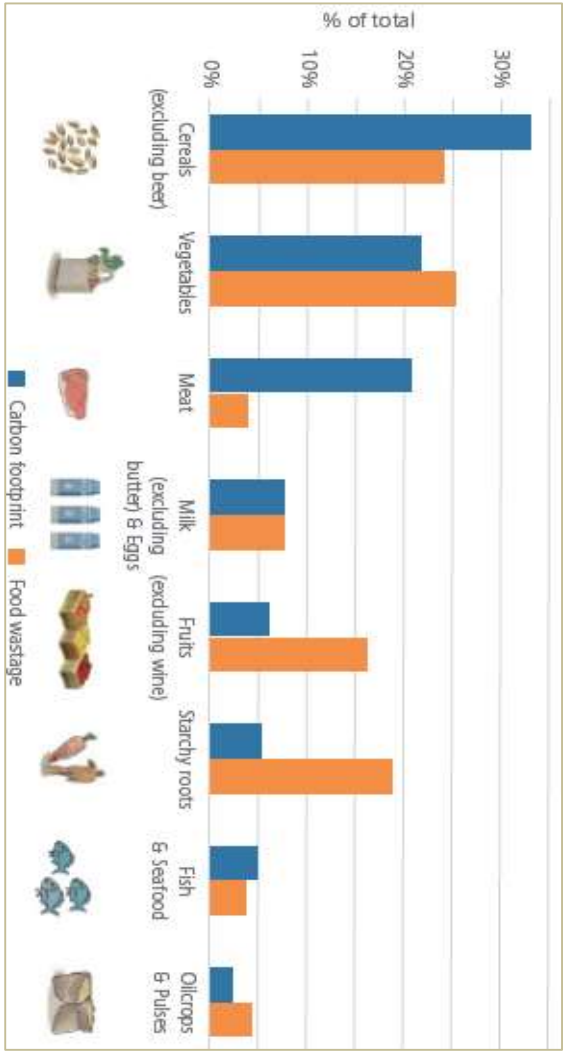


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Our understanding: India food waste and food loss story

- **India** produced **263 million tons** of food in **2013-2014** and required **225-230 million tons (**per year) of food. We still find **difficulty in feeding our people due to food wastage** *(A. Sarkar et al.).*
- **90%** of post harvest food wastage in developing countries is caused by losses in the supply chain rather than consumers discarding edible food *(Toby Peters, University of Birmingham).*
- About **$ 15 Billion (Rs. 92,000 crores)** worth of major agricultural produce at **2014 wholesale prices** is lost in India every year *(Central Institute of Post-Harvest Engineering and Technology, 2016).* The actual loss will be manifold if we consider impact on retail price, hunger, poverty, health, climate, land and water usage.
- Government of India's motivation to **double the farmers' income** by 2022 while taking the farm produce to the market with the right quality and yield - Improved efficiencies in the entire **agri-supply chain** is critical. India will create **22,000** Gramin Agricultural Markets (**GrAM**) which could act as cold-chain hubs.
- In 2037-38, under business as usual scenario, **cold-chain** and **refrigeration** system (retail outlets and domestic) would account for **31%** of India's **total primary energy supply for cooling** (India Cooling Action Plan, 2019).

Contribution of commodities to carbon footprint & food loss



Source: UN's Food & Agriculture Organization, 2011

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Our understanding: current scenario

- While many factors contribute to post-harvest losses in India, one of the major causes is the lack of effective cold chains.
- But many factors have restricted the development of effective cold-chains in India such as inadequate policies, supply chain barriers, carteling and profiteering.
- In a bid to address this challenge, in 2016, the Government of India launched ‘Operation Green’ with the goal of reducing food loss and doubling farmers’ income by supporting agri-logistics, food processing units and farmer producer organizations. A key measure under Operation Green is to develop and improve cold-chains in India.
- Because of the impetus provided by Operation Green, cold-chains are expected to proliferate rapidly in the next few years.
- However, it is necessary to get the policies and their implementation right in an environment friendly way.
- **Already, we have ended up creating many large, fragmented and inefficient cold storages, which often run on diesel power due to the unavailability of reliable electricity supply.**
- With 60% of cold storages located in four states i.e. Uttar Pradesh, West Bengal, Gujarat and Punjab, a vast majority of the cold storage is them are used only for a single commodity – potato(Centre for Public Policy Research).
- Thus, our existing cold storage infrastructure is unable to meet the huge demand supply gap for other farm produce.

Our understanding – cold-chain

A cold-chain is the integrated set of activities undertaken in a resilient network of temperature-environment controlled pre-conditioning, pack houses, vehicles or containers, cold stores, and distribution hubs which seamlessly maintains the safety, quality and quantity of temperature and environmentally sensitive food while moving it swiftly from farm, harbour or beach to consumption centres across geographies and over time.



Modern packhouse at (or in proximity) to farm-gate.



Cold storage (bulk) when storing at farm-gate



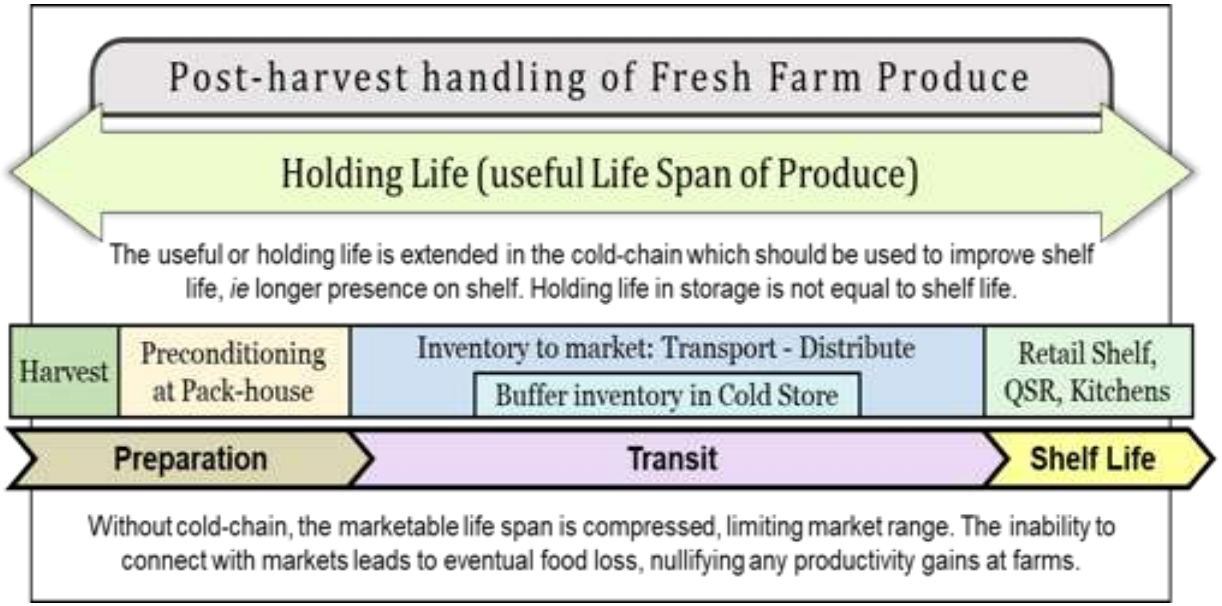
Transport from packhouse to next stage in the supply chain



Cold storage (hub) in proximity to market



Ripening units (in case of select produce only)



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Our understanding – cold-chain

- Connect local clusters of farmers, growers and fishers with higher-value local, national and international markets while simultaneously building the sustainable and resilient food supply system we need to feed 10bn people, - primarily urban market.
- The market connectivity afforded by a cold-chain enables and incentivises farmers to raise their output because they will earn more from what they produce
- Cold-chains allow farmers and growers to transition from growing crops of staples to producing the higher value, perishable, micronutrient-rich foods
- Cold-chains have the potential to allow higher value to move downstream to rural communities.

Key understanding	► We must appreciate COLD-CHAIN as an independent function and not as a sub-function of Agriculture, Dairy, Food Processing or Transport!
Good news	► Cold-chain development is important to the political economy of the country.



"Will build an efficient storage and transport mechanism for agriculture produce."



"Formulate a policy to enable the construction of modern warehouses, cold storage and food processing facilities in every block of the country."

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Missing pieces

Farm	Packhouse	Transport	Cold Storage/Ripening Chambers
▪ Managing timing of harvest with regard to logistics and market and holding life. ▪ Least damage to produce as possible. ▪ Close proximity to pre-conditioning centres – preferably within a 2-4 hour radius. ▪ Use of post-harvest handling carriers to mitigate transport damage to pre-conditioning centre	▪ Sorting of produce by market value / destination ▪ Curing of root & tuber crops (e.g. red chillies, potatoes, cassava, yams, onions). ▪ Washing or cleaning to remove field residues, pesticide or treat with fungicides. ▪ Drying in case of washing and pre-cooling (where required). ▪ Segregation/ Grading by size of produce for logistics handling before packaging. ▪ Rapid pre-cooling for most fruit and vegetable crop types or slow cool down for other vegetables	▪ Dispatch from farm-gate to pre-conditioning centres, cold storage and retail points. ▪ Maintaining temperature and humidity parameters throughout the logistics chain. ▪ Transportation time (when and how long) ▪ Packaging of food products while transporting. ▪ Maintaining living (breathable and disease free) environment for fruits and vegetables, throughout the logistics chain.	▪ Rapid chilling or blast freezing of harvested animal product - meats or milk. ▪ Short-term storage prior to onward dispatch to market centres or for long-term storage. ▪ Divert low value or non-marketable surplus to food processing facilities ▪ Farm-coding – record-keeping for traceability of produce. ▪ Follow guidelines to avoid incompatibility, cross-contamination or tainting of produce

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Source: Promoting Clean and Energy Efficient Col-Chain in India, MP Ensystems, Shakti Sustainable Energy Foundation and University of Birmingham (2019)

Recommendations

The move away from diesel-based fuel chains will reduce GHG emissions and usher in more sustainable development. Higher system efficiency, renewable energy integration and choice of refrigerants will also help mitigate GHG emissions from this sector. The new cold-chains must be financially viable. But in order to do this, **a disruptive paradigm shift is required**. Till now, the concept of clean cold-chains has been an alien one and cold storage is considered as a stand-alone infrastructure rather than a key component of the agri-supply chain.

The new India's 'clean cold-chains' are intended to transport food produce from the farm gate to end consumers sustainably and relay demand from consumers to the farm gate efficiently that too with a minimal environmental impact.

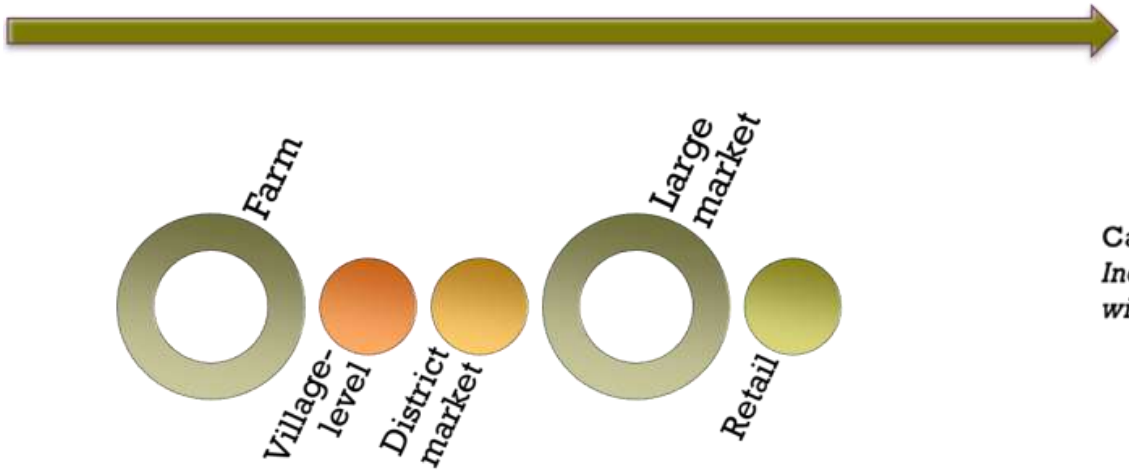
- ❑ **We must explore new ideas like creating Agri-IT infrastructure which enables market data driven harvesting of produce to avoid unnecessary storage.**
- ❑ **We must encourage the private sector to provide 'cooling as a service', rather than the conventional approach of selling cooling equipment to farmers and traders.**
- ❑ **An alternative approach can be one where multiple cooling requirement of a rural community are delivered efficiently a Community Cooling Hub.**
- ❑ **Another option is to develop a series of regional or state-level clean cold-chain 'Living Labs' and 'Innovation Centres' to test and validate technology & business solutions.**
- ❑ **"Think thermally" while designing a cooling solution.**

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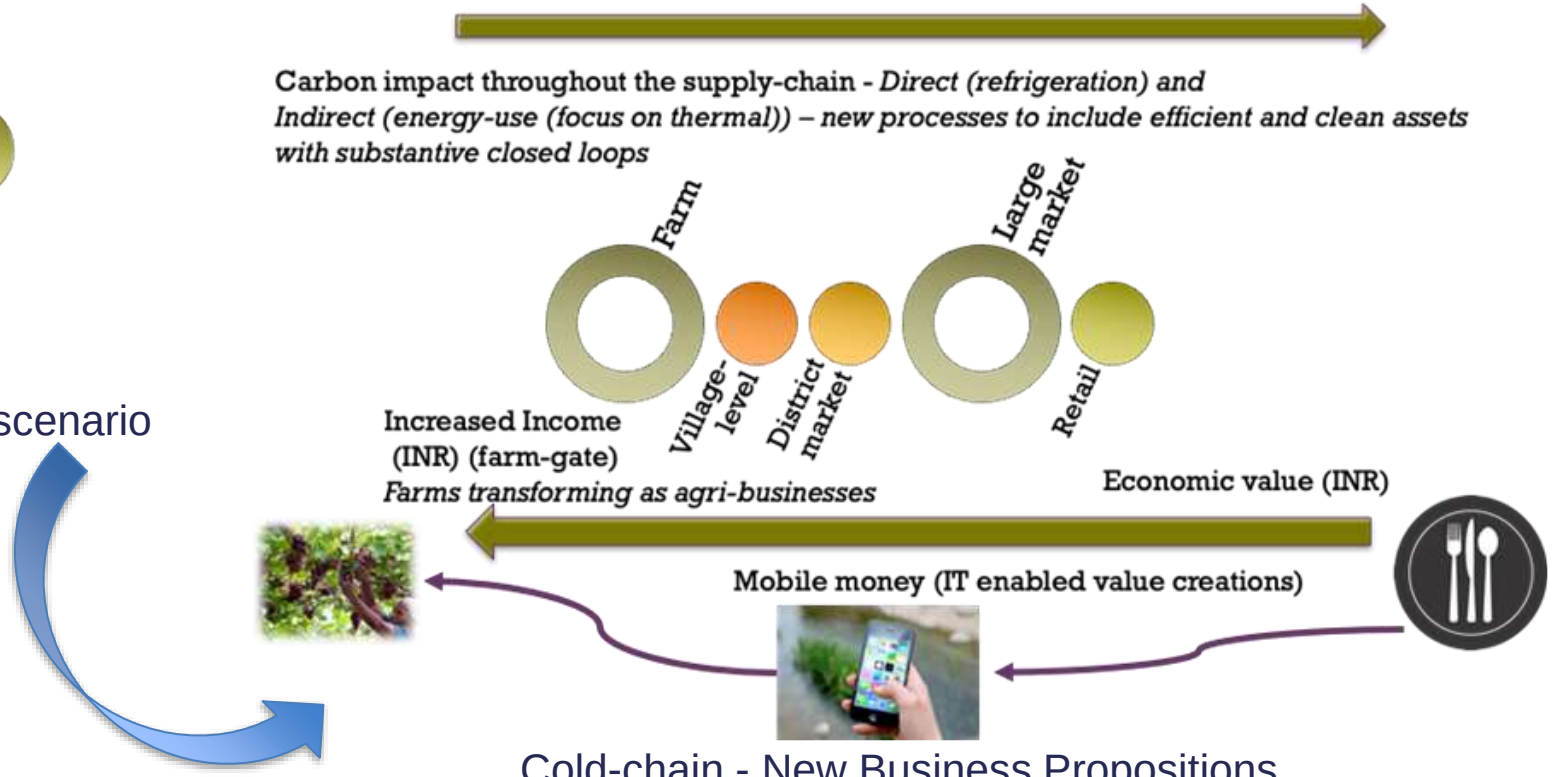
Source: Promoting Clean and Energy Efficient Col-Chain in India, MP Ensystems, Shakti Sustainable Energy Foundation and University of Birmingham (2019)

Open loop > Closed loop system

Existing and Proposed business model



Cold-chain - Business-As-Usual (BAU) scenario



Cold-chain - New Business Propositions

Source: Promoting Clean and Energy Efficient Col-Chain in India, MP Ensystems, Shakti Sustainable Energy Foundation and University of Birmingham (2019)

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Our ongoing initiative: Community cooling hub

Project partners:

UNIVERSITY OF BIRMINGHAM

CEE
Centre for Environment Education

EN SYSTEMS
Advisory Pvt. Ltd.

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- Pilot in three rural clusters within Nasik, Satara and Nandurbar districts of Maharashtra.
- Food products: Agriculture, Horticulture and goat milk
- Other demands: health, vaccine etc.
- Covering around 6,000 rural households in these districts
- We are assessing current and future cooling need of the rural community to design and recommend appropriate cold chain business solution.

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THANK YOU

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