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COLD CHAIN LOGISTICS

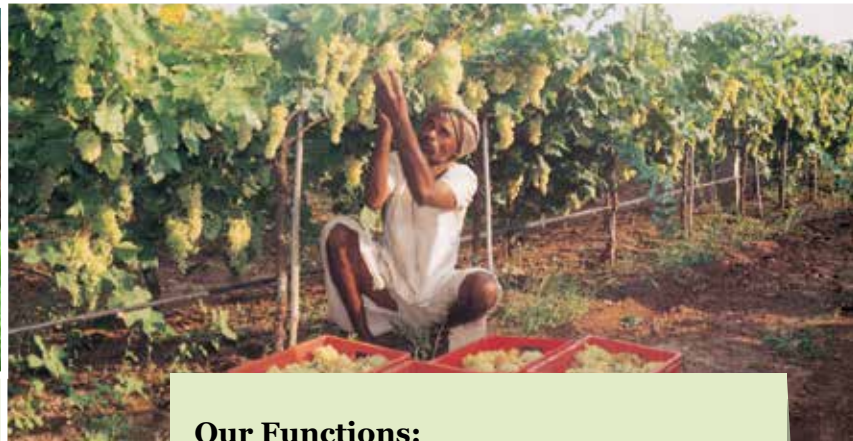
Transforming Agri-Food Supply Chain

May 2018



The Associated Chambers of Commerce and Industry of India

National Bank for Agriculture and Rural Development



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Head Office Plot C-24, 'G' Block Bandra Kurla Complex, Bandra (East) Mumbai - 400 051

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The Associated Chambers of Commerce and Industry of India

ASSOCHAM Corporate Office:

5, Sardar Patel Marg, Chanakyapuri, New Delhi-110 021

Tel: 011-46550555 (Hunting Line) • Fax: 011-23017008, 23017009

Email: assochem@nic.in • Website: www.assochem.org

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MESSAGE

The cold chain industry is seen as an emerging and fast growing business sector in India. Considering the current issue of food shortage and food security in India, cold chain facilities will play an important role in the country. According to report by Emerson Climate Technologies India, every year fresh produce worth INR 133 billion are thrown away because of the country's lack of adequate cold storage and transport facilities. However, this sector has witnessed a considerable growth in the last decade and is expected to have further improvement in growth rate in the years to come.*

The role of Ministry of Food Processing Industry, Government of India is instrumental in development of cold chain infrastructure in India and is implementing scheme for its promotion. Other departments such as National Centre for Cold-chain Development (NCCD), NABARD, National Horticulture Board (NHB) and State Governments are also taking initiatives for the development of cold chain industry in India. This will enable industry to adopt better and more efficient technologies to ensure year-round availability of perishable food products and reasonable prices to the consumers but also equitable distribution to other parts of the country. India's cold chain sector is a combination of surface storage and refrigerated transport. The industry has been growing at a CAGR of 20% for the last three years. Currently, India has 6,300 cold storage facilities unevenly spread across the country, with an installed capacity of 30.11 million metric tonne.

Latest technology used world over in cold chain sector, is making inroads in India. And with the government sanctioning new cold chain projects in the recent past, the demand for more efficient cold storages is going to increase in the future. Hence, with further support from government, new players are going to enter India and a platform is required where these latest know how, equipments and infra facilities gets noticed and new players are made aware of.

*The Report “**National Conference & Awards on Cold Chain – Technologies, Convergence and Capacity Building**” aims to highlight emerging trends in the cold chain industry in India and Government initiatives. We believe this publication offers a fresh perspective on the challenges and opportunities of the Cold Chain industry and will inspire businesses to take definite steps toward achieving the potential of this industry.*

(Sandeep Jajodia)

President

ASSOCHAM



ACKNOWLEDGEMENT

We are pleased to announce the “National Conference & Awards on Cold Chain – Technologies, Convergence and Capacity Building” on May 22nd, 2018, at New Delhi.

The cold chain industry is indeed an emerging and fast growing business sector in India. Considering the current issue of food shortage and food security in India, cold chain facilities will play an important role in the country. Every year fresh produce worth INR 133 billion are thrown away because of the country’s lack of adequate cold storage and transport facilities. However, this sector has witnessed a considerable growth in the last decade and is expected to have further improvement in growth rate in the years to come. Various initiatives of the Government of India and other agencies is enabling industry to adopt better and more efficient technologies to ensure year-round availability of perishable food products and reasonable prices to the consumers but also equitable distribution to other parts of the country.

We are confident that the deliberations and suggestions at this conference will benefit all the stakeholders.

ASSOCHAM sincerely thank the Ministry of Food processing Industries, Government of India, ISHRAE and NCCD for their support.

The financial assistance received from Research and Development Fund of National Bank for Agriculture and Rural Development (NABARD) towards publication of journal/printing of proceedings of the Conference is gratefully acknowledged.

We also thank to MRSS India for bringing out a very comprehensive study. This extensively researched publication will highlight challenges in cold chain sector and way forward to create a robust and strong cold chain industry.

We also greatly appreciate the support received from the corporate partners. I also appreciate the efforts put in by Dr. Om S Tyagi, Mr. Chetan Vij and Mr. Nitesh Sinha.

(D. S. Rawat)
Secretary General
ASSOCHAM



MESSAGE

*It gives me great pleasure to note that ASSOCHAM is organizing conference on “**National Conference & Awards on Cold Chain - Technologies, Convergence and Capacity Building.**”*

It is a privilege for MRSS India to engage in this symposium as a knowledge Partner.

The Indian Cold Chain industry is poised for healthy growth in the future & the Industry is evolving at a faster speed in India due to shift in focus from increasing the production to better storage and transportation facility of the commodity. Now it becomes an integral part of the supply chain industry comprising of refrigerated storage and refrigerated transportation.

As a Knowledge Partner, MRSS India is committed to provide support in driving a higher level of consumer and market understanding to all stakeholders. This will pave the way for a healthier level of flow of investment into the sector, both from Indian and overseas strategic intent into this sector.

I am confident that this report will enable the domestic and the global Cold Chain Technology companies to understand the emerging business opportunities in India. Further, this will help major companies to understand the Indian capabilities for making investments in this sector.

A handwritten signature in blue ink, appearing to be 'Raj Sharma', with a stylized flourish at the end.

(Raj Sharma)

Chairman

MRSS India

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LIST OF ACRONYMS

3PLs	Third Party Logistics
ADR	Authorized Distributor of Record
APMC	Agricultural Produce Market Committee
ASRS	Automated Search and Retrieval Systems
BE	Budget Estimates
CA	Controlled Atmosphere
CAGR	Compound Annual Growth Rate
CBER	The Center for Biologics Evaluation and Research
CDER	The Center for Drug Evaluation and Research
CIPHET	Centre for Post-Harvest Engineering Technology
DC	Distribution Centre
DMI	Directorate of Marketing and Inspection
EFTA	European Free Trade Area
EIA	Environmental Impact Assessment
EOI	Expression of Interest
ETP	Effluent Treatment Plant
F & V	Fruits and Vegetables
FAIDF	Fisheries and Aqua culture Infrastructure Development Fund
FAO	Food and Agricultural Organisation
FDA	US Food and Drug Administration
FDI	Foreign Direct Investment
FHEL	Fresh & Healthy Enterprises Limited
FIGs	Farmer Interest Groups
FPO	Farmer Producer Organization
FSC	Future Supply Chain
FSSAI	Food Safety and Standards Authority of India
FTL	Full Truck Load
GDP	Good Distribution Practice
GHP	Good Hygienic Practices
GMO	Good Manufacturing Practices
GPS	Global Positioning System
GVA	Gross Value Added
HACCP	Hazard Analysis and Critical Control Points
IATA	The International Air Transport Association
ICH	International Committee on Harmonization

IFPMA	The International Federation of Pharmaceutical Manufacturers & Associations
ISTA	International Safe Transport Association
LTL	Less Than Truck Load
MDRO	Multi Drug Resistant Organisms
MIDH	Mission for Integrated Development of Horticulture
MoFPI	Ministry of Food Processing Industry
MPEDA	Marine Products Export Development Authority
MSE	Medium & Small Enterprises
MT	Metric ton
NABARD	National Bank for Agriculture & Rural Development
NCCD	National Centre for Cold-chain Development
NDDB	National Dairy Development Board
NF	National Formulary
NHB	National Horticulture Board
NHM	National Horticulture Mission
PDA	The Parenteral Drug Association
PDMA	Prescription Drug Marketing Act
PhRMA	The Pharmaceutical Research and Manufacturers of America
PPP	Public Private Partnership
PQS	Performance, Quality and Safety
PX-UV	Pulsed Xenon Ultraviolet
QRM	Quality Risk Management
QSR	Quick Service Restaurants
R & D	Research & Development
RE	Revised Estimates
SAMPADA	Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters
TCR	Temperature Control Regulations
TFO	Total Financial Outlay
TMS	Transportation Management Software
TQM	Total Quality Management
UP	Uttar Pradesh
USP	United States Pharmacopeia
USP	The United States Pharmacopeia
WDRA	Warehousing Development and Regulatory Authority
WHO	World Health Organization
WMS	Warehouse Management Systems

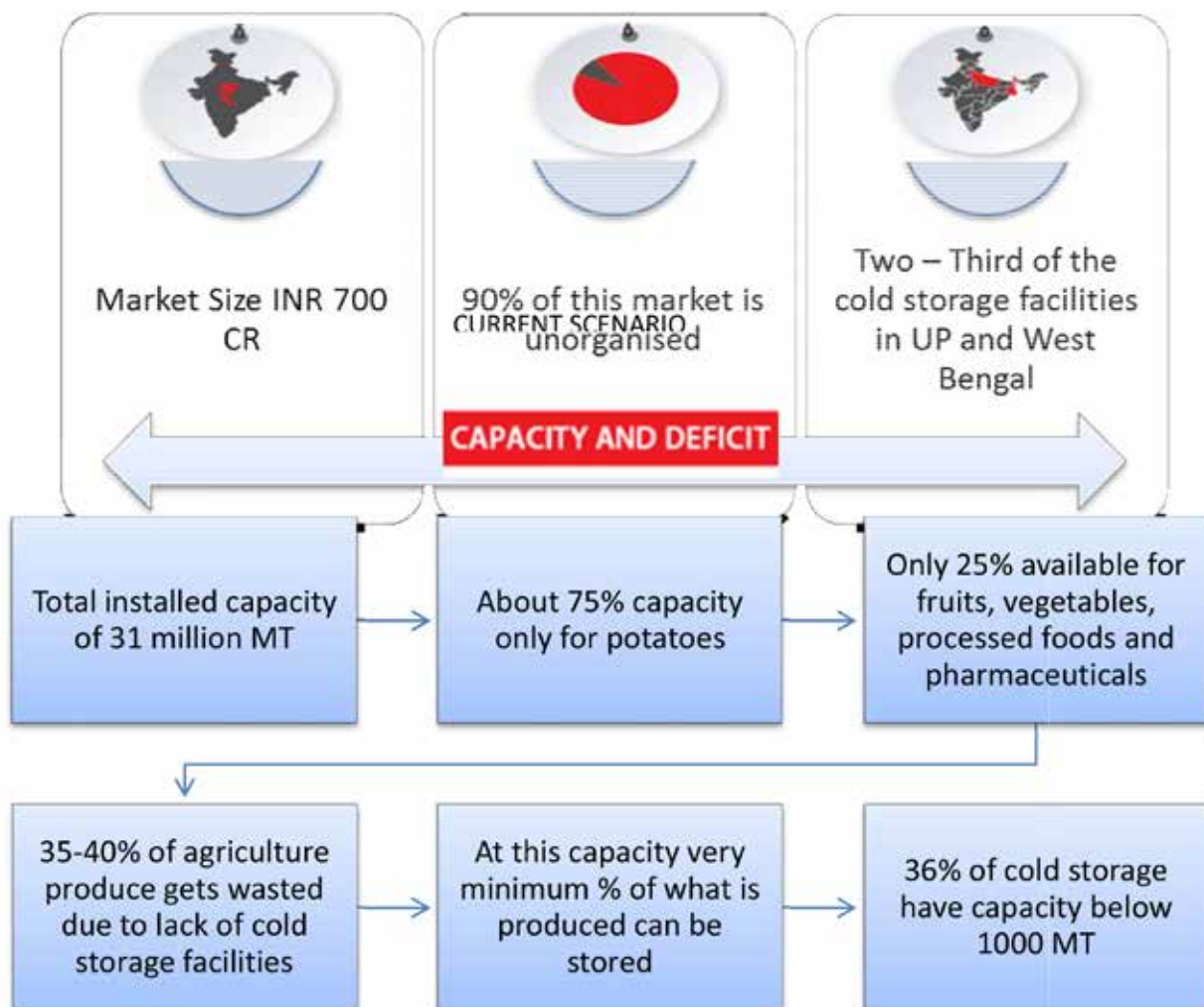
Executive Summary

Agriculture plays a vital role in India's economy. Over 58 per cent of the rural households depend on agriculture as their principal means of livelihood. The share of primary sectors (including agriculture, livestock, forestry and fishery) is estimated to be 20.4 per cent of the Gross Value Added (GVA) during 2016-17 at current prices. GVA from the sector is estimated to have grown at 3 per cent in FY18. India is one of the largest producers and a leader of various agricultural products. But due to fledgling cold supply chain there is a heavy loss of food and other resources. The Indian cold chain market is highly fragmented in which about 3500+ players are present. There are a large numbers of small players present in the Indian cold chain industry including some of the well-known organized companies. Majority of the cold chain infrastructure supports the storage of potatoes and potato seeds. India is the second largest producer of vegetables worldwide but its share in global export of vegetables is around 1.3% only. On an average, about 30-40% of horticultural produce gets wasted annually in India due to lack of cold chain infrastructure which includes both storage and transportation facilities.

The cold-chain industry in India is forecasted to grow at a CAGR of 19% during the period of 2017 – 2022 owing to the rising need of the infrastructure to reduce wastage. As per the industry estimate the cold chain market in India is anticipated to reach Rs 700 billion (US\$13 billion) by 2018. India is expected to achieve the ambitious goal of doubling farm income by 2022. Government of India will fund for creation of livelihood and infrastructure in rural areas. The agriculture sector in India is expected to generate better momentum in the next few years due to increased investments in agricultural infrastructure such as irrigation facilities, warehousing and cold storage.

From the past few years, Indian cold chain industry has witnessed some positive changes. Private sector participation has increased in the cold chain industry to cater to the increasing demand for cold chain logistics. The majority of the cold storages built in last few years are meant for multi-purpose storage and this trend is expected to continue in coming years as well. The demand for cold chain logistics from organized retail, pharmaceutical industry has been growing day-by-day. These sectors are booming at great pace which will further enhance the demand for cold chain logistics in coming days. The shift towards horticulture and processed food is also expected to increase the demand for cold chain solutions in India. Cold chain involves the transportation of temperature-sensitive products along a supply chain through thermal and refrigerated packaging methods to protect the integrity of these shipments. There are several means in which cold chain products can be transported: Refrigerated trucks and railcars; Refrigerated cargo ships; and Air cargo. Today, the produce travels extended distances due to the increased interest of health-conscious consumers and there is a growing capacity of expenditure of the middle class

Cold chain industry in India



to ensure freshness as well as quality while demanding high-end products. Cold storage not only ensures quality of the produce by keeping it fresh but also extends life of the produce.

Emerging Trends in cold chain industry

- Focus shifting to end to end cold chain and not just storage
- Modernization of existing stores
- Better and more sophisticated machinery and equipment
- Setting up of multipurpose cold storages rather than conventional single commodity storage
- Modern pack houses
- Ripening Facilities
- Farm-gate or source point Cold storage
- Energy Efficient technology and new storage technology
- Integrated cargo complexes are being planned at major airports in India which will be equipped to handle all kinds of goods, including perishables

Cold chains are being pushed towards globalization. The demand for fresh food is growing world-wide, and that requires increased innovation to overcome capacity and infrastructure constraints and mitigate disruption risks to ensure quality delivery for meeting these demands without driving up inventory or costs components on each element of the supply chain. The Food and Agricultural Organization (FAO) estimates that there will be 70 percent increase in food production and availability by 2050. This will ensure adequate food supply to over 9 billion inhabitants by 2050 which would be a huge challenge for the world. Thus, it is vital to explore every possible means of achieving progress, particularly the reduction of post-harvest losses.

This is evident from the available facts and figures that Government initiatives, growing organized retail, pharmaceutical industry, horticultural produce and food processing would enhance the demand for cold chain logistics in the coming years and Industry has to be equipped to meet that challenge. Government of India has taken various initiatives to attract private investment in this sector and it is expected changes in coming years. In the era of globalization and Government of India's open & dynamic policies, many large domestic and foreign companies are to join the league in coming years to cater the growing demand of cold chain logistics. Therefore, it is obvious for a need of large investment in terms of latest technology in the Indian cold chain industry in near future.

ASSOCHAM- MRSS India would like to suggest the following road map in order to achieve the ambitious plan the Government needs to proactively strategize to

- Ease the import rules for cold chain equipment including refrigerated vans

- Develop FPOs & FIGs and enable them to develop direct market links
- Develop improved business models by promoting producer owned supply chains
- Amendments to APMC aimed at enabling direct market driven supply chains and opening alternate market options
- Continue to extend grants and subsidies for cold chain infrastructure development and also extend the schemes to include sectors like logistics and transport.
- Develop multi-modal cold chain links through rail and highways, aimed at a fast track corridor for perishables.
- Promote the use of Negotiable Warehouse Receipts for notified perishable goods stored in WDRA accredited cold storages.
- Promote skill development programs for all levels of cold chain; farm-gate aggregation and pre-cooling, storage, transport, handling, packaging, etc.
- Establish produce specific protocols linked with domestic FSSAI and ATP Legislation for the export markets.
- Promote energy efficiency and low carbon imprint technologies and operational processes in the cold-chain.
- Promote development of a national virtual network or grid of cold warehousing and transport available to public lease.
- Establish NCCD as a centre of excellence to promote an integrated approach to cold-chain development, spanning agricultural and non-agricultural products.

Chapter 1

Current Scenario of the Cold Chain Industry

1.1. Introduction

Agriculture plays a vital role in India's economy. Over 58 per cent of the rural households depend on agriculture as their principal means of livelihood. The share of primary sectors (including agriculture, livestock, forestry and fishery) is estimated to be 20.4 per cent of the Gross Value Added (GVA) during 2016-17 at current prices. GVA from the sector is estimated to have grown at 3 per cent in FY18. India is one of the largest producers and a leader of various agricultural products. But due to fledgling cold supply chain there is a heavy loss of food and other resources. These losses have been stated to be as high as US\$8 to 15 billion per annum from the agriculture sector alone.

There is a need to develop cold chain sector to avoid these problems. Cold supply chain involves the transportation of temperature-sensitive products. It is a supply chain which takes place through thermal and refrigerated packaging methods to protect the integrity of the products in shipments. The cold chain sector is a combination of surface storage and refrigerated transport. Contrary to the popular belief, cold chain is not merely refrigeration of perishable commodities. Cold chain is a logistics system that provides a series of facilities to maintain ideal storage conditions for perishables from the point of origin to the point of consumption in the food supply chain.

The cold-chain industry in India is forecasted to grow at a CAGR of 19% during the period of 2017 – 2022 owing to the rising need of the infrastructure to reduce wastage. The cold chain market in India is anticipated to reach Rs 700 billion (US\$13 billion) by 2018.

India is expected to achieve the ambitious goal of doubling farm income by 2022. The agriculture sector in India is expected to generate better momentum in the next few years due to increased investments in agricultural infrastructure such as irrigation facilities, warehousing and cold storage.

1.2. Current Scenario

The cold chain industry in India is still at a nascent stage. Although, there is large production of perishables but still the cold chain potential remains untapped due to multiple reasons like high share of single commodity cold storage; high initial investment (for refrigerator units and land);

lack of Basic Enabling Infrastructure (roads, water supply, power supply, drainage, ETP, etc.); lack of awareness for handling perishable produce and lapse of service either by the storage provider or the transporter leading to poor quality produce.

However, the increasing urbanization and growth of organized retail, food servicing and food processing sectors are boosting the growth of the cold chain industry in India. The trend is now shifting towards establishing multipurpose cold storages and providing end to end services to control parameters throughout the value chain.

Taking into consideration the geographic spread majority of the cold storages are located in and around potato growing areas. About 61 percent of the cold storage capacity is concentrated in the states of West Bengal, Uttar Pradesh and Bihar, wherein storage of potatoes accounts for 85-90% of the capacity. Storage units in Maharashtra, parts of Gujarat and the country's southern states are designed for storing commodities such as dairy products, fruits, processed fish and meat products, and seasonal vegetables. However, the market is gradually getting better organized and focus has shifted towards multi-purpose cold storage is rising.

Moreover, the refrigerated transport in the country is under-developed with less than 10,000 reefer vehicles and zero reefer containers for rail movement. Recent surveys have also indicated that although most of the cold storages facilitate transportation of commodities, 79 percent does not own any transportation. It can be perceived that transport is going to increasingly be the main bottleneck to maintaining the integrity of the cold-chain, along with modern pack-houses as points of origin for fresh farm produce.

Cold stores are the major revenue contributors of the Indian cold chain industry, yet, around 36 percent of the cold storages in India are believed to have a capacity below 1000 MT. Thus, lack of proper and adequate food storage, processing and cold chain logistics remains a serious challenge. Nevertheless, the Indian Government is one of the driving forces in developing the cold chain industry and supports private participation through various subsidy schemes and grants. Investment in Cash & Carry Wholesale Trading / wholesale trading (including sourcing from MSEs) / E-commerce activities have been opened under the automatic route for 100% FDI participation.

For private players, the high level of initial capital required to construct a cold chain unit continues to be the biggest challenge. But if the government pitches in with a clear plan and promotes more PPP initiatives in this field, we could see a momentum growth in the cold chain industry in India.

1.3. Potential for cold chain

India has seen a phenomenal growth from last decades in production of horticulture produce, dairy and meat products over the last decade. Presently, India occupies a position amongst the

top three in production of a host of commodities including spices, fisheries, poultry, milk, fruits and vegetables, but even with such large production volumes, India's present share in global exports is quite negligible. The holistic picture is provided below:

India is the largest producer of milk globally contributing around 19 percent of the world's total milk production with an output of 163.7 million MT which is further expected to reach 180 million MT by 2020, while NDDB has projected demand to touch 200 million MT annually. The dairy sector in India is expected to grow at 15 per cent CAGR to reach Rs 9.4 trillion (US\$ 145.7) billion by 2020 including products such as skimmed milk powder, casein milk, cream, etc.

India ranks as the second largest producer of Fruits and Vegetables (F&V) in the world. India's horticulture output reached 300.64 million tonnes in 2016-17 with exports worth USD 1.6 Bn and is expected to reach 305.43 million tonnes in 2017-18. As per the study conducted by Centre for Post-Harvest Engineering Technology (CIPHET) in 2015, India witnesses nearly 4.6 – 15.9 percent wastage in fruits and vegetables annually due to lack of modern harvesting practices and inadequate cold chain infrastructure.

India has the world's largest population of livestock and produces around 7.4 MT of meat and around 83 Bn eggs annually as per 2016-17 estimates. The wastage levels in perishables in India are significantly high with approximately 2.7 percent in meat and 6.7 percent in poultry.

With a production of around 11.4 million MT, India is the second largest fish producer in the world. The marine food processing levels are approximately 23 percent, yet, the wastage levels are approximately 10.5 percent in marine fish and 5.2 percent in inland fish.

India topped the list of shrimp exporters globally in 2016 with exports of US\$ 3.8 billion which are expected to double to US\$ 7 billion by 2022. The increase in exports is despite an oversupply from major shrimp-producing nations and stringent testing norms.

India is the second largest producer of food grains globally and houses numerous varieties of cereals and pulses that are largely consumed domestically. As per 3rd Advance Estimates of 2016-17, the estimated production of Food grains was 273.38 million tonnes (Rice - 109.15 million tonnes; Wheat - 97.44 million tonnes; Coarse Cereals - 44.39 million tonnes and Pulses - 22.40 million tonnes).

During 2017-18 crop year, food grain production is expected to reach a record 277.49 million tonne. India witnesses nearly 5 percent wastage in cereals majorly due to lack of storage infrastructure and primitive grain handling mechanism. To reduce this wastage level and fulfill the increasing demand for grains and its processed forms, India needs adequate infrastructure, processing facility and research & development in this area.

The Indian food and grocery market is the world's sixth largest, with retail contributing 70 percent of the sales. Yet, the wastage levels are significantly on the higher side. This is mainly caused due to lack of cold chain infrastructure which includes both storage and transportation facilities.

The Food and Agricultural Organisation (FAO) estimates that there will be 70 percent increase in food production and availability by 2050. This will ensure adequate food supply to over 9 billion inhabitants by 2050 which would be a huge challenge for the world. Thus, it is vital to explore every possible means of achieving progress, particularly the reduction of post-harvest losses.

Losses of perishable foods are most important in developing countries where over 80 percent of the global population resides, and where about one quarter of the production is lost due to a lack of an incomplete cold chain. These losses represent more than 400 million tons per year.

The large post-harvest losses affect food security to the rural economies by markedly widening the gap between consumer prices and the amounts the producers are being paid at the end. They make products less affordable for consumers, and reduce farmers' income, thus discouraging them from producing and supplying to markets.

Predicted loss of fresh food storage in developing countries

Food product Storage	At optimum cold temperature	Optimum temperature + 10°C	Optimum Temperature +20°C	Optimum Temperature + 30°C
Fresh Fish	10 days at 0°C	4-5 days at 10°C	1-2 days at 20°C	A few hours at 30°C
Milk	2 Weeks at 0°C	7 days at 10°C	2-3 days at 20°C	A few hours at 30°C
Fresh Green Vegetables	1Month at 0°C	2 weeks at 10°C	1 week at 20°C	Less than 2 days at 30°C
Potatoes	5-10 months at 4-12°C	Less than 2 months at 22°C	Less than 1 month at 32°C	Less than 2 weeks at 42°C
Mangoes	2-3 weeks at 13°C	1 week at 23°C	4 days at 33°C	2 days at 43°C
Apple	3-6 months at - 1°C	2 months at 10°C	1 month at 20°C	A few weeks at 30°C
<i>Source: Adapted from Kitinoja (2013)</i>				

The impact of poor food preservation on global food supply is thus undoubtedly far greater than the observed food losses. It is also noteworthy that the loss of hundreds of millions of tons of foodstuffs involves wasting of the scarce or non-renewable resources required to produce and transport them which exerts an additional effect on global warming. The costs of the cold chain, both economic and environmental, can often be more than offset by the economic and environmental benefits due to reduced post-harvest losses.

The Indian food processing industry accounts for 32 per cent of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption,

export and expected growth. According to report by the US Department of Agriculture, the Indian food market is set to almost double by 2025, to reach \$344 billion at a CAGR (Compound Annual Growth Rate) of over four percent. Thus, there exists huge potential for cold chain which is elaborated below:

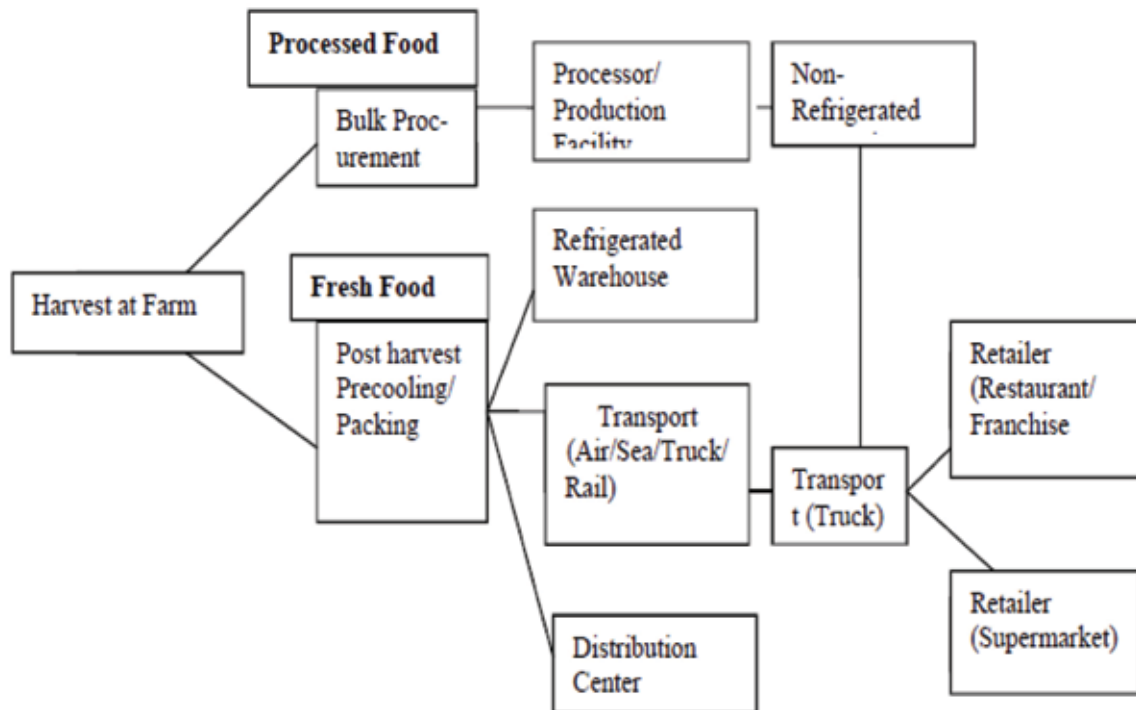
The Government of India plans to triple the capacity of food processing sector from the current 10 percent of agriculture produce and has committed INR 6,000 crore (US\$ 936.38 billion) for the period 2016 – 20 coterminous with the 14th Finance Commission cycle on a new Central Sector Scheme – Pradhan Mantri Kisan SAMPADA Yojana. This scheme is being implemented by Ministry of Food Processing Industries and is expected to create modern infrastructure with efficient supply chain management from farm gate to retail outlet.

This initiative will not only provide a big boost to the growth of food processing sector in the country but also help in providing better returns to farmers and is a big step towards doubling of farmers income, creating huge employment opportunities especially in the rural areas, reducing wastage of agricultural produce, increasing the processing level and enhancing the export of the processed foods.

The sub-sectors under consideration in this scheme are Mega Food Parks, Integrated Cold Chain and Value Addition Infrastructure, Creation of Backward and Forward Linkages, Infrastructure for Agro-processing Clusters, etc.

1.4. Existing Infrastructure

Cold stores form the heart of the cold chain. The cold storage industry in India indicates that the cold stores have been established initially from the beginning of twentieth century but with very slow development. Earlier, the units were designed mostly for storage of potato and were located in areas like UP, West Bengal, Punjab, and Bihar, etc. The state of Maharashtra has been the forerunner in introducing the concept of multiproduct, multi-chamber cold stores and has taken the lead amongst other states in the country. These multipurpose cold storages are cold storages where potatoes, fruits and vegetables, meat, fish, etc. can be stored simultaneously at the same time.



Process of Cold Chain, Rodrigue, Dr. Jean-Paul and Notteboom, Dr. Theo (2014)

The cold storage sector is still undergoing a major metamorphosis, with the government focusing on food preservation. A lot of stress is being laid on energy efficiency as the cold stores are energy intensive. With the advent of newer materials / equipment, every part of a cold chain renders itself amenable for improvement and is witnessing changes for eg. the type of construction, insulation usage, refrigeration equipment, type of controls managing cold chain, etc. for effectiveness.

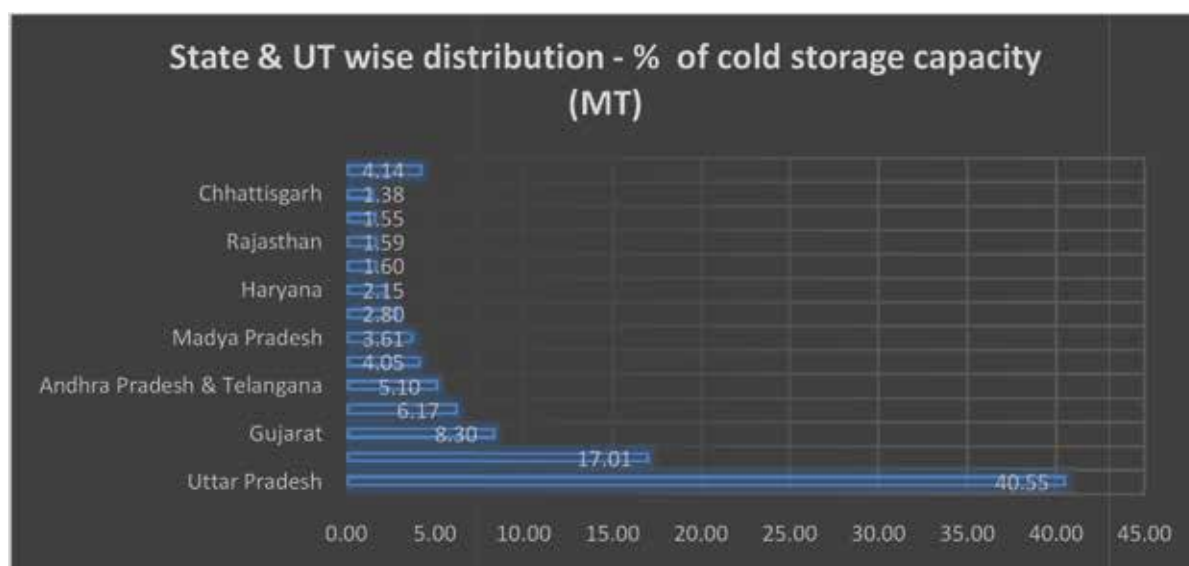
The industry has been growing significantly owing to the increasing Government initiatives, rising need for the cold chain facilities, increasing private sector investments of both domestic and foreign players, etc. With a view to promote investments, The Ministry of Finance has covered Cold-chain under Infrastructure category.

As per the information available from Directorate of Marketing and Inspection (DMI) up to 2009, National Horticulture Board (NHB), National Horticulture Mission (NHM) & Ministry of Food Processing Industries (MoFPI) as on 31.03.2017, there are 7645 cold storages with a capacity of 34.95 million MT in the country in the following Agency wise distribution:

Number of cold storages and capacity in MT as on 31.03.2017

Cold Storages upto 2009		Cold Storages from 2009-10 to 2016-17						Total	
		NHB		NHM		MoFPI			
Nos.	Capacity (MT)	Nos.	Capacity (MT)	Nos.	Capacity (MT)	Nos.	Capacity (MT)	Nos.	Capacity (MT)
5381	24450652	886	4567886	1142	5170946	236	767507	7645	34956991

Currently, about 57 percent of the total cold storage capacity is concentrated in 2 states only, namely, Uttar Pradesh and West Bengal. The top 5 states in terms of total installed capacity are Uttar Pradesh (14.2 million MT), West Bengal (5.9 million MT), Gujarat (2.9 million MT), Punjab (2.1 million MT) and Andhra Pradesh & Telangana (1.8 million MT) and these 5 states together contribute to an overall 77 percent of the storage capacity.



In the above figure, 15 States and 7 Union Territories whose individual cold storage capacity is below 1 percent have been clubbed together into “**Others**” category and their total cumulative contribution is **4.14 percent amounting to 1.44 million MT**. These 15 States are namely; Tamil Nadu, Jharkhand, Uttarakhand, Assam, Himachal Pradesh, Jammu and Kashmir, Kerala, Tripura, Meghalaya, Goa, Nagaland, Arunachal Pradesh, Manipur, Mizoram and Sikkim. The 7 Union Territories are namely; Delhi (UT), Chandigarh (UT), Andaman and Nicobar Islands (UT), Pondicherry (UT), Lakshadweep (UT), Dadar and Nagar Haveli (UT) and Daman and Diu (UT) and out of this list the last two UTs are having zero cold storage capacity.

The State wise & Agency wise distribution of Cold Storage as on 31.03.2017

		upto 2009*		2009-10 to 2016-17							
S. No.	Name of the State			NHB		NHM		MoFPI		Total	
		No.	Capacity (MT)	No.	Capacity (MT)	No.	Capacity (MT)	No.	Capacity (MT)	No.	Capacity (MT)
1	Andaman & Nicobar Islands (UT)	2	210	0	0	0	0	1	600	3	810
2	Andhra Pradesh & Telangana	290	900606	36	220158	101	619021	15	42776	442	1782561
3	Arunachal Pradesh	1	5000	0	0	0	0	1	1000	2	6000
4	Assam	24	88068	10	61738	0	0	2	8100	36	157906
5	Bihar	246	1147041	28	111821	29	153233	3	3500	306	1415595
6	Chandigarh (UT)	6	12216	1	246	0	0	0	0	7	12462
7	Chhattisgarh	69	341885	14	68323	13	65349	2	8530	98	484087
8	Delhi	95	126158	2	3699	0	0	0	0	97	129857
9	Goa	29	7705	0	0	0	0	0	0	29	7705
10	Gujarat	398	1267304	50	169199	295	1419209	21	46095	764	2901807
11	Haryana	244	393121	39	147816	45	152509	10	56384	338	749830
12	Himachal Pradesh	18	19858	7	20504	29	54805	12	35850	66	131017
13	Jammu & Kashmir	19	42869	6	24630	7	37707	6	7310	38	112516
14	Jharkhand	45	170148	8	36757	5	29775	0	0	58	236680
15	Karnataka	170	407165	8	78844	12	49392	8	24777	198	560178
16	Kerala	193	58105	1	5000	0	0	4	17300	198	80405
17	Lakshadweep (UT)	1	15	0	0	0	0	0	0	1	15
18	Madhya Pradesh	197	808052	22	114580	71	320083	10	20950	300	1263665
19	Maharashtra	466	546748	30	106860	58	151122	50	173662	604	978392
20	Manipur	0	0	0	0	0	0	2	5500	2	5500
21	Meghalaya	3	3200	1	5000	0	0	0	0	4	8200
22	Mizoram	0	0	1	3471	0	0	2	530	3	4001
23	Nagaland	2	6150	0	0	0	0	2	1200	4	7350
24	Orissa	101	291039	0	0	68	247100	2	2002	171	540141
25	Pondicherry (UT)	3	85	0	0	0	0	0	0	3	85
26	Punjab	422	1345193	55	176908	166	584902	17	48701	660	2155704
27	Rajasthan	110	324226	26	98907	21	88760	9	43385	166	555278
28	Sikkim	1	2000	0	0	1	100	0	0	2	2100
29	Tamil Nadu	148	238536	16	65047	1	6000	9	28042	174	337625
30	Tripura	11	29450	3	16027	0	0	0	0	14	45477
31	Uttar Pradesh	1589	10118000	503	2975267	184	1016530	23	66265	2299	14176062
32	Uttarakhand	15	68499	5	9272	10	21650	16	60998	46	160419
33	West Bengal	463	5682000	14	47812	26	153699	9	64050	512	5947561
	Total	5381	24450652	886	4567886	1142	5170946	236	767507	7645	34956991

(Source: Directorate of Marketing and Inspection (DMI) upto 2009, National Horticulture Board (NHB), National Horticulture Mission (NHM) & Ministry of Food Processing Industries (MoFPI)

Another striking fact is that the North Eastern Region comprising of the eight states, namely, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura have a cumulative cold storage capacity of 0.23 million MT only. Thus, the cold chain sector in India still appears to be in the nascent stage, although it does have an enormous growth potential keeping in mind the climatic diversification and vast geographically size of the country.

In order to arrest post-harvest losses of horticulture & non-horticulture produce and to provide remunerative prices to farmers, Ministry of Food Processing Industries is implementing the Central Sector Scheme of to provide integrated cold chain and preservation infrastructure facilities from the farm gate to the market and is currently assisting 238 approved cold chain projects as on 31.04.2018.

Consolidated list of State-wise 238 Approved Cold Chain Projects as on 31.04.2018

States & Union Territories	Completed Projects	Ongoing projects	Total No of projects	Project Cost (INR in Crores)	Approved Grant-in-aid (INR in Crs)	Grant Released (INR in Crores)
Andaman and Nicobar Islands (UT)	0	1	1	5	2.45	0
Andhra Pradesh	3	4	7	273.86	60.13	25.89
Arunachal Pradesh	0	1	1	15.32	8.49	0
Assam	2	0	2	38.28	17.7	15.55
Bihar	1	2	3	63.57	26.68	16.66
Chhattisgarh	2	0	2	39.33	13.36	11.52
Gujarat	8	10	18	801.8	150.7	69.69
Haryana	6	3	9	237.33	68.31	42.52
Himachal Pradesh	9	3	12	221.34	100.31	76.97
Jammu and Kashmir	3	4	7	100.06	56.28	32.87
Karnataka	4	5	9	206.94	54.93	25.99
Kerala	1	3	4	84.28	26.2	8.53
Madhya Pradesh	4	2	6	138.01	43.22	23.38
Maharashtra	28	27	55	1490.63	386.84	222.89
Manipur	1	1	2	33.45	17.83	9.96
Mizoram	2	0	2	22.46	12.77	12.77
Nagaland	0	2	2	36.44	17.19	0
Orissa	2	0	2	90.63	12.08	12.08
Punjab	9	8	17	422.28	125.2	79.89
Rajasthan	4	6	10	240.28	67.28	27.98
Tamil Nadu	3	6	9	241.66	66.53	21.41
Telangana	2	5	7	208.56	52.3	25.34
Uttar Pradesh	8	13	21	534.98	174.2	87.94
Uttarakhand	14	8	22	374.13	202.35	126.55
West Bengal	6	2	8	181.81	50.34	41.22
Total	122	116	238	6102.43	1813.67	1017.60

As per industry estimates, around 95 percent of the cold storages are owned by the private sector and but most of them are operated by small cold storage service providers. followed by 3 percent cooperatives and remaining 2 percent are under Public Sector Undertakings. Despite large scale production of perishable foods, the cold chain logistic resources remain untapped.

Further, Department of Agriculture, Cooperation & Farmers Welfare is implementing Mission for Integrated Development of Horticulture (MIDH) for holistic development of horticulture which also provides assistance for creation of post-harvest infrastructure including establishment of Cold Storages. The scheme is implemented by States, based on Annual Action Plan. States have been advised to use 35% – 40% of their annual budget for creation of Post-harvest management infrastructure including cold storages. The components are project based and demand driven.

Details of year wise funds allocated and released by Ministry of Food Processing Industries under the scheme for Integrated Cold Chain and Value Addition Infrastructure in the last five years.

NHB	BE (INR Crores)	RE (INR Crores)	Expenditure (INR Crores)
2013-14	100	103.75	103.73
2014-15	160	153.37	153.37
2015-16	181	180.5	160.36
2016-17	158.23	185.21	184.88
2017-18	180	--	20.87
(As on 21.07.2017)			

1.5. Government Initiatives for improvement of Cold chain infrastructure

- There is a large unfulfilled gap that exists in the sector for investments in cold storage, CA storage, reefers, ripening chambers, IQF, milk chilling and processing etc. In order to bridge this gap, Ministry of Food Processing Industries (MoFPI) is implementing scheme for Creation of Backward and Forward Linkages under Pradhan Mantri Kisan Sampada Yojana which is applicable to perishable horticulture and non-horticulture produce such as Fruits&Vegetables, Dairy products, Meat, Poultry, Fish, Ready to Cook Food Products, Honey, Coconut, Spices, Mushroom, Retails Shops for Perishable Food Products etc. thereby enabling linkage of farmers to processors and the market for ensuring remunerative prices for agro produce.
- As on 05.04.2018, MoFPI has approved 23 proposals in order of merit out of 55 proposals received and appraised. The total number of proposals to be assisted under the scheme is 50 and last day of submission of Expression of Interest from potential promoters for setting up of Backward & Forward Linkages in the processed food industry is 31.05.2018.
- The Ministry of Food Processing Industries (MoFPI) is also implementing scheme for Creation of Infrastructure for Agro Processing Clusters under Pradhan Mantri Kisan Sampada Yojana to create modern infrastructure for food processing in the country. Under this scheme, MoFPI has approved 8 projects as of 09.04.2018 out of state-wise ceiling limit of 100 Agro Processing Clusters (APC). Each agro processing clusters under the scheme will have two basic components i.e. Basic Enabling Infrastructure (roads, water supply, power supply, drainage, ETP etc.) and Core Infrastructure/ Common facilities (ware houses, cold storages, IQF, tetra pack, sorting, grading, etc.) with at least 5 food processing units with a minimum investment of INR 25 crores. The units are to be set up simultaneous along with the creation of common infrastructure.
- Another initiative from the Government is the The Mega Food Park Project that aims at providing a mechanism to link agricultural production to the market by bringing together farmers processors and retailers so as to ensure maximizing value addition, minimizing wastage, increasing farmers income and creating employment opportunities particularly in

rural sector. This scheme is based on “Cluster” approach and envisages creation of state of art support infrastructure in a well-defined agri / horticultural zone for setting up of modern food processing units along with well-established supply chain. Mega food park would typically consist of supply chain infrastructure including collection centers, primary processing centers, central processing centers, cold chain and around 30 to 35 fully developed plots for entrepreneurs in order to set up food processing units.

So far, 42 Mega Food Parks projects have been approved out of which 12 Mega Food Parks are currently functional. The location of these 12 projects along with total leasable area in acres and amount of grant released out of 50 crores as on 03.05.2018 is provided in the table below:

List of completed and operational Mega Food Parks as on 03.05.2018

Project Name	State	Project Cost (INR in Crores)	Leasable area (in acre)	Amount of grant released (Out of 50 Cr.)
Integrated Food Park, Tumkur	Karnataka	144.33	57	48.22
Jangipur Bengal Mega Food Park, Murshidabad	West Bengal	132.70	46	45.00
Greentech Mega Food Park Pvt. Ltd., Ajmer	Rajasthan	113.57	40	43.18
Patanjali Food and Herbal Park, Haridwar	Uttarakhand	95.08	38	50.00
Srini Food Park, Chittoor	Andhra Pradesh	121.10	35	49.92
Satara Mega Food Park, Satara	Maharashtra	139.33	34	44.50
Himalayan Food Park Pvt.Ltd., Udham Singh Nagar	Uttarakhand	98.08	30	41.80
Jharkhand Mega Food Park, Ranchi	Jharkhand	114.74	29	43.78
North East Mega Food Park, Nalbari	Assam	80.85	28	45.00
International Mega Food Park, Fazilka	Punjab	130.38	26	45.00
MITs Mega Food Park Pvt Ltd, Rayagada	Odisha	80.17	26	37.45
Indus Mega Food Park, Khargoan	Madhya Pradesh	131.28	24	49.12

Moreover, a consolidated list of 184 Food Parks have been identified by the Ministry as on 18.04.2018 for the purpose of making available affordable credit to agri-processing units in the designated food parks by setting up of special fund of INR 2000 crores in NABARD.

1.6. Usage of cold chain system

A modern cold chain uses climate control technology and modern packaging and handling, from the time of harvest of the produce to the point of sale. In such a supply chain, the produce is maintained in a controlled climate environment from the stage of harvest till the point of purchase at retail stores.

The controlled climate environment reduces the rate of metabolism in harvested Fruits & Vegetables, hence, extending the shelf life of the produce. Whilst the degree of life extension due to controlled environment varies from one fruit/vegetable to another, the impact is significant across. Any break in the environment across the chain accelerates the rate of decay. Thus, modern cold chains are designed to start right from the farms.

The produce is pre-cooled within an hour of harvest to suck out the farm heat from the produce and retard decay. Transportation is in reefer trucks, storage is in controlled climate warehouses, and retailing is through refrigerated shelves. Such a supply chain not only reduces value loss and damages across the chain it also enhances the life of the produce.

Life extension allows the stakeholders a couple of significant arbitrage opportunities – temporal arbitrage and geographic arbitrage. Temporal arbitrage is the buying of the produce when the prices are low and selling when the prices are high. Geographic arbitrage, however, is buying the produce where the prices are low and selling where the prices are high. With short shelf lives, both the opportunities cannot be tapped - however life extension opens windows to these opportunities.

Globally cold chains have now become an integral part of supply chain management for the storage and transportation of temperature-sensitive goods. The focus has now shifted from increasing production to better cold storages and transportation of food produce. The utilization of cold chain logistics includes both cold storages and refrigerated transportation and is used to increase the shelf life of food produce.

- **Ripening Units:**

There has been considerable interest in scientific ripening and storage of food like banana, mango etc. whilst the cold chain system is being used for the perishable food products. In recent years the units are being established at a number of places. This can be seen in the South India, Gujarat & Maharashtra.

- **Distribution Centres:**

With the growth of cold chain in the country, the food distribution centres are also being established here. The first such unit was constructed in Navi Mumbai region. Further, growth is

expected in this sector as number of smaller centres has been set up by the food retail sector. A cold chain can most readily be defined as a series of warehousing and distribution activities that is designed to ensure ideal storage and transportation conditions for temperature-sensitive products. Cold chain services can add benefit in improving quality of life for billions of people around the world. This system is high in demand, especially in less developed economies that suffer from malnutrition, high rates of food spoilage and chronic disease.

- **Export-Import Purposes:**

Cold chain systems have now become important for the growth of global trade in perishable products and to the worldwide for availability of food and health supplies. As every year, billions of tonnes of fresh food products and millions of dollars' worth of exports are lost due to poor cold chain systems in developing markets and has been reflected in the World Economic Forum lists where food crises lie as fourth on its top global risks of highest concern for the next 10 years. Globally, billions of dollars are spent on improving agricultural processes to create higher food yields, but the fact that nearly half of all food never makes it to a consumer's plate which is largely ignored. (Cold Chain Top Markets Report, 2016 ITA).

1.7. Key players

The cold chain market is largely unorganized till date, however the major cold chain players in the country are:

- ColdEx Logistics Private Ltd.
- Stellar Value Chain Solutions Private Ltd.
- Future Supply Chain Solutions
- Fresh and Healthy Enterprises Ltd.
- Gubba Cold Storages Ltd.
- Snowman Logistics Private Ltd.
- GatiKausar India Ltd.
- M. J. Logistics Services Ltd.
- R. K. Foodland Private Ltd.
- Cold Star Logistics Private Ltd.

ColdEx Logistics Private Ltd.

Headquartered at New Delhi, ColdEx Logistics Private Limited is a ISO 22000 Certified company and one of the trusted brands in the cold chain industry offering one-stop shop solution to all temperature-controlled supply chain requirements across India serving leading brands and catering to almost all industry verticals be it QSR chains, confectionary, food processing, pharmaceutical, meat, poultry, fruits and vegetables and many more.

SuperEX is the primary long haul FTL service, having a fleet of 800+ reefer trucks including multi-temperature vehicles capable of handling all temperature ranges from +25°C to -18°C categorized as Frozen (-18°C), Chilled (+2°C to 4°C), Cool (+ 15°C to 20°C) and Ambient. SuperEX is equipped with fleet management software, TMS and GPS with temperature monitoring function and a 24x7 call centre that tracks all vehicles until they reach the final destinations.



ColdExpress is the LTL/part load offering to the market and is a door-to-door service carrying all products both in frozen (-18°C) and chilled (2 to 4°C) categories. This service is available in Delhi, Mumbai, Hyderabad, Bangalore and Kolkata corridors.

StoreEX is the multi-user warehousing service offering temperature-controlled distribution centres close to consumption points along with a team of experts with ample warehousing knowledge and experience in order to manage and maintain the state-of-the-art infrastructure with high service levels. The 5 multi-user distribution centres are located in Kundli (Haryana), Mumbai, Bangalore, Hyderabad and Kolkata. Additionally, the company provides value-added services such as packing, kitting, etc. and other tailor-made solutions.

The Kundli DC which is in close proximity to Delhi NCR boasts state-of-the-art facilities having total pallets space of 3500 pallets and entire warehouse divided into 6 chambers of 14 meters height with a pallet racking height of G+5 enabling the most optimum use of the space with extra layer of brick wall protection built in addition to insulated panels. Multi temperature facility with frozen, chilled, cool and ambient under one roof along with WMS for optimization and efficiency coupled with latest technology of building management System comprising of CCTV, security systems and temperature monitoring system.

CityEX brings the last mile service with dedicated vehicles serving distributors, dealers and stores at optimized cost and on-time deliveries ensuring products availability to the final consumer. ColdEXperts is the in-house business consulting and R&D vertical.

Stellar Value Chain Solutions Private Ltd.

Founded in 2016, Stellar Value Chain Solutions Pvt Ltd, is a Mumbai based third-party logistics company in the domain of Contract Logistics, Transportation, Temperature Controlled Supply Chain, e-Fulfilment and Value-Added Services. The company is having a Pan India presence in 25 Logistics Parks across 21 cities, with more than 30 million sq.ft of covered space. Their operations are based on WMS / TMS systems for end to end transparency and spanning across Delhi NCR, Mumbai, Bangalore, Chennai, Kolkata, Nagpur, Hyderabad, Pune, Ahmedabad, Guwahati,

Coimbatore, Vizag, Patna, Goa, Chandigarh, Lucknow, Jaipur, Indore, Kochi, Bhubaneswar and Ranchi.

"One India Connectivity" through a hub and spoke network with more than 50,000-line haul trucks running daily on a time definite schedule. The reengineered vehicles are fitted with specialized hidden locks to prevent any damages or in transit thefts. The fleet is GPS enabled and ensures full time visibility and 24x7 continuous monitoring from Central Control Tower for real time decision making and support. The Central Control Tower tracks each vehicle and warehouse for temperature compliance, generating on line real time alerts in case of any deviation.

With Multi User Dry Warehousing Facility, E-Fulfilment Centre, Express Transportation Hub & Temperature Controlled Storage along with Solar Panels for Captive Consumption, Waste Recycling Facility, Truck Parking Areas, Driver Amenities, etc., Stellar ensures world class amenities with all buildings HSE compliant and LEED Certified.

Future Supply Chain Solutions

Promoted by Future Enterprises Limited, Future Supply Chain Solutions is one of India's largest organized third-party supply chain and logistics service provider offering automated and IT-enabled warehousing, distribution and other logistics solutions to a wide range of customers. With pan-India warehousing structure and distribution network, "hub-and-spoke" transportation model and automated technology systems, the company operates in various sectors across India, including retail, fashion and apparel, automotive and engineering, food and beverage, fast-moving consumer goods (FMCG), e-commerce, healthcare, electronics and technology, home and furniture and ATMs. In 2017, the company has been endowed with Excellence Award – 3PL Solutions at the ICC Supply Chain & Logistics Awards and also the Best Cold Chain 3PL Service Provider of the Year at the Cold Chain Industry Awards. There are three key areas of services and these are namely;

- Contract Logistics: warehousing, distribution and other value-added services
- Express Logistics: point-to-point, less-than truck-load, time-definite transportation services
- Temperature-Controlled Logistics: cold-chain warehousing, transportation solutions and long-haul distribution of perishable products

The company operates through an extensive network of 46 distribution centres, including 4 temperature-controlled distribution centres, 14 hubs and 105 branches across India (including franchisees and 13 of which are co-located on the same premises as our hubs) covering 11,228 pin codes across 29 States and 5 Union Territories, covering approximately 3.80 million square feet of warehouse space and 2 distribution centres at customer premises, covering an area of approximately 0.37 million square feet.

The distribution centre at the Multi-modal International Hub Airport at Nagpur (MIHAN) is one of the largest and most highly automated distribution centres in India and covers approximately 0.37 million square feet of warehousing space, housing a high-speed cross-belt sorter system, which was the first of its kind in India, with a sorting capacity of approximately 2,000 cases per hour (which is over three times more productive than traditional, non-automated sortation).

The company's adoption of technology and automated processes differentiates them within the supply-chain management industry in India. These include

- "Dynamic Put-to-Light" (PTL) sortation system, which is an effective sorting technology,
- Radio-frequency-enabled Warehouse Management System (WMS) that coordinates across receiving, put-away, and put, pack and dispatch processes in distribution centre operations,
- Transport Management System (TMS), providing shipment-level visibility from pick-up, to delivery, to billing and is linked to enterprise resource planning system,
- Vehicle Tracking System (VTS), which enables our customers to track their goods online and in real-time while in transit,
- High-speed cross-belt sorter at our distribution centre in MIHAN, Nagpur,
- Remote access to our delivery vehicles and
- A real-time data logging system to monitor temperature variations in distribution centres and reefer trucks used in temperature-controlled logistics business.

Fresh and Healthy Enterprises Ltd.

Fresh & Healthy Enterprises Limited was incorporated in 2006 as a wholly owned subsidiary of Container Corporation of India Limited, a Govt. of India Undertaking under Ministry of Railways. Realizing the potential in this area CONCOR decided to set up its fully owned subsidiary called Fresh and Healthy Enterprise Limited. Its first 12,000 MT State-of-the-art CA store is one of the largest in the country and is operational since August 2007. This state-of-art facility was setup on 17 acres of prime land at industrial estate in Rai, near Delhi with the following features:

- 78 chambers, which can be operated from centralized control and independently.
- Equipped with latest computer Controls for Temperature, Oxygen, Nitrogen Generator, Carbon Dioxide Scrubbers
- Grading and sorting lines imported from Sammo, Italy.
- Automatic washing and waxing facility.
- Both bulk and retail packing machines from Italy.
- Refrigeration and air conditioning equipment's are from Germany, China etc.

- Storage of fruits and vegetables in plastic bins made of food grade plastic from Israel.
- 100% power backup.
- Entire facility is A.C. including grading and packing area.
- All movements inside the facility are by battery operated forklifts and electric stackers

Gubba Cold Storages Ltd.

Gubba Group was established in 1879 as a trading company, then dealing in agricultural commodities. This paved the way to set up the 1st cold storage of Andhra Pradesh in 1987. The company has 15 cold storages (14 in Telengana and 1 in Aurangabad). With 30 years of expertise and experience, the Gubba Cold Storage is an 11.8 million cubic feet company having innovated and engineered the 1st of its kind rack supported cold storage in India. This is handled by state-of-the-art material handling equipment's and preserves seed in 1.2-ton jumbo bags.

Gubba Seed Cold Storage:- Gubba has been in the preservation of seed since 1998. Catering to the preservation needs of more than 200 seed companies in India and abroad, the company has created world class seed cold storages to preserve commercial and foundation seed at 10 to 14 degrees centigrade. Foundation seed is stored by more than 100 seed companies.

Gubba Frozen Cold Storage:- Provides an environmental controlled minus temperature cold storage services ranging from 0 to -20 degrees centigrade. A robust refrigeration system and technology to preserve and keep frozen products like meat, poultry, sea food, sweet corn, green peas, dairy products, yeast, confectionery and so on in proper condition.

Gubba Chilled Cold Storage:- Gubba Cold Storage provides preservation for various products in temperatures ranging from 0 to +10 degrees with or without controlled humidity for products like dairy, pharma, fruits and vegetables, eggs, processed food, fruit pulps and flowers both indigenous and ornamental.

Gubba Infra Solutions:- Gubba Cold Infra Consulting, a wing of Gubba Cold Storage provides Cold Storage consulting services and have commissioned some cold storages across the country.

Gubba Pharma Cold Storage:- Preservation through stringent hygienic conditions for life saving vaccine and drugs in the pharma cold storage.

Gubba Germplasm Bank:- First ever germplasm bank in private sector not just in Telangana but, in India. Here, the Germplasm can be stored by seed companies from 5 to 40 years. This facility provides world class preservation and security standards for the most valuable Germplasm seeds. On the same note this facility is an outcome of the standards which matches the HACCP, OHSAS certifications.

Snowman Logistics Private Ltd.

Snowman Logistics Private Ltd. is one of the largest temperature-controlled logistics services providers in the country, offering multi-chamber and multi-temperature warehousing solutions and distribution centre's specializing in easy assembling and distributing to all outlets across a spectrum of temperature – from ambient to chilled and frozen (i.e. +25°C to -20°C). In addition, majority of Reefer Vehicles are equipped with GPS and GPRS technologies including a few vehicles that are equipped with advanced geo-fencing (i.e., a virtual perimeter for a real-world geographic area) capabilities. The network includes facilities near key port terminals.

The warehousing infrastructure comprises advanced equipment handling and racking system. Further, Snowman use software systems such as warehouse management systems and enterprise resource planning. Four temperature-controlled warehouses comprised EIA and MPEDA (Marine Products Export Development Authority) certifications; four temperature-controlled warehouses were certified under the Drugs and Cosmetics Act, 1940. Majority of the Company's temperature-controlled warehouses certified for ISO 14001 (TUV-SUD), ISO 22000 (TUV-SUD) and FSSAI.

Snowman operates vehicles with a capacity of ferrying loads ranging from 2.5 tonnes to 20 tonnes. Each Reefer Vehicle is equipped with a data logger to ensure continuous monitoring of temperature and are GPS enabled for real time tracking to customers with real-time information about the cargo even when in transit. Further, the data logger enables to ensure that the prescribed temperature is maintained to ensure that the quality of the temperature sensitive products is not compromised.

In addition to the refrigerated service, Snowman also provides retail distribution through a consignment agency model for certain select customers. In addition to the regular warehousing and distribution, Snowman provides value added services such as kitting, labelling, sorting, stuffing and de-stuffing of containers, repacking and bulk breaking. Also, into sorting, grading, packing and washing select fruits and vegetables.

GatiKausar India Ltd.

GatiKausar India Limited is the cold chain solutions vertical of Gati Limited, offering temperature-controlled supply chain solution backed by its large size of refrigerated fleet, temperature-controlled warehouses across India and well-trained team of cold chain experts.

The company employs automated machine handling equipment for efficient auto retrieval and storage of products, barcode scanning for recording and managing all the products, and shop floor automation to make the supply chain more efficient. GatiKausar owns and operates temperature-controlled TAPA-A certified warehousing space with four different chambers – frozen, chilled, semi-chilled and ambient. Moreover, Warehouse Management System (WMS)

with FEFO (First Expiry, First Out) methodology to optimize the supply chain. Employees are well trained in handling the stocks and carry out all the process of kitting – de-kitting – as safely as possible with utmost care and diligence.

GatiKausar operates more than 180 temperature-controlled vehicles to provide immediate transportation solutions using Hub & Spoke model. The fleet includes small refrigerated vehicles for in city milk deliveries to large refrigerated vehicles for long haul or last mile delivery. Refrigerated storages and temperature-controlled



vehicles are maintained in pristine quality and installed with advanced telematics for route-alert, speed-alert, and door opening and closing alert.

GatiKausar enables live monitoring of vehicle movement through KEMS, a web-based performance portal for customer needs. Along with GPS, the trucks are also fitted with temperature monitoring devices to routinely check if the optimum temperature is maintained. The company provides automated reports for every shipment and also analyses data across facilities to manage transportation in multiple regions.

M. J. Logistics Services Ltd.

Incorporated in 2005, M J Logistics Services Ltd. is a leading player in the 3PL industry and a strong force in North India for various service offerings viz. Cold chain solutions, 3PL Warehousing & logistics services, Primary & secondary distribution, etc. having succeeded in managing more than 1.2 million square feet of the entire warehouse space, including cold and dry logistics services under a single roof. MJLSL operates from Punjab, Haryana, Uttar Pradesh, Himachal Pradesh, Uttarakhand, Greater Noida, and Delhi in Northern India & Mumbai in Western India, to deliver state of the art logistics to its clients.

The key verticals include automotive and light engineering parts management (after markets, Distribution Management, In-plant Logistics & VMI); Food & FMCG, Processed Food, Beverages, Agri-commodities; Cold chain (Frozen Foods, Retail Backend & QSR, Dairy Products, Fruits & vegetables, Pharmaceuticals, Industrial Biosciences) and Value-added services support (De-bulking, Segregation, Picking, Packaging, Kitting, Binning, Labelling).

The company boasts of World Class Infrastructure with Modern equipment's and Mechanized Environment at Palwal (Haryana) and Panvel (Maharashtra); Food Safety and Hygiene conforming to Hazard Analysis and Critical Control Points (HACCP) / ISO 22000 norms.

R. K. Foodland Private Ltd.

RK Foodland a leading Supply Chain Solutions company serving the Agriculture, Retail, Quick Service Restaurant, Food Service, and Pharmaceuticals industry in India. It is part of the Radhakrishna Group of Companies established in 1966. The company claims to be the first to introduce Multi Temperature Vehicles in India and operates more than 300 Ambient & Multi Temperature Vehicles.

Control Tower at RK Foodland forms the backbone of the business unit integrated logistics. All vehicles are remotely managed and controlled by a centralized control tower, which manages live temperature monitoring, dashboard generation, and SMS alerts, while the vehicles are in transit. RK Foodland's most effective and robust Transport Management System (TMS) provides real-time analysis on various parameters like Unit Utilisations; Excessive Idling; Raise proactive alerts and handling exceptions through proper escalation channels; Running vs Stoppage Hours and Adherence to Temperature Thresholds.

With over 1.2 million square foot of prime, multi-temperature warehousing capacity in strategic locations across India, the range of distribution centre management solutions are amongst the most diverse in India and encompassing dedicated, Shared User, Automated and Multi-Temperature operations – adhering to the highest standards of QHHSSEMCC-ITC (Quality, Health, Hygiene, Service, Safety, Environment, Maintenance, Compliance, Contingency, and In-The-Community) coupled with WMS and customized distribution centre solutions.

Cold Star Logistics Private Ltd.

Mumbai based Cold Star Logistics Private Limited is promoted by Tuscan Ventures, one of the few logistics-focused investment firms in India that practices a unique philosophy of scaling up businesses through a twin combination of growth capital and operational excellence. ColdStar is operating across the cities of Chandigarh, New Delhi, Kolkata, Cochin, Kakinada, Chennai, Bengaluru, Hyderabad, Pune, Mumbai and Ahmedabad providing specialized refrigerated storages, warehousing, transportation, distribution and logistics services for fresh and frozen commodities.

Using specialised temperature-controlled reefer/freezer trucks for refrigerated transport, ColdStar offers a seamless truck transportation chain for perishables and food items. The company has leverage controlled atmosphere reefer technology to increase product quality, shelf life, and decrease dehydration thus enabling customers – leaders in Food, Retail, FMCG and Pharmaceuticals – to preserve product value across the supply chain. The company specializes in temperature-controlled trucking needs including just-in-time shipment through the following:

- Specialized material handling equipment
- Standardized storage environment – palletization
- Focus on product integrity and conformance with EHS
- Highest level of hygiene and safety standards
- Information visibility – inventory management, shipment history, production scheduling, and stock replenishment
- Specialized refrigeration equipment
- Best-in-class trained professionals specializing in providing maximum protection to customers' products

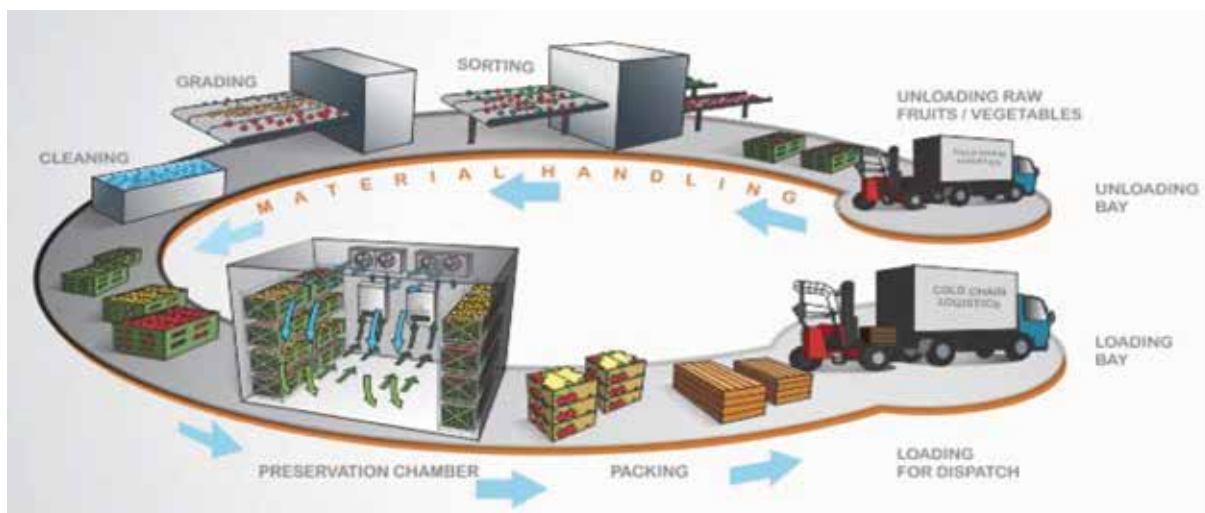
Chapter 2

Technology

2.1 Existing Technology

It goes without saying, technology's influence on the cold chain logistics industry is equally profound. From the implementation of temperature monitoring to the optimization of product put-away and selection, technology has and always will be an industry game changer.

Cold-chain is the process which involves the transportation of temperature-sensitive products along a supply chain through thermal and refrigerated packaging methods to protect the integrity of these shipments. There are several means in which cold chain products can be transported – Refrigerated trucks & railcars, Refrigerated cargo ships, and Air cargo. Hence, the Cold Chain Industry has now become an integral part of the supply chain industry comprising of refrigerated storage and refrigerated transportation.



Cold-chain involves temperature-controlled warehousing and transport through various applications comprising of humidity control, pre-defined air composition, modified atmosphere packaging and much more in order to preserve the product quality from inclement natural or ambient conditions.

While handling fresh horticulture produce, the pack house is the key harvest point thereby preparing the fresh produce to enter the cold chain conduit. A pack-house merely aggregates this fresh whole harvest, segregates it for market movement, cleans & packs it for safe handling,

precools the package for better holding and to transport the produce. As these activities do not alter the natural characteristics of the fresh food item or transform it into a new food product, the pack-house is considered part of the logistics chain or cold-chain.

The pre-conditioning of the produce after harvest is of primary importance as the fresh produce could be sold locally in the immediate vicinity to realize value or processed through local processing factory. The production (by food processor) is closely linked to market demand (on sales forecasts) as far as practicable. Where not possible, the product is stored in captive cold stores under direct control of processor, or on factory premises until a market pull generates dispatch through the cold-chain.



The modern pack house is the starting point of the cold chain for fresh produce that needs to be linked to distant markets through temperature-controlled phases. An integrated pack-house has a covered shaded area for receiving the farm produce which has to be off-loaded before undergoing pre-selection and weighing followed by food handling hall with mechanised handling and

cleaning equipment along with sorting & grading conveyors to allow the working personnel to selectively pick and choose the produce for next activity. If the routing requires long travel, then the packaging plays a major role for the safe transportation of the product. There are specific package designs for the fresh produce. After the packaging, the produce and its package are entered into the pre-cooling stage at optimal temperatures so as to retard senescence.

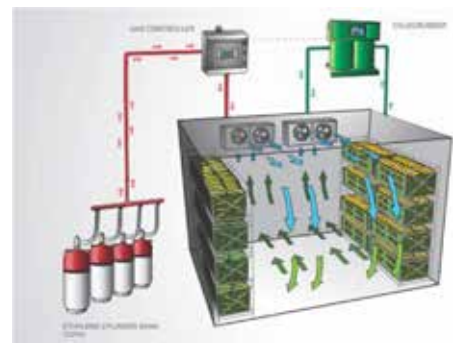
Thereafter, the packaged fresh produce is kept in a transitory staging cold room awaiting transport to faraway markets. The next link in this chain is the transport where the unitised cargo lots are preferred to facilitate safe as well as speedy handling. The pallet is the most common unit load used globally and these are loaded onto carriers – the reefer trucks or larger unit loads like the reefer container.

The logistics infrastructure needs are synergistic for both fresh and processed supply chain systems. The onwards market connectivity is in form of logistics capacity, which comes into use after the product is dispatched or released from the factory. This capacity is will be in form of long haul reefer transport (rail, road, sea, air), receiving hubs (to deconsolidate for onwards dispatch), reefer distribution (small units for retail-end delivery), merchandising platforms (retailing cabinets) and domestic refrigerators. Thus, the small insulated carriers, street vending carts, display cabinets controlling temperature and /or humidity, frontend wholesale or retail storage are also part of the cold-chain distribution network.

The uniformity in the load units allow for harmonisation of the handling equipment and promote standardisation of operations in the cold chain. The palletisation of a load facilitates safe multi-modal handling, whilst transporting and when in cold stores. The pallet handling is done through mechanised means to ensure quick and ease of operations and this greatly reduces the losses that occur because of mishandling. Hence, those cold stores are given preference which are equipped with fork lifts, roll-on / roll-off ramps and can handle pallet-based cargoes. These days the modern cold storages that also serve as distribution centres use high reach storage systems and deploy dock shelters, ramps and high reach handling equipment which overall ensures a better land area utilisation.

Finally, the retail shops at the last mile needs infrastructure requirements to handle the cold chain routed fresh produce. Thus, cold-chain forms the bridge that stitches together the rural landscape with urban consumption, leading to value all around.

A unique cold chain component is the ripening chamber and this is used for fresh produce like mangoes, bananas, papayas and de-greening of citrus fruits. Whereas the cold chain extends the living cycle, the ripening chamber does the opposite and advances the physiological activity depending on the market demand by adjusting the maturity cycle of the produce. Normally, the produce would otherwise ripen naturally towards the end of their life span.



The ripening chambers are designed to maintain mild-chill temperatures so as to dose the fruit with ethylene which is a natural ripening trigger. The air circulation is adjusted such that the dosing is spread evenly inside the chamber. The ripening cycle is usually around 4 – 5 days after which the ripened produce moves out for retail. The shelf life of ripened produce is minimal and thus ripening chambers need to be built at the last mile of the cold supply chain, close to the consumption base. It is but obvious that the ripened produce cannot last long and should not be dispatched for long distance travel.

Another requirement is the need for cold warehousing. This is predominantly used for few crops which require long term storage as they are single harvest crops across the country. Such crops like potato, apples, etc. enter into cold storage soon after harvest and spend most of their life span inside cold stores depending on optimal demand and / or price from markets. Such cold stores are located close to production areas and the produce is stored in bulk without going in for retail packaging. It's only during the off-season periods that the product is released to the market. Gradually with time, the produce is emptied out and cold store is readied for the next harvest. These cold stores need to be equipped with sorting and grading infra-structure.

The other cold storage is at the front end of the supply chain primarily designed for transient storage and is enabled for fast distribution (cross-docking) operations. The goods entering this cold storage have already been pre-conditioned and packed at a pack-house or processing centre, hence, arrive in packaged form for retail distribution. These front end cold stores are distribution centres or hubs receiving and dispatching cargo at a frequent basis and serves as the critical infrastructural connect with the market. The ante-room, also known as a staging area is large in size to allow for multiple activities and movements inside the cold store. Such cold distribution hubs are located close to consumption centres, metros and other steady demand centres such as ports and airports so as to serve as a feeding centre.

2.2 How technology is changing the cold chain

Differing technologies continue to have an impact on the cold chain. There is a noticeable movement towards alternator driven refrigeration systems, as opposed to traditional diesel systems for HGVs. These offer operators significant noise reduction benefits as well as very powerful capacity units.

Equally, relatively new technologies such as hydro-electric power for engine-less transport cooling appear to offer sustainable and energy-efficient refrigeration solutions. The manufacturers claim that, by sourcing power from the truck engine, they can improve fuel efficiency, lower noise levels and reduce maintenance, which are key considerations for any operator of temperature-controlled transport.

Today's technology offers a variety of tools to not only keep products at the right temperature, but to better monitor the load—from temperature sensors and GPS tracking to self-reporting alerts for computers and mobile devices. Smart refrigerated units even help monitor the location, temperature, humidity, and motion of shipments in real time.

Advanced tracking abilities give relevant parties advanced warning of any changes or malfunctions with the equipment. These types of notifications can help ensure necessary maintenance is performed regularly or even secure alternate capacity before a load is compromised. Unfortunately, this type of technology can be costly.

2.3 Cold chain innovations

Protecting health care products from damaging temperatures

Keeping perishable vaccines at a specific temperature range (e.g., 2°C to 8°C) as they travel from manufacturer to beneficiary is vital for immunization programs—and extremely challenging, especially in low-resource settings. Unreliable electricity, poorly maintained equipment, and long distances between health care facilities can compromise temperature control efforts, exposing

vaccines to unsuitable temperatures that negatively impact potency. Overheating and accidental freezing can result in vaccine wastage (when vaccines are discarded due to suspected damage) or the inadvertent administration of sub-potent vaccine, which increases the risk that beneficiaries are not fully protected from disease. A weak cold chain limits how far a vaccine can be effectively transported and therefore how many people can access the lifesaving intervention. Notable innovations have included:

Temperature monitoring

The tracking and regulation of temperatures is critical for assessing vaccine handling quality, detecting malfunctioning equipment, and preventing temperature fluctuations that can negatively impact vaccine potency and safety. Various temperature monitoring technologies now exist to better record and manage cold chain performance.

Controlled temperature chain

Certain vaccines are much more heat stable than what is indicated on their vial labels. A controlled temperature chain is an approach being explored for the distribution of some heat-stable vaccines to remote and difficult-to-access areas for limited periods of time (e.g., one to four days), when access to refrigeration and ice is extremely limited.

Solar direct-drive refrigerators

It is an ideal solution for regions with limited electricity. Many health facilities in remote areas operate without grid electricity, have unreliable electricity, or find that using electricity is too costly. In these settings, solar energy is a promising solution for powering the storage and transportation needs of vaccines and heat-sensitive drugs at controlled temperatures. Solar-powered vaccine refrigerators have been available for almost 30 years. Until recently, the refrigerators available in this class were essentially first-generation design, using photovoltaic (solar) modules that recharge a high-quality, industrial battery system to store solar energy for use during night and poor solar days. While some solar refrigeration projects have been successful for more than ten years, many have suffered from battery system failures.

Battery-free solar direct-drive technology

Solar direct-drive refrigerators are next-generation solar refrigerators because they do not require an external battery. Instead of storing electrical energy in a battery, direct-drive refrigerators use cool storage (an “ice battery”) hidden in the refrigerator cabinet to maintain vaccine temperatures within the required range of 2°C to 8°C. At night or during cloudy, rainy weather, the well-insulated cool storage maintains acceptable temperatures for many days. In 2010, the first solar direct-drive vaccine refrigerator was prequalified by WHO, meeting a new set of performance, quality, and safety (PQS) standards for solar direct-drive refrigerators.

New technology to keep fruits, vegetables fresh for 1,000 days

Black Box is a unique technology developed by scientists in Spain. It can be easily set up in any factory or plant. Regular cold storage utilizes nitrogen. However, in the Black Box system, there will be neither nitrogen nor any preservative. The stored commodities will have their natural content and nutrition value intact for 1,000 days. Whether it is fruits, vegetables, or meat, anything can be kept fresh for 1,000 days using Black Box. The technology had been patented in the US and tried and tested worldwide. The returns to farmers will increase four-fold.

2.4 Major cold Chain Technologies

The major cold chain technologies in providing a temperature controlled environment during transportation may involve:

Dry ice:

It is solid carbon dioxide, temperature is about -80°C and is capable of keeping a shipment frozen for an extended period of time. It is particularly used for the shipping of pharmaceuticals, dangerous goods and foodstuffs and in refrigerated unit load devices for air cargo. Dry ice does not melt, instead it sublimates when it comes in contact with air.

Packaging:

There has been considerable focus on the development of packaging equipment with improved properties over conventional insulated packages. Significant efforts have been made on improved vacuum insulated panels, on-demand systems that do not require pre-conditioning, as well as flexible, actively temperature managed solutions that are now emerging, each with their own strengths and weaknesses, as well as a shift away from outdated solutions such as dry ice toward cryogenic distribution.

The common feature with many of these newly emerging technologies is the fact that these shipping systems are reusable and require well developed reverse logistics as well as cleaning procedures to ensure that there is no outside or cross-contamination which may tend to pose its own challenges.

Development of consistent, effective decontamination processes poses its own unique challenges. Each type of equipment has its own unique materials, which may be impacted negatively by different solvents commonly utilized in laboratory or clean room disinfection. Alternative, non-contact means of decontamination would be advantageous and could have utility across a wide range of packaging materials. One of these new technologies being developed within the transportation space is xenon-pulsed ultraviolet light disinfection. Pulsed xenon-based ultraviolet light no-touch disinfection systems are being increasingly used for hospital room disinfection after patient discharge.

These systems have been shown in multiple studies to effectively reduce aerobic bacteria in the absence of manual disinfection. In some of the studies, PX-UV exposure resulted in a 5-log CFU reduction for multidrug-resistant organisms (MDROs) on spiked plates. Cryoport is actively developing a xenon-pulsed ultraviolet light disinfection system for its cryogenic and C3 shippers, providing enhanced disinfection as well as the ability to disinfect at cryogenic temperatures, reducing processing time and increasing the number of turns a piece of equipment can be used within a set period. These methods are being developed to reduce cost of goods as well as improve overall equipment performance.

Gel packs:

There are some pharmaceutical and medicinal shipments which have been classified as chilled products, which must be stored in a temperature range between 2 and 8°C. For providing this temperature gel packs are used, also for packages that contain phase changing substances that can go from solid to liquid and vice versa to control an environment. Depending on the shipping requirements, these pack can either start off in a frozen or refrigerated state. Along the transit process they melt to liquids, while at the same time capturing escaping energy and maintaining an internal temperature.



PCM Pallet cover system:

Cold Chain Technologies (CCT), the Global leader in temperature-controlled distribution solutions for the life sciences supply chain, launched the industry's first pallet cover system with integrated phase change material (PCM) – KoolTemp® GTS Enshield.



GTS Enshield is a freight-efficient solution that combines the insulation and easy pack-out of a pallet cover with the temperature regulating benefits of CCT's Koolit® Advanced PCM Gel, which are integrated in the cover. The GTS Enshield provides the flexibility, simple pack-out, and freight efficiency of a pallet cover, along with temperature control properties that were only available from full pallet container systems in the past.

With the GTS Enshield, therapies stay at the right temperature while costs per dose delivered go down, in some cases by as much as 50 percent. The GTS Enshield was designed for pre-palletized product loads up to 50", although it can easily adapt to smaller payloads. Unlike most pallet covers, which work best with wider range room temperature freight, the GTS Enshield can be used in strict 2-8° C, 15-25° C (CRT), and frozen applications.

EPS Molded Insulated Containers Perfect for next day delivery:

EPS Molded Containers are light-weight molded insulated packaging solutions that provide the most cost-efficient approach to the next day delivery of temperature-sensitive products. These durable containers are available in a variety of styles, thicknesses, and customized interiors.

- Compact, lightweight and highly efficient
- Stand-off pads on base to keep product away from condensation
- Channeled wall construction for more efficient convection cooling
- Most insulated containers are available with or without an outer carton.



Eutectic Plates:

Eutectic plates are known as "cold plates". The principle eutectic plate is similar to gelpacks. Plates are filled with a liquid and can be reused many times. These have a wide range of applications, such as maintaining cold temperature for rolling refrigerated units. They can also be used in delivery vehicles to keep temperature constant for short periods of time, a process that can be suitable for deliveries in noise sensitive areas or for night deliveries.

Liquid nitrogen:

It is the cold substance, of about -196°C, used to keep packages frozen over a long period of time. It is mainly used to transport biological cargo such as tissues and organs. Though, it is considered as a hazardous substance for the purpose of transportation.

Quilts:

Quilts are insulated pieces that are placed over or around freight to act as buffer in temperature variations and to maintain the temperature relatively constant. Thus, frozen freight will remain frozen for a longer time period, often long enough not to justify the usage of more expensive refrigeration devices. It is also used to keep temperature sensitive freight at room temperature while outside conditions can substantially vary in different weather conditions.

Reefers:

This is the generic name for a temperature controlled transport unit, which can be a van, small truck, a semi-trailer or a standard ISO container. These units, which are insulated, are specially designed to allow temperature controlled air circulation maintained by an attached and independent refrigeration plant. A reefer is able to keep the cargo temperature cool and even warm.

Refrigerated Containers:

Refrigerated containers, reefers, etc. are the refrigerated cargo being transported around the world. The reefer has become a common temperature-controlled transport unit which can be used

to insure load integrity. It can accommodate a wide range of temperature settings and accordingly a wide range of temperature sensitive products. It is a versatile unit able to carry around 20 to 25 tons of refrigerated cargo and is fully compatible with the global intermodal transport system, which implies a high level of accessibility to markets around the world. The refrigeration unit of a reefer requires an electric power source during transportation. It is important to underline the refrigeration units as they are designed to maintain the temperature within a prefixed range. The shipment must be brought to the required temperature before being loaded into a reefer, which requires specialized warehousing and loading / unloading facilities.

A new generation of reefers is coming which will be equipped with an array of sensors monitoring the temperature effectively and shutting the cooling plant when not needed and is unnecessary to use. This may improve the reliability of temperature control as well as can extend the autonomy of the reefer.

Data monitoring:

One out of every two pharmaceutical products will be thermo sensitive and will require temperature monitored from point of manufacturing to 'last mile' delivery. The DSCSA is also pushing companies to adopt newer technologies for chain of condition and chain of custody adherence. Next generation data loggers are now readily present and can track an entire range of specifications in near real time such as location, temperature (inside and out), shock, orientation, anti-tamper, humidity, and pressure.

Most of these devices use lithium metal or lithium ion cells or batteries as a power source. Lithium cells and batteries are classified as dangerous goods and therefore must meet all of the applicable provisions of the Dangerous Goods Regulations (DGR) when shipped by air.

This applies regardless of whether the lithium cells or batteries are shipped as cargo in their own right or whether the lithium cells or batteries are installed in a small device such as a data logger that is placed inside or attached to packages of cargo. In addition, to be permitted in transport, all lithium cell and battery types must have passed the applicable tests set out in Subsection 38.3 of the UN Manual of Tests and Criteria.

Data loggers:

Data loggers monitor temperatures in refrigerators and freezers for clinics participating in the CDC Vaccines for Children program as well as hospitals, clinics, and WHO sites. The loggers communicate wirelessly via Bluetooth Low Energy to mobile devices.



Using the InTemp app, one can easily view data, check logger status, set alarms, and create and share secure PDF reports for streamlined reporting and regulatory compliance. All loggers feature advanced audible and visual alarm capabilities for notification of temperature excursions, an internal sensor for ambient temperature monitoring, and a 3-year NIST Certification of Calibration.

Informatics:

It has become clear that effective cold chain logistics management is vitally important to preserving the efficacy of valuable cold chain dependent medicines and for risk mitigation. Unfortunately, most companies do not integrate logistics planning early enough in their clinical trial design; it is often an afterthought once the product is nearing commercialization.

Adding complexity, such as adding more links to a supply chain as seen in regenerative therapy programs, increases the steps and/or temperatures that must be controlled and increases risk of a temperature excursion.

2.5 Conclusion

As an ever-increasing number of cold-chain dependent therapies move from the bench into clinical trials and finally to approval, and regulatory requirements for packaging, and chain of custody increase, the specialized packaging, tracking, and data capture requirements for these highly valuable and temperature-sensitive biological materials will need to keep pace.

Advanced technologies for cold chain management to ensure their safety and efficacy when they reach the patient will become of paramount importance. Next generation packaging technologies, advanced package tracking, intelligent informatics systems and knowledge of international regulations can provide tools that companies and logistics managers need to reduce the risk of failure due to cold chain logistics issues.

Chapter 3

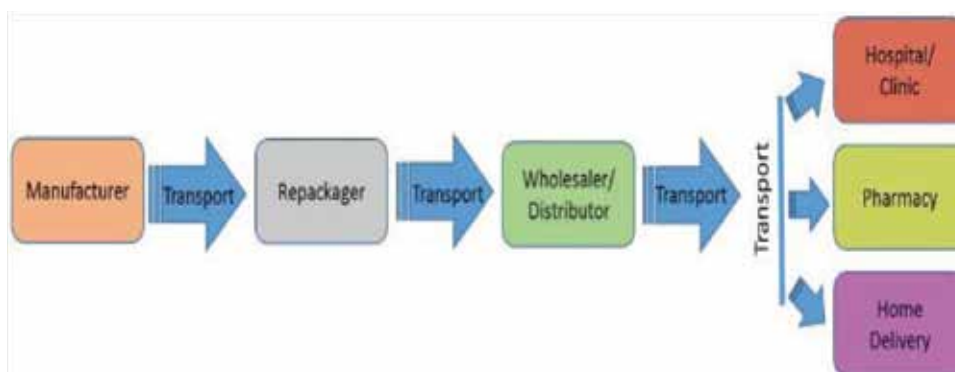
Regulations

3.1 Cold Chain Management

Cold chain management and logistics is a specialized concentration within supply chain management that utilizes temperature-controlled transportation and storage and distribution systems to ensure the product remains within its recommended conditions. A cold chain management program is meant to:

- Ensure the appropriate storage and handling conditions (temperature) are maintained throughout the cold chain.
- Document the storage conditions (temperature) throughout the cold chain.
- Maintain the product safety and integrity throughout the cold chain (temperature, counterfeiting).

The basic elements of a pharmaceutical or biologic cold chain are shown in Figure below:



Establishing an effective cold chain strategy requires the thoughtful integration of cold chain requirements starting with product design and extending to environmental control during transit. Integrating Quality Risk Management (QRM) principles at strategic points within product development is the best way to anticipate downstream cold chain challenges.

Best-in-class organizations undertake primary packaging studies as the first step in answering the larger product stability and environmental label claim requirements. Framing this activity as an integral part of the cold chain design activity rather than perceiving it as a strictly product

development activity allows commercial considerations to be included in the product design discussion.

This holistic view provides the greatest opportunity for defining any subsequent commercial cold chain alternatives, such as shipper design, active vs. passive container design decisions, and country-specific regulatory requirements. The key elements of some of the major activities that can influence an effective governance strategy are shown in the figure below:



FDA & ICH: Regulations and Standards for Temperature-Controlled Supply Chains

The two greatest risks in pharmaceutical and biotechnology supply chains are the risk of product becoming adulterated during transport and the risk of non-compliance with federal regulations, guidelines and standards. Post this, the greatest concern of manufacturers and distributors is cost containment in an increasingly globalized, increasingly complex supply chain.

The two organizations that carry significant regulatory weight are the combined forces of the US Food and Drug Administration (FDA) and International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH). The FDA co-founded the ICH with the European Community in 1990 with the goal of creating a globally harmonized approach to the understanding and application of technical guidelines for drug manufacturers.

The outcome of harmonisation was to decrease unnecessary replication of costly regulatory processes, thereby promoting more efficient manufacturing, processing and distribution methods for regulated products on a global scale. Whereas the jurisdiction of the FDA is primarily in the United States and Puerto Rico, the ICH is an international entity that involves the US, Japan and the European Union. Other parties involved in ICH include:

- The Pharmaceutical Research and Manufacturers of America (PhRMA)

- The Center for Drug Evaluation and Research (CDER)
- The Center for Biologics Evaluation and Research (CBER)
- The European Commission
- The European Federation of Pharmaceutical Industries Association
- The Japanese Ministry of Health, Labor and Welfare
- The Japanese Pharmaceutical Manufacturers Association
- ICH Secretariat
- The International Federation of Pharmaceutical Manufacturers & Associations (IFPMA)
- Other ICH sponsors: Health Canada, the European Free Trade Area (EFTA), and the World Health Organization

Moving temperature-sensitive products necessarily renders the supply chain a “cold chain” (sometimes also called “cool chain”) and products that fall under the purview of federal law and enforcement agencies further evolves the logistics process into a regulated cold chain. However, there is currently no single standard, guidance, regulator, document or arbiter with the final say on a compliant cold chain for a given region. Instead, manufacturers and distributors face a myriad of regulations, conferences, technical reports and recommendations from disparate agents.

A growing list of documents, legislation, requirements, recommendations and guidelines reveal how fragmented the current regulatory environment is in cold chain management:

- The EU Guide to Good Manufacturing Practice, Annex 13
- The Guidelines on Good Distribution Practice (GDP) of Medicinal Products
- CDC Guidelines for Maintaining and Managing the Vaccine Cold Chain
- WHO Guidelines on the international packaging and shipping of vaccines
- PDA Technical Report 39
- The US Code of Federal Regulations
- US and European Pharmacopoeia

Three key regulations from the FDA that address cold chain are:

- 21CFR 203.32 “Prescription Drug Marketing—Drug sample storage and handling requirements.” This subpart (D--Samples) contains two parts that stipulate that
 - “Storage and handling conditions” not adversely affecting the drug and

- b) Manufacturers, distributors of record, and their representatives comply with all compendia and labeling requirements.
- ii. 21 CFR 203.36 “Fulfillment houses, shipping and mailing services, co-marketing agreements, and third-party recordkeeping” looks at “co-marketing agreements” with any third party involved in shipping and storing drug samples. This section states that the manufacturer or distributor is responsible for record keeping and documentation and must comply with the Prescription Drug Marketing Act (PDMA) and amendments. The PDMA document contains recommendations relating to 21 CFR Parts 203 and 205 and outlines how to document drug products that pass from manufacturers to Authorized Distributor of Record (ADR) and provisions regarding pedigrees.
- iii. 21 CFR 211.150 of Subpart H: Holding and Distribution - “Distribution procedures” states that these products must be shipped within: “...appropriate temperatures and under appropriate conditions in accordance with requirements, if any, in the labeling of such drugs, or with requirements in the current edition of an official compendium, such as the United States Pharmacopeia/National Formulary(USP/NF).”

Appropriate manual, electromechanical, or electronic temperature and humidity recording equipment, devices, and/or logs shall be utilized to document proper storage of prescription drugs. The recordkeeping requirements shall be followed for all stored drugs which is elaborated below:

“Recordkeeping” states that drug distributors must maintain records and inventories that show receipt and distribution or “other disposition” of prescription drugs. These records must include the source of the drugs, the address of the location that the drugs were shipped from, the identity and quantity, and the dates of receipt/distribution/other disposition. Records must be kept and accessible for inspection for 3 years after the date of their creation.

The regulations reveal what one expects:

Documentation is key to compliance with federal regulations. Unfortunately, the supply chain has many links; each requires thorough records and many stakeholders can contribute to a document portfolio of a given product in the chain. Stakeholders typically include drug or biotechnical testing laboratories and manufacturers, contract manufacturers and packagers, distribution centers, wholesalers, and finally, healthcare facilities or pharmacies.

The distribution path can include different types of transportation and several climatic zones, and each new mode of transport and location will come with its own temperature fluctuations. When setting up a cold chain management system that complies with federal regulations, one would need to create or obtain detailed records of stability data, geographical data (including

climatic zones), and shipping and storage durations at each point in the journey, and contingency procedures for delays, out-of-specification conditions or other unexpected events.

3.2 Regulatory Considerations

The drug sponsor takes primary responsibility for ensuring that the product is fit for use. Specifically, manufacturers of cold chain products have direct control over the correct storage and handling of their products from the start of production through dispatch from their main supply warehouse until the products reach the first point of shipment. This point may be a local operating company, wholesaler, or a hospital.

However, while accountable, the drug sponsor can only have an indirect influence on cold chain compliance. The drug sponsor may indicate how the products should be stored and handled based on evidence from preclinical studies and basic knowledge about therapeutic drug physio-chemical properties and requirements. An effective cold chain strategy must also recognize when responsibility lies with a support services component of the supply chain.

Specific compliance requirements for establishing an effective cold chain structure and governance strategy are based upon a combination of regulatory requirements defined by the corresponding regulatory body such as FDA, EMA, WHO, Health Canada, etc. However, industry best practice guidance's from organizations such as the International Safe Transit Association (ISTA), United States Pharmacopeia (USP), International Air Transport Association (IATA), International Committee on harmonization (ICH), and the Parenteral Drug Association (PDA) offer important, practical information on the details and considerations required.

Product Stability

ICH

Understanding the impact of environmental variation on a product's safety and efficacy is a prerequisite to establishing a cold-chain strategy. ICH Q1A (R2), which addresses stability testing of new drug substances and products, is a central industry best practice for building an effective stability program. This data is used to understand the impact, considering the magnitude and duration of temperature excursions that could occur in the distribution process. Data derived from intermediate and accelerated environmental conditions can be used to determine the potential impact of short-term excursions that could occur in the shipping and distribution process.

Packaging Design and Qualification

USP

The United States Pharmacopeia (USP) 39 chapter 1079 describes "Good Storage and Shipping Practices" with guidance for handling cold chain pharmaceutical products. This chapter provides

the requirements for ensuring a product's "identity, strength, quality, and purity" across the entire distribution channel - from manufacturer to end user covering the handling and storage of products in warehouses, during transit, and in pharmacies. This chapter states: "Operational and performance testing should be part of a formal qualification protocol."

Thermal testing qualification may be performed using a validated controlled temperature chamber or actual transit testing using the expected transport method and shipping lanes (from origin to destination). Certified test labs use validated environmental chambers to simulate the ambient temperature that the package may encounter using standard profiles that simulate the transit of the package through the distribution channel with changes in temperature and duration. The profiles are established by the International Safe Transport Association (ISTA) and cover both land and air transport of various times and package configurations. Detailed test reports are obligatory to demonstrate support of the regulatory requirements.

ISTA

The ISTA organization focuses on the specific concerns of transport packaging. ISTA is the leading industry developer of testing protocols and design standards that define how packages should perform to ensure protection of their contents during the ever-changing risks of the global distribution environment. ISTA 2 provides the requirements and standards protocols for environmental testing including temperature, pressure and humidity.

Transportation and Monitoring

PDA

The Parenteral Drug Association (PDA) is an industry educational organization that provides detailed guidance regarding activities in drug development in technical reports available to its membership. Each report deals with specific technical, compliance, and monitoring requirements for a particular activity within drug development.

The two cold chain management guidance pertain to establishing a cohesive cold chain strategy and governance structure: PDA Technical Report No. 39, revised 27: "Guidance for Temperature-Controlled Medicinal Products: Maintaining the Quality of Temperature-Sensitive Medicinal Products through the Transportation Environment" (Suppl., vol. 61, no. S-2); and PDA Technical Report 46 Last Mile. TR39 provides a very detailed discussion of all the requirements of a cold chain management program from package design and qualification through good distribution practices. TR46 focuses upon good distribution practices of the final product.

IATA

The International Air Transport Association (IATA) is the trade association for the world's airlines, representing 260 airlines and 83 percent of the total air traffic. IATA supports many areas of

aviation activity and helps formulate industry policy on critical aviation issues. IATA provides several essential elements specific to cold chain requirements.

The IATA has published a temperature control regulations (TCR) guide designed to help stakeholders involved in the transport and handling of pharmaceutical product to safely meet the requirements. The TCR defines industry best practices for drug manufacturers, ground handlers, freight forwarders and airlines. All healthcare temperature sensitive products require the IATA “Time and Temperature Sensitive” label. This label is specific to the healthcare industry and must be affixed to all shipments booked as time- and temperature-sensitive cargo to indicate the external transportation temperature range of the shipment. It is the responsibility of the shipper (or designated shipper’s agent by service agreement) to ensure that the label is applied properly.

3.3 Cold Chain Management Trends

1. Regulation is increasing

As the value of new drug therapies and their sensitivity to storage conditions has escalated, one might argue that drug manufacturers do not need any additional incentive to ensure environmental control. For years most countries require that pharmaceutical drug products remain within filed temperature limits. However, the EU’s guidance on Good Distribution Practices has extended this requirement to include transportation. While not required in the U.S., we anticipate a similar requirement and many organizations have already adopted temperature-controlled transportation as part of their current cold chain strategy. Biologics are not the only sector driving this practice: even controlled room temperature labelled products require refrigerated transport vehicles to minimize the potential for temperatures excursions.

2. Active vs. Passive Shippers

As logistics become more complex, the risk profile of new drug therapies has prompted a shift toward greater environmental control. Passive shippers have been the method of choice for many years. Passive shipping configurations are manufactured systems that are typically insulated with polystyrene, polyurethane, or vacuum insulated panels. Many have been pre-qualified to hold a particular temperature for a certain amount of payload capacity for a specified period of time. With these types of configurations, the shipper uses gel packs or similar materials to maintain the desired temperature.

On the other hand, active shippers are powered by electricity and/or battery. Active shipping configurations are considered to be more secure than passive systems because units lock and are never opened during transport. As a result, this design helps reduce the risk of theft and may help maintain regulatory compliance. However, they have the disadvantage of requiring reverse logistics, meaning the containers must be returned to be reused adding cost and complexity to the logistical planning process.

3. Training Remains a Big Issue

With increasing regulation, the compliance component becomes even more critical. Training has always been a large part of cold chain management. To facilitate this organizations such as IATA provide a checklist for ground handlers and airlines to use to ensure the minimum verifications are conducted during the transport.

4. Increased Logistic Outsourcing

Cold chain performance is subject to the same pressures as normal supply chain process to push performance and drive down costs. Many pharma companies have turned to third party logistics (3PLs) firms that are incentivized to make the necessary investments in technology, infrastructure, and systems to drive continuous improvement and gain a competitive market edge. Specialized capabilities such as Automated Search and Retrieval Systems (ASRS) and in-situ x-ray verification of product are examples of tailored specialized capabilities that some 3PLs have adopted to meet the evolving demands of the cold supply chain.

Conclusion

As the value and criticality of life saving drug therapies escalate, regulatory requirements are moving toward closer control over every facet of the cold chain. Even with the disparity in formal requirements among different markets, drug manufacturers and 3PLs are gravitating to the most conservative requirements to drive standardization and ultimately efficiency.

With the informal adoption of more stringent requirements, the ability for each piece of the cold supply chain to comply with industry best practices will be challenged. Training will continue to be an issue as ground crews, freight forwarders, and airlines navigate the confusion between absolute requirements and desired practice.

Industry organizations such as IATA have attempted to drive standardized work through the use of checklists for freight forwarders and airlines to follow, however the reality is that the ability of these ground teams to stay on top of these responsibilities remains problematic. The success metrics of today's cold chain are at best a moving target with formal and informal regulation complicating today's global supply chain. Collaboration among external service providers could provide the foundation for future compliance risk reduction and potential business success.

Chapter 4

Key Challenges

4.1 Background

Cold chain expansion is one of the greatest challenges to operate this business in any international environment. There is lack of infrastructure in a developing market for sustenance of cold chains. Maintaining transportation systems is really a cumbersome task for transporting refrigerated products in a timely manner. It adds further costs and complications due to lack of reliable power for cold warehouses, power hookups for reefer trailers at ports and transportation hubs, and providing adequate facilities at the final customer locations.

Globalization has made the relative distance between regions of the world much smaller, the physical separation of these same regions is still a very important reality. Freight can be damaged in transport operations due to greater physical separation. Some goods can be damaged by shocks while others can be damaged by undue temperature variations.

For a range of goods labeled as perishables, particularly food (produces), their quality degrades with time since they maintain chemical reactions which rate can be mostly mitigated with lower temperatures. It takes time and coordination to efficiently move a shipment and every delay can have negative consequences, notably if this cargo is perishable. To ensure that cargo does not become damaged or compromised throughout this process, businesses in the pharmaceutical, medical and food industries are increasingly relying on the cold chain.

An integrated cold chain is necessary not only for a profitable retail environment, but also for inclusive growth. The obvious benefit of an integrated cold chain is a reduction in the amount of fruits and vegetables that are wasted annually. The physical logistic connectivity serves as a bridge between the rural – urban supply – demand divide and helps scale up sales and promote relevant farm – level productivity.

Food losses mean lost income for small farmers, higher food prices for consumers and a missed opportunity to export food to developing countries, where many people do not get the minimum required number of calories per day to achieve food security. A robust Indian cold chain could make a significant contribution to helping feed the nearly one billion hungry people in the world, including those in India.

In order to boost to the cold-chain sector, The Government of India has taken initiatives like forming National Centre for Cold Chain Development (NCCD). Also, the Government has opened

and allowed 100% FDI participation under the automatic route for investment in Cash & Carry Wholesale Trading / wholesale trading (including sourcing from MSEs) / E-commerce activities, yet, it will still take some time to get the expected outcomes from these initiatives.

4.2 Major Challenges

Some of the key challenges and issues in the sector are provided below:

- The industry is still highly fragmented with overall 3500 companies working in this space and organized players make up only 10 percent of the industry. The agricultural supply chain has too many intermediates and inadequate connections. The non-integrated services, thus leads to lack of ownership amongst the stake holders.
- Lack of quality warehousing infrastructure leading to the problem of non-adherence to the correct cold-chain practices during the storage and transportation of cold chain products. NCCD completed a comprehensive study on “All India Cold-chain Infrastructure capacity (Assessment of Status and Gaps) in August 2015 and found that the integration of cold-chain does not exist due to a large gap in form of inadequate pack-houses along with associated capacity in transport.
- Without the preconditioning centres, the produce cannot be readied for the cold-chain, and without transport, there are breaches in integrating the movement in the cold chain. Thus, large investments need to flow into rural India and the focus should be to develop and create new pack houses with associated transport capacity at the village level.
- Globally, the highest food loss and waste is reported in case of fruits and vegetables and is estimated upto 45%. According to report by Emerson Climate Technologies India, every year fresh produce worth INR 133 billion are thrown away because of the country’s lack of adequate cold storage and transport facilities.
- Taking into consideration the geographic spread majority of the cold storages are located in and around potato growing areas. About 61 percent of the cold storage capacity is concentrated in the states of West Bengal, Uttar Pradesh and Bihar, wherein storage of potatoes accounts for 85-90% of the capacity. Storage units in Maharashtra, parts of Gujarat and the country’s southern states are designed for storing commodities such as dairy products, fruits, processed fish and meat products, and seasonal vegetables. However, the market is gradually getting better organized and focus has shifted towards multi-purpose cold storages.
- Poor logistics connectivity is causing imbalance between demand and supply. There is a lack of roads and highways connecting rural areas to cities. To help in doubling farmers’ income and to make agriculture more sustainable, there is a need to develop holistic market connectivity for perishable and semi-perishable produce. Such connectivity would require cross-geographical flow of fresh foods and preferably involve multi-modal transport connectivity.

- According to industry estimates, approximately 104 million metric tons of perishable produce is transported between cities each year. Of this figure, about 100 million metric tons moves via non-reefer mode and only 4 million metric tons is transported by reefer. High operation costs, lack of small size reefer vehicles for shipment from distributor to retailer, hence, higher ambient temperature.
- The movement of food grains has regularly used railways wagons, yet, for perishables there is no evidence of similar positive focus. All major city centres also have modern rail terminals and freight handling yards. These cities can easily be identified as the destination of agri-produce freight. A scheduled, fixed route service will promote and spearhead the development large volumes along identified freight lanes. The Planning Commission's "Total Transport System Study on Traffic Flows and Modal Costs" by RITES, published in March 2008 highlighted that in case of fruits and vegetables, 97.4% of volume moves on roadways.
- There is an uneven distribution of cold storage facilities in the country as out of a total of 7645 cold storages having capacity of 34.95 million MT, it is seen that more than 72 percent of this capacity is spread across states of UP, West Bengal, Gujarat and Punjab. But still the situation is severe in the south of the country where there are limited numbers of cold storage units plus the climate is hotter and far more humid. Also, 36 percent of the cold storages in India are believed to have a capacity below 1000 MT.
- Maintaining Cold Chain services during drug distribution has its own set of challenges. The old condition of cold chain equipment used in transportation, high waiting and queuing time due to lack of requisite infrastructure at the seaports and airports, high ambient temperature in India, unawareness on the significance of maintaining Cold chain services etc. contributes to the problem of restricted growth of Cold chain industry in India.
- Drug Packaging can play a significant role in maintaining temperature-controlled services in pharmaceutical industry. But, quite often due to unavailability of small size reefer vehicles for shipment from distributor to retailer, drugs are generally shipped on low quality reefer vehicles. This leads to violation of Good Distribution Practices (GDP) as practices like storing and shipping drugs directly with ice-cubes in a thermocol box can only lead to compromised drug safety, quality and efficacy. Unfortunately, this is in sharp contrast on the efforts taken by other supply chain players to enhance patient value.
- Besides, the 3PL service providers are often of the opinion that they are not provided any incentives for maintaining cold chain services due to the long transport lead times owing to poor road condition and high number of toll nakas (which leaves very low margin for their operations).
- There is a need for technology interventions like GPS and sensors which can be monitored centrally to track the temperature and position of truck to ensure better control on product

quality. Moreover, lack of an industry wide IT platform implementation across the supply chain to track and trace drugs consignment has further magnified the problem.

- Cold chain productivity can be improved by extending the use of refrigeration technology and implementing better standards for food safety. Environmentally sustainable equipment, including those using natural refrigerants, can be used to lower the food production carbon footprint by reducing food wastage and helping to eliminate unnecessary greenhouse gas emissions from the cold chain.
- Low awareness of labour in handling temperature-sensitive products: In India, the supply chain of most products is long and fragmented. A product changes many hands from source to delivery point. Most workers involved in this are not properly trained in handling temperature-sensitive products resulting in deterioration of product quality before reaching the consumer.
- Education, such as the need for specialized cold storage systems for different commodities, and how to properly maintain these facilities will have a positive effect on the quality of food and reduction of food wastage. Training and practices can help drive standards for storage and transportation, working with international agencies to adapt protocols and technology from overseas to Indian conditions for best cold chain practices.
- For private players the high level of initial capital required to construct a cold chain unit continues to be the biggest challenge. Also, there is a hesitation to increase capital investment and incorporate modern technologies. But if the government pitches in with a clear plan and promotes more PPP (Public-private Partnership) initiatives in this field, we could see a momentum growth in the cold chain industry in India.

High Fuel Cost

The ever-increasing fuel costs and the number of Temperature Controlled Vehicles needed to move these perishable products for transportation needs throughout the supply chain are pertinent questions in the cold chain industry. The transport vehicles, generator sets used for back up during power cuts, fork lifts or counter balance trucks for loading / unloading are diesel-powered engines. The price of diesel in India has been increasing steadily over the years. The table below highlights the hike in diesel prices for last 3 years across the Metro cities:

Diesel price hike as per Indian Oil Corporation website

Year	January 01, 2016	January 02, 2017	January 01, 2018	May 11, 2018	CAGR %
Delhi	45.03	57.82	59.7	65.93	13.55
Kolkata	48.8	60.06	62.36	68.63	12.04
Mumbai	52.16	63.61	63.35	70.2	10.41
Chennai	46.25	59.47	62.9	69.56	14.57

Thus, one of the major roadblock for the sector to grow further is the operating cost of cold storage which apparently lies at \$ 60 per cubic meter in India while compared to \$ 30 in the west. The reason for this huge difference is on the account of higher energy expenses in India and shortage of adequate infrastructure. Fuel costs in India constitute around 30 percent of operating expenses of cold storages as compared to 10 percent in the West.

The major concerns that the cold storage sector faces are power supply, lack of trained personnel, outdated technology and infrastructure. However, inconsistent power supply and poor electricity is the biggest obstacle in the development of cold storage industry.

The cold storage sector is dependent on steady power supply. In India, some of the regions are prone to power cuts and hence there is an inherent need to invest in power back-ups, which ultimately enhances the capital investment requirements.

% of Electricity Deficiency States / Union Territories

State / Union Territory	% of Electricity Deficiency	No of Cold storages	Capacity (MT)
Assam	24.7	36	157906
Jharkhand	14.9	58	236680
Jammu & Kashmir	13.6	38	112516
Bihar	12.7	306	1415595
Kerala	10.4	198	80405
Haryana	10.2	338	749830
Manipur	10.1	2	5500
Chandigarh	6.4	7	12462
Karnataka	5.4	198	560178
Punjab	5.2	660	2155704
Andhra Pradesh & Telengana	3.9	442	1782561
Arunachal Pradesh	3.4	2	6000
Uttarakhand	3.3	46	160419
Puducherry	1.3	3	85
Total		2334	7435841

- As per Central Electricity Authority Load Generation & Balance Report 2017-18 the top 5 States having the highest percentage of electricity deficiency in the country are namely; Assam, Jharkhand, Jammu & Kashmir, Bihar and Kerala.
- The above table shows that 2334 out of 7645 cold storages are affected by insufficient power supply which constitutes 30 percent.
- On the capacity side 7.43 million MT out of 34.95 million MT cold storage capacity is prone to power cuts in the country which is around 21 percent.

4.3 Creation of Cold Chain Infrastructure

Cold Chain serves as a linkage between the producer and end user. Several components need to be developed for designing an effective cold chain infrastructure, namely

- Static Infrastructure like Cold stores, Pack-houses, Pre-coolers, etc.
- Mobile Infrastructure like Reefer vans / trucks, Carriers, Merchandising carts, etc. (basically transport units for connecting the static infrastructure)
- Handling Protocols & Design Standards
- Skilled Resources

The success of any cold chain depends upon its efficiency to cater to products that are sensitive to the environment, yet, stay fresh through the various controls and practices when transported from their place of origin to their destination.

4.3.1 Static Infrastructure

Pack-houses with pre-coolers are mostly recommended closer to the farm-gate or at source while cold chain serves as the marketing supply link for the produce. As a matter of fact, the procedures for setting up cold chain centres are long drawn. It is pertinent to obtain “Change of Land Use” from agricultural land to industrial land for initiating to set up cold chain. Unlike other industries, cold chain involves minimum industrial effluent and other wastes. Yet, the delay and processes in acquiring CLU have a negative impact on cold chain development.

Subsequently, just like any other project there are requirements of permits from TCP (Town and Country Planning), Pollution Control Board, Fire Departments, etc. Since, there are no fast track or priority processing systems for permits issued to cold chain infrastructure, hence, this slows down the entire initiative.

On a similar note, Banks and other financial institution too do not encourage priority funding to cold chain projects. Also, there are no preferential interest rates for funding cold chain; no priority lending is permitted. In fact, NABARD funds State Government and Government sponsored organisations but are not permitted to refinance banks or directly fund private sector entities.

Although the Government has exempted cold storage projects from basic custom duty as part of its initiatives, yet, there are certain post project components necessary for the optimisation of cold storage operations, namely, energy optimisation and automation systems, data recorders and other sensors where the custom duty exemption are not applicable, thereby a lacuna in promoting modern energy efficient systems.

The domestic manufacturers seldom have a vision in developing a wide basket of indigenous refrigeration and associated control system mechanism. As such, majority of the modern industrial

equipment and technology are imported from foreign suppliers or their marketing offices in India where too at times the stocks are limited. Hence, the lead time in sourcing equipment's adds to the delay in procurement and development.

In order to maintain the product specific environmental parameters, cold chain requires significant source of energy and in most cases, the availability of energy is minimal at farm gate or at the cold chain initiation stage. Thus, the backup systems are mainly diesel driven and comes with associated costs. Any such additional energy costs impact the cold chain development and its supply chain. The need of the hour is to promote non-conventional or hybrid energy systems for cold chain use such as the use of magnetic levitation, salt-based cooling, solar thermal energy banks as well as intelligent energy monitors, etc.

As a result of Government subsidy policies, the cold storages were developed in clusters, irrespective of business model validation or impact on demand gap analysis or constraints in location. For example, excess capacity developed in regions for potato resulting in less utility of cold storages. This resulted in single commodity bulk storage development. Ideally, cold storages should be developed as distribution nodes and aligned to last mile consumer demographics.

4.3.2 Mobile Infrastructure

The effectivity of cold chain is defeated without the use of temperature-controlled distribution connectivity between source to market place. Although, there are 7645 cold storages with a capacity of 34.95 million MT in the country, the capacity in reefer transport is abnormally on the lower side. It is observed that the country has made steady progress in standalone cold storages but it is also required to develop other associated infrastructure components in the cold-chain so as to integrate the cold-chain, to expand reach to markets and thereby minimise the loss to perishable products.

According to the National Centre for Cold-chain Development's (NCCD) 2015 study of the status of the nation's cold chain infrastructure, India has a shortage of reefer transportation vehicles - having fewer than 10,000 vehicles against an estimated 62,000 needed vehicles. Thus, India has negligible reefer transportation for its domestic movement of perishables.

On top of it, bulk of the refrigerated transport segment in India is fragmented with large number of small, unorganized / non-integrated private players focusing on select commodities or regions and even processors and the producers are increasingly outsourcing the logistics facilities rather than creating it as an integral part of their business. There is an immediate need to focus on transport including multi-modal options for the overall development of the sector.

Unlike other vehicles, there is a supply constraint for reefer trucks as these are not sold off the shelf mainly due to the presence of limited OEM supplying fully built refrigerated vehicles.

Mostly, the OEM supplies the base chassis and the same is retrofitted at some different premises by the insulated body manufacturer. Once this is completed, the refrigeration equipment supplier installs and commissions the reefer equipment. Needless to mention, that this entire arrangement has its own procedural, financial, warranty and cost repercussions.

Although, vehicle procurement loans are available at low costs or through bank hypothecation route, yet, in case of reefers, the component chassis, insulated body and refrigeration are subject to different financing norms. The base chassis is financed at preferential market rates, whereas the cold chain components comprising of insulated body and refrigeration unit are financed at higher costs. Hence, a reefer vehicle has a higher cost impact than ordinary commercial vehicles.

There are excise duty exemptions for reefer vehicles but in most cases the supply is in the form of disassembled components and hence, the industry is not able to avail this fiscal benefit. At times, additional countervailing duty is imposed on the same components even where safeguard or anti-dumping duty is not applicable. Central Excise authorities are of the opinion that the “Cab Chassis” is a finished product and cannot be moved for further job work. As per Central Excise rules, moving the cab chassis for job work to complete the final reefer vehicle (fitment of cold-chain equipment) enthralls payment of Excess Duty plus cess.

The core utility components, namely, reefer body comprising insulated container and refrigeration unit are required to be transported to the truck chassis manufacturer’s facility after paying Excise duty. Thereafter, the aggregate vehicle is returned to originating plant for inspection, integration and testing prior to delivery. This multiple movement adds to fuel wastage, related costs like driver costs, delay in delivery to cold chain users.

Like other vehicles, reefer trucks are subject to National Permit to travel between states. This permit is applied annually but is not issued after the 8th year; thereafter the reefer vehicles are allowed to move inter-state only. Thus, these regulations limit the operating and earning life of reefer vehicles.

Nowadays, there is an awareness to focus on marketing and merchandising infrastructure with a view to upgrade front end retail outlets which completes the entire gambit of cold chain including street vending carts, retail shelves, display cabinets and retail side storage. But, there is a lack of monitoring of reefer parameters in the vehicles which leads to spoilage and loss in value including physical wastage of the product.

4.3.3 Standards and Protocols

The cold chain industry comprises of two segments- Temperature Controlled Warehousing (TCW) and Temperature Controlled Transportation (TCT) Vehicles (Reefer Vans). It is important to develop special design standards for transport delivery and specific designs for pack houses

and pre-coolers. The current design standards focus mainly on specifying infrastructure design and is developed to facilitate project approval subsidy and do not extend across other aspects of cold chain. This attention to engineering design aspects limits the innovativeness and induction of new technologies.

The flexible design of cold chain infrastructure will allow added utility benefits considering the diverse produce catchment area and flexible work force; yet, the primary focus still remains on large rigid designs which are marketed by the principal companies. It is expected that our country would benefit from mass storage to direct access storage but there is little focus on this area.

To save operating costs of the refrigerating equipment, insulation as a thermal barrier is used during construction to minimize external heat ingress. At times, the technical standards followed in construction and operation of facilities are unsuitable for Indian conditions, which results in lower performance of standard refrigerated systems. Moreover, cold chain requires localised and remote monitoring controls which are critical to its efficiency while serving as a conduit to the consumer.

Specific standards about alternate technologies should be developed to strategically focus attention through pilot projects on innovation incubation systems. Standards require to be developed across the entire value chain with compliance to food safety and other safety regulations and environmental safeguards. Product specific protocols linked to regulatory compliance are the need of the hour.

Further, any recommendations by regulatory authorities like FSSAI, etc. are to be considered as knowledge dissemination to stakeholders and should not be confused with Standards both by end users and subsidy appraisers.

There is an embedded risk to cold chain operators while handling perishable products, since, commercial protocols related to assisting transactional bottlenecks are virtually absent. Finally, it is equally important to link Self-help Groups directly with Wholesale Groups to promote entrepreneurship at the farm-gate, thereby developing direct market access to Farmer Groups and minimizing their pertinent risks involved in extending links to markets over long distance.

4.3.4 Skilled Resources

In India, the supply chain of most products is long and fragmented. A product changes many hands from source to delivery point. Most workers involved in this are not properly trained in handling temperature-sensitive products resulting in deterioration of product quality before reaching the consumer. It has been noticed that cold chain is more successful in some specific segments like frozen food, dairy, pharmaceutical products as these require minimal skill sets.

The knowledge dissemination is inadequate in the cold chain industry as there are no specialized institutes for cold chain technicians; the learnings are primarily derived from on-the-job training. The lack of domain skills coupled with no access to trained knowledge base adds up to the disconnect. The appropriate skill sets are intrinsic to cold chain, since, such service involves both products as well as cargo specific inputs and demands continuous attention.

The largest disconnect remains in addressing the training needs of personnel which inadvertently creates operational errors leading to product shrinkage, wastage, damage, etc. In fact, all these occurrences get noticed after consuming the requisite amount of energy, thereby not only translating to gross energy loss but also significant losses in the product value chain.

Furthermore, today's focus is on minimizing the fuel and power costs which itself contributes to approximately 30 percent of operating expenses of cold storage in India. Such untrained utilization adds to power wastage. The need of the hour is to focus on the development of the technical cadre (engineers and technicians) who could install, commission, maintain and maximize the various equipment required in the cold chain. The appropriate knowledge of the subject would enthrall the individual staff to take correct decisions on desired climate control procedures and better handling of the produce to enable the farmer-producer to reap maximum benefits from his farm.

Chapter 5

Role of Financial Institutions

5.1 Role of financial Institutes

The Government agencies like APEDA, NHM, NABARD and others have been encouraging investors by providing them term loans at nominal interest rates and other financial assistance and subsidies in order to invest in cold chain infrastructure.

5.2 APEDA

APEDA has been actively involved in creation of cold chain infrastructure for horticulture produce to improve quality and value addition of produce and to achieve optimum shelf life resulting into increased quality exports of Indian agriculture produce. Recently, major focus has been laid to encompass setting up of processing units for horticulture and agriculture produce and also strengthen the infrastructure at seaports. Further, Prime Minister's Office has also identified Creation and Management of Cold Chain Infrastructure for Agriculture products as a thrust area and targets have been fixed for different Government agencies engaged in the field of creation of cold storage capacities including APEDA for agro export products.

Under its Scheme for Infrastructure Development, APEDA provides 90% assistance of the eligible project cost to State Government Agencies for setting up of cold chain infrastructure which includes pre-cooling, cold store, high humidity cold store, CA stores, and material handling plant and machinery viz. sorting grading, washing, waxing, packing in an integrated manner; Centre for Perishable Cargo at airports; Qualitative infrastructure at seaports, Processing Units, Testing Laboratories, etc. for common use by exporters for exports of agriculture products.

Various State Government agencies, State Agricultural Marketing Board, State Agriculture / Horticulture Departments and other organizations in the past, have been benefited by APEDA for setting up of such facilities by strengthening their export infra capabilities and capacities. More than 100 projects have so far been sanctioned by APEDA in last 15 years in various states, which includes setting up of integrated pack houses with pre-cooling, cold storage, material handling, vapour heat treatment, irradiation facilities; Centres for Perishable Cargo at 12 major airports, flower auction centres, Setting up/Upgradation of Laboratories for export testing for common use, etc.

Standard Operating Procedure (SOP) of the Scheme:

- Only Central and State Government and public-sector enterprises are entitled to avail assistance.
- The proposed facility should be for common benefit of exporters of APEDA scheduled products and directly resulting in adequate increase in export volumes and remunerative returns to farmers.
- Land free from all encumbrances and in the possession of the project implementing agency is pre-requisite for consideration of assistance.

Scheme component for Infrastructure Development

Sub Component	Pattern of Assistance
PART I	
A) Establishment of common infrastructure facilities by APEDA or any other Government or Public-Sector agency.	90% grant-in-aid by APEDA and 10% from other government or public-sector agency other than land. Calculation of the project cost and Government of India assistance shall not be available for the procurement of land.
B) For establishment of common infrastructure facility in PPP mode	Operating Guidelines are under preparation.
PART II	
A) Assistance for purchase of specialised transport units for animal products horticulture and floriculture sector.	40% of the cost subject to a ceiling of INR 7.5 lakh per beneficiary.
B) Assistance for all APEDA scheduled products for:	
1. Setting up of sheds for intermediate storage and grading / storage / cleaning operation of produce.	40% of the cost of equipment subject to a ceiling of INR 10.00 lakh per beneficiary
2.(a) Setting up of mechanized handling facilities such as sorting, grading, washing, waxing, ripening, packaging & palletisation, etc.	40% of the cost of equipment subject to a ceiling of INR 25.00 lakh per beneficiary
2.(b) Setting up of both pre-cooling facilities with proper handling system as well as cold storage for storing	40% of the cost of equipment subject to a ceiling of INR 25.00 lakh per beneficiary
2.(c) Providing facilities for treatment such as fumigation, X-ray screening and other screening/detection equipment's, hot water dip treatment, Water softening Plant	40% of the cost of equipment subject to a ceiling of INR 25.00 lakh per beneficiary

2.(d) Setting up of integrated post-harvest-handling system (pack houses with any two or more of the above facilities (mentioned in 2(a) to 2(c))	40% of the cost subject to a ceiling of INR 75.00 lakh per beneficiary
3. Setting up of cable cars (covering minimum of 50 ha of plantation) for banana and other crops (as decided by APEDA)	40% of the cost subject to a ceiling of INR 75.00 lakh per beneficiary
4. Setting up of vapor heat treatment, electronic beam processing or irradiation facilities	40% of the cost subject to a ceiling of INR 50 lakh per beneficiary
5. Assistance for setting up of environment control system e.g. pollution control, effluent treatment etc	40% of the cost subject to a ceiling of INR 35 lakh per beneficiary
PART III	
Assistance for fresh & processed horticultural produce for Setting up of specialized storage facilities such as high humidity (Relative humidity more than 95%) cold storage deep freezers, controlled atmosphere (CA) or modified atmosphere (MA) storage etc	40% of the cost subject to a ceiling of INR 25 lakh per beneficiary
<i>Note: Maximum avail per unit per plan period under part-II-B of Infrastructure Development Scheme shall not exceed INR 75 lakhs.</i>	

Market Development Assistance Scheme w.e.f. 01.06.2013

Sub Component	Pattern of Assistance
A. Packaging Development	
Sub-Component 1	
(i). Activity for development of packaging standards and design (ii). Up-gradation of already developed packing standards	100% for APEDA internal scheme
Sub-Component 2	
Assistance to exporters for use of packaging material as per standards and specifications developed or adopted by APEDA	Assistance to registered exporters of fresh fruits & vegetables, flowers and eggs @ 25% of the total cost of packaging material (including inner packaging materials viz. punnets, sleeves, rubber band etc), subject to a ceiling of Rs 5 lakh per beneficiary per annum.

Sub-Component 6	
<p>Market facilitation centre in major trading hubs of world</p> <p>Showrooms / Warehouses would be setup in leased or rental accommodation for identified products at identified centre's identified on the basis of marketing studies/surveys. Such showrooms/warehouses may be set up by one or more eligible agencies and for one or more product categories.</p>	<p>Under the component 75%, 50% and 33% of leasing/ rental charges in the first, second and the third year, respectively, would be provided as assistance. There would be a ceiling of Rs.100.00 lakhs for each market/product per annum.</p> <p>However, in cases of multi product showroom/ warehouse(s) the ceiling would be Rs.500 lakhs for each market per annum.</p> <p>APEDA, after the review of the performance and impact made by such interventions, may allow financial support of 25% of leasing / rental charges per year for a further period not exceeding three years.</p>

5.3 NABARD

NABARD has instrumental in providing loans to Warehouses, Cold Storage and Cold Chain Infrastructure. The Reserve Bank of India (RBI) has issued guidelines for creation of Warehouse Infrastructure Fund (WIF 2014 -15) consequent to the announcement of an allocation of Rs. 5,000 crore to NABARD in the 2014-15 budget for supporting creation of infrastructure for storage of agricultural commodities. The Fund envisages extension of loans to Public and Private sectors for construction of warehouses, silos, cold storages and other cold chain infrastructure.

Eligible Institutions/Entities

- State Governments
- State/Central Government Owned/assisted entities, Cooperatives, Federations of Cooperatives, Farmers' Producers' Organizations (FPOs), Federations of Farmers' Collectives, SPVs set up under PPP mode, etc.
- Primary Agricultural Credit Societies (PACS) / Cooperative Marketing Societies (CMS) or similar institutions
- Corporates/Companies/Individual Entrepreneurs etc.
- Agricultural Produce Marketing Committees (APMCs)

Accordingly, loans were provided for projects involving creation of storage infrastructure with a minimum aggregate capacity of 5000 metric tons (MT) for agricultural and allied produce, including construction of:

- Warehouses
- Silos
- Cold storage, controlled atmosphere (CA) stores, other cold chain infrastructure activities like pack houses/integrated pack houses, reefer vans, bulk coolers, individually quick-frozen units, chilling/freezing infrastructure, etc.
- Construction/modernization/upgradation of Marketing infrastructure facilities of Agricultural Produce Marketing Committee (APMC).
- Modernization/improvement of the existing storage infrastructure projects will be considered on merit of each proposal provided it leads to scientific/additional storage capacity.
- There's no minimum capacity for projects of Governments/ Government owned corporations.

Special priority was announced for the projects proposed in Eastern and North Eastern states and food grain deficit states. Direct loans to private sector and to the entities owned/sponsored by the State Govt., which are not covered by guarantee, would be governed by the terms of lending indicated below:

Direct Loans to Private Sector – Terms of Lending

Type of Borrower	Maximum Quantum of Loan (% of TFO)	Tenure of Loan (Years)	Rate of Interest (% p.a.)
Agencies owned / sponsored by Government of India, SPVs set up under the projects in PPP mode, FPOs, Federations of Farmers' Collectives, Apex Marketing Boards, etc. Also, Cooperatives (and their Federations), APMCs or similar institutions	95	7 years	PLR*+Risk Premium
		More than 7 years	PLR*+Risk Premium + Tenor Premium
Corporates / Private Companies / Individual Entrepreneurs, etc.	75	7 years	PLR*+Risk Premium
		More than 7 years	PLR*+Risk Premium + Tenor Premium

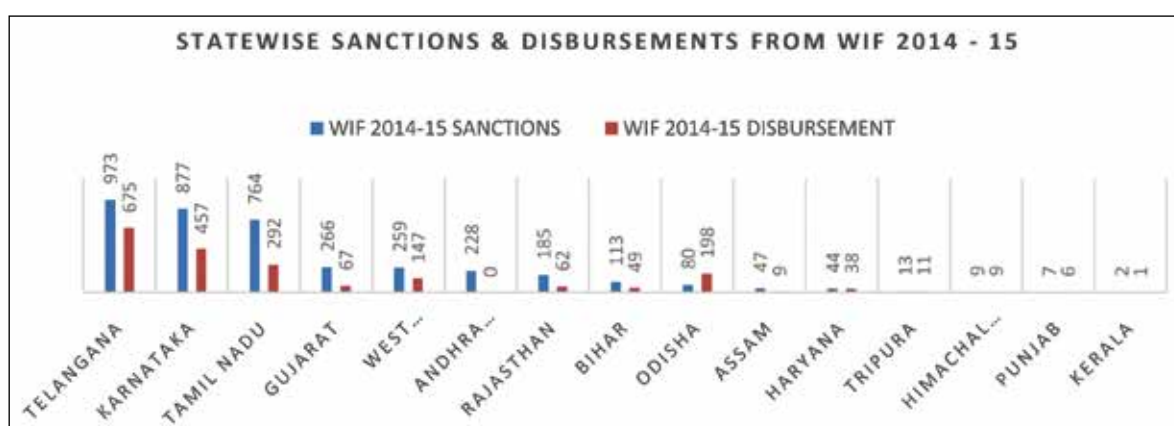
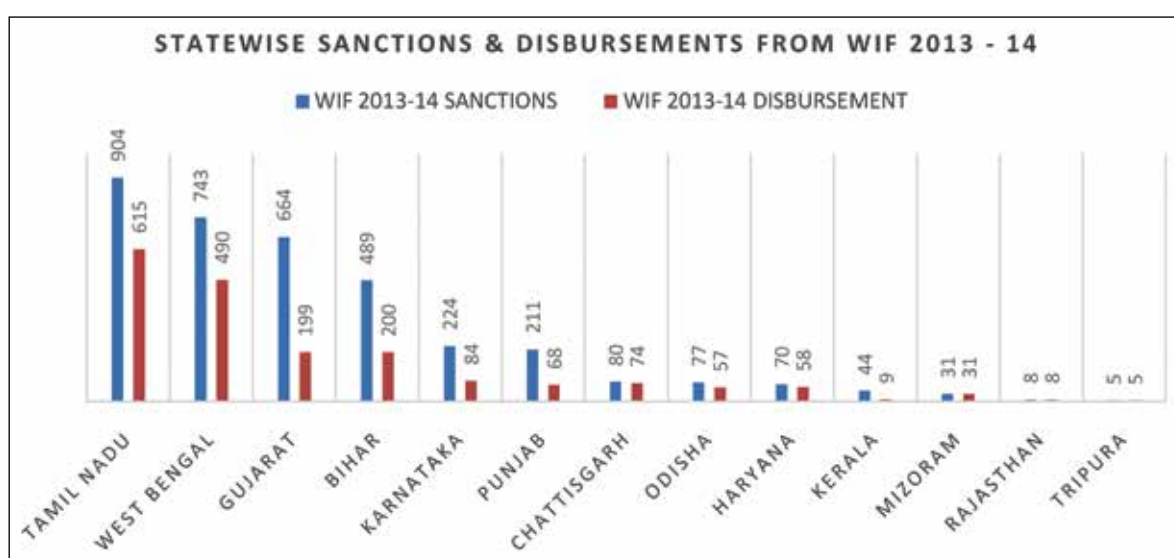
* PLR is Prime Lending Rate of NABARD

Conformation to Norms of WDRA / NCCD

Loans will be provided in respect of only those dry and wet storage projects which conform to the norms / standards prescribed by Warehousing Development and Regulatory Authority (WDRA) / National Centre for Cold-chain Development (NCCD). The borrowers also to give an undertaking for obtaining accreditation / registration from WDRA for storage infrastructure / following the standards as set by NCCD for cold chain infrastructure, on completion of the infrastructure.

The total sanctions and disbursements of loans from Warehouse Infrastructure Fund 2013 – 14 and 2014 – 15 as on 31 December 2017 are provided below:

LOANS	WIF 2013-14	WIF 2013-14	WIF 2014-15	WIF 2014-15
	SANCTIONS	DISBURSEMENT	SANCTIONS	DISBURSEMENT
Loans to State Government and State Government Undertakings	3550.89	1897.48	3866.2	2020.57
Loans to Other Agencies	133.65	117.65	19	19
Total Loans	3684.54	2015.13	3885.2	2039.57



It is observed that the Southern States of Tamil Nadu, Telangana and Karnataka are provided with the highest amount of sanctions from the Warehouse Infrastructure Fund (WIF) to mitigate the severity in the south of the country where there are limited numbers of cold storage units plus the climate is hotter and far more humid which results in reducing the life of the produce significantly. Subsequently, a special fund of Rs. 2,000 crore in NABARD as on 26.04.2018 has been made available to be offered at an affordable credit rate to Agro Processing Units in

the consolidated list of 184 Designated Food Parks from the Food Processing Fund 2015 – 16 established by the Reserve Bank of India in NABARD, the nodal agency for the purpose.

5.4 MIDH

The Government of India supports the development of cold-chain through the Mission on Integrated Development of Horticulture (MIDH) of the Ministry of Agriculture and Farmers Welfare. MIDH provides several incentives to interested stakeholders and promoters. Financial assistance of 35% to 50% of admissible cost of projects is granted. Fully funded project with loan sanctioned from a nationalized Bank. Subsidy is directly linked to credit availed to incentivize owners by reducing their credit burden.

- 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: Office of local Horticulture Mission or National Horticulture Board.
- Components: Modern Pack-houses with Pre-coolers, Cold Rooms, Cold Stores, Reefer Vehicles, Reefer Containers, Ripening Units, Alternate Energy, Retail shelves, Vending carts.

Post-Harvest Management (Normal Storage and Cold-chain Components)		
Sl No.	Description	Cost Norms for MIDH (admissible cost)
1	Functional Pack House	Rs 4.0 lakh / unit with size of 9m x 6m.
2	Integrated (modern) Pack houses	Rs 50.0 lakh/ unit with throughput capacity of 16 MT/day, with facilities for conveyor belt sorting, grading, washing, drying & weighing.
3	Precooling Unit	Rs 25.0 lakh/ unit with batch capacity of 6 MT.
4	Cold Room (staging)	Rs 15.0 lakh/ unit of 30 MT storage capacity
5	Mobile Precooling Unit	Rs 25 Lac per Unit.
6	Cold Storage Type 1 : basic mezzanine structure with large chamber(> 250MT) type with Single temperature Zone	Rs 8000/MT upto 5000 MT capacity. Rs 7600/MT for capacity between 5001 to 6500 MT - NHB Rs 7200/MT for capacity between 6501 to 8000 MT - NHB Rs 6800/MT for capacity between 8001 to 10000 MT - NHB
7	Cold Storage Type 2: PEB structure for Multi-temperature and product use, more than 6 chambers (<250MT) and basic material handling equipment.	Rs 10000/MT upto 5000 MT capacity Rs 9500/MT for capacity between 5001 to 6500 MT - NHB Rs 9000/MT for capacity between 6501 to 8000 MT - NHB Rs 8500/MT for capacity between 8001 to 10000 MT - NHB
8	Refrigerated Transport Vehicles	Rs 26 lakh for 9 MT, pro-rata but not below 4 MT Rs 30.00 lakh for 15 MT, pro-rata between 9 to 15 MT - NHB
9	Ripening Chamber	Rs 1.0 lakh/MT, ceiling of 300MT
10	Evaporative / Low Energy cool chamber	Rs 5.00 lakh/unit for 8 MT capacity
11	Low cost onion storage	Rs 1.75 lakh/unit of 25MT

12	Pusa Zero energy cool chamber	Rs 4000 / unit of 100 kg
13	Integrated Cold-chain supply system	Rs 600 lakh/project using two or more of above components
14	Integrated Post-harvest Management Projects eg. Packhouses, Ripening unit, Reefer vans, Retail Outlets, Precooling, Primary processing, etc.	Rs 145 lakhs per project. Components of post-harvest management can be taken up as individual stand-alone projects as guided by norms listed above - NHB

- Items 1, 10, 11, 12: subsidy at 50% of total cost.
- Others: Credit Linked Back-ended subsidy at 35% in General areas / 50% in Hilly & Scheduled areas.
- Item 6, 7, 8 above are marked differentiated by capacity for implementing by NHB exclusively. Item 14 marked above under NHB and allows standalone components as per NHM norms

Details of Cold Chain Add-on Components (for CA and modernisation)		
Sl No.	Description	Cost Norms for MIDH (admissible cost)
1	CA Generator	Rs 125 Lakh Per Unit, maximum of 2 units
2	Specialised CA doors	Rs 2.50 Lakh per door, maximum 20 doors
3	CA Tents	As per original invoice, maximum 5 enclosures
4	Programmable Logic Controller	50% of cost of original invoice, Maximum Rs 10 lakh
5	Dock Leveller System	Maximum Rs 7 Lakh per Unit, max 5 units
6	WRDA System	100 % cost of original invoice, maximum Rs 2 lakh
7	Specialised Packaging lines	100 % cost as per invoice, maximum Rs 15 lakh per project
8	High Reach handling equipment	Rs 17 Lakh per unit, for max 2 units
9	Modernisation of refrigeration	50% of cost, max Rs 100 lakh @ Rs 2500/MT capacity
10	Modernisation of insulation	50% of cost, max Rs 100 lakh @ Rs 1500/MT capacity
11	Reefer Container	Maximum Rs 6 lakhs per 9 MT (20 ft. reefer container)
12	Advanced Grader	100% of invoice cost, max Rs 75 lakhs per line
13	Stacking System	100% of invoice cost, maximum Rs 2000/MT
14	Retail Shelf/Equipment	Maximum Rs 10 lakh per establishment
15	Alternate technology (Vapour absorption, Solar, hybrids, etc.)	100% of invoice cost, maximum Rs 35 lakhs per project

- Above section applies for technology add-on for all projects under NHB and NHM
- Credit Linked Back-ended subsidy at 35% in General areas / 50% in Hilly & Scheduled areas.
- Maximum permissible subsidy for combination of add-ons is Rs 750 lakhs

Other Cold-chain allied components		
Sl No.	Description	Cost Norms for MIDH (admissible cost)
1	Retail Markets/outlets (Environmentally controlled)	Rs 15 lakh/unit
2	Static/Mobile Vending cart/platform with cool chamber	Rs 30,000/unit
3	Long distance Transport Solution	Rs 2000.00 lakh - NHB

- Item 1, 2: Credit Linked Back-ended subsidy at 35% in General area / 50% in Hilly & Scheduled areas.
- Item 3: Subsidy at 50% of the total cost.

5.5 Integrated Scheme for Agricultural Marketing

The marketing systems and post-harvest marketing infrastructure have not been able to keep pace with the growing production and marketable surplus. Hence, the need for providing farmers with access to competitive markets with adequate infrastructure including cold chain logistics, to enable them to realize better prices on the one hand and providing nutritious food to consumers at stable and affordable prices on the other.

With this objective in view, the Government of India on 13th November, 2013 approved the proposal of Department of Agriculture & Cooperation for continuation and integration of on-going Central Sector Schemes as Integrated Scheme for Agricultural Marketing (ISAM) during the XII Plan (2012-2017) which has the following sub scheme:

Agricultural Marketing Infrastructure (AMI) [the existing schemes of Grameen Bhandaran Yojana (GBY) and Development/Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization (AMIGS) will be merged as AMI]

Stand-alone cold storage projects are not admissible for subsidy since subsidy for stand-alone cold storages is extended by NHB, NHM etc. However, cold storage as a part of a permissible integrated value chain project will be eligible for subsidy provided the cold storage component is not more than 75% of TFO. If it is more than 75%, subsidy will be restricted. For these projects, subsidy will be calculated on the basis of capacity calculation and cost norms of NHM, DAC whichever is lower.

5.6 Pradhan Mantri Kisan SAMPADA Yojana

Government of India (GOI) has approved a new Central Sector Scheme – Pradhan Mantri Kisan SAMPADA Yojana (Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters) with an allocation of Rs. 6,000 crore for the period 2016-20 coterminous with the 14th

Finance Commission cycle. The scheme will be implemented by Ministry of Food Processing Industries (MoFPI).

PM Kisan SAMPADA Yojana is a comprehensive package which will result in creation of modern infrastructure with efficient supply chain management from farm gate to retail outlet. It will not only provide a big boost to the growth of food processing sector in the country but also help in providing better returns to farmers and is a big step towards doubling of farmers income, creating huge employment opportunities especially in the rural areas, reducing wastage of agricultural produce, increasing the processing level and enhancing the export of the processed foods.

The following schemes will be implemented under PM Kisan SAMPADA Yojana :

- Mega Food Parks (On going)
- Integrated Cold Chain and Value Addition Infrastructure (on going)
- Creation / Expansion of Food Processing & Preservation Capacities (new)
- Infrastructure for Agro-processing Clusters (new)
- Creation of Backward and Forward Linkages (new)
- Food Safety and Quality Assurance Infrastructure (on going)
- Human Resources and Institutions (on going)

PM Kisan SAMPADA Yojana is expected to leverage investment of Rs. 31,400 crore for handling of 334 lakh MT agro-produce valued at Rs. 1,04,125 crore, benefiting 20 lakh farmers and generating 5,30,500 direct/indirect employment in the country by the year 2019-20.

5.6.1 Mega Food Park

The Scheme of Mega Food Park aims at providing a mechanism to link agricultural production to the market by bringing together farmers processors and retailers so as to ensure maximizing value addition, minimizing wastage, increasing farmers income and creating employment opportunities particularly in rural sector. The Mega Food Park Scheme is based on “Cluster” approach and envisages creation of state of art support infrastructure in a well-defined agri / horticultural zone for setting up of modern food processing units along with well-established supply chain.

Mega food park typically consists of supply chain infrastructure including collection centers, primary processing centers, central processing centers, cold chain and around 30-35 fully developed plots for entrepreneurs to set up food processing units.

Project Components

- The scheme aims to facilitate the establishment of a strong food processing industry backed by an efficient supply chain, which includes Collection Centres, Primary Processing Centers (PPC), Central Processing Center (CPC) and Cold Chain infrastructure.

- **Collection Centers and Primary Processing Centers (PPC):** These components have facility for cleaning, grading, sorting and packing facilities, dry warehouses, specialized cold stores including pre-cooling chambers, ripening chambers, reefer vans, mobile pre-coolers, mobile collection vans etc.
- **Central Processing Centers (CPC):** Includes common facilities like Testing Laboratory, Cleaning, Grading, Sorting and Packing Facilities, Dry Warehouses, specialized storage facilities including Controlled Atmosphere Chambers, Pressure Ventilators, variable Humidity Stores, pre-cooling Chambers, Ripening Chambers, Cold Chain Infrastructure including Reefer Vans, Packaging Unit, Irradiation Facilities, Steam Sterilization Units, Steam Generating Units, Food Incubation cum Development Centers etc.
- The extent of land required for establishing the CPC is around 50- 100 acres, though the actual requirement of land would depend upon the business plan, which may vary from region to region. The land required for setting up of PPCs and CCs at various locations would be in addition to land required for setting up the CPC.
- It is expected that on an average, each project will have around 30-35 food processing units with a collective investment of Rs.250 crore that would eventually lead to an annual turnover of about Rs.450-500 crore and creation of direct and indirect employment to the extent of about 30,000 persons.

Pattern of Assistance

- The scheme envisages a one time capital grant of 50% of the project cost (excluding land cost) subject to a maximum of Rs. 50 crore in general areas and 75% of the project cost (excluding land cost) subject to a ceiling of Rs. 50 crore in difficult and hilly areas i.e. North East Region including Sikkim, J&K, Himachal Pradesh, Uttarakhand and ITDP notified areas of the States.
- A Program Management Agency (PMA) is appointed by the Ministry to provide management, capacity building, coordination and monitoring support. For meeting the cost of the above and also other promotional activities by the Ministry, a separate amount, to the extent of 5% of the overall grants available, is earmarked.

5.6.2 Integrated Cold Chain & Value Addition Infrastructure

The objective of the Scheme of Cold Chain, Value Addition and Preservation Infrastructure is to provide integrated cold chain and preservation infrastructure facilities, without any break, from the farm gate to the consumer. It covers pre-cooling facilities at production sites, reefer vans, mobile cooling units as well as value addition centres which include infrastructural facilities like Processing / Multi-line Processing / Collection Centres, etc. for horticulture, organic produce, marine, dairy, meat and poultry etc.

The integrated cold chain project is set up by Partnership / Proprietorship Firms, Companies, Corporations, Cooperatives, Self Help Groups (SHGs), Farmer Producer Organizations (FPOs), NGOs, Central / State PSUs, etc. subject to fulfilment of eligibility conditions of scheme guidelines. With a view to promote investment in Cold Chain the Ministry of Finance has covered Cold Chain under Infrastructure category.

Project Components

The scheme aims to facilitate the establishment of a strong cold chain facility for agricultural, horticultural, dairy, fish & marine, poultry & meat products by establishing linkage from farm gate to the consumer, end to end, to reduce losses through efficient storage, transportation and minimal processing. The different components of the Cold Chain projects are as under:

- Minimal Processing Centre at the farm level and centres is to have facility for weighing, sorting, grading, waxing, packing, pre-cooling, Control Atmosphere (CA)/ Modified Atmosphere (MA) cold storage, normal storage and Individual Quick Freezing(IQF).
- Mobile pre-cooling vans and reefer trucks.
- Distribution hubs with multi products and multi Control Atmosphere (CA)/ Modified Atmosphere(MA) chambers/ cold storage/ Variable Humidity Chambers, packing facility, Cleaning in Process (CIP) Fog treatment, Individual Quick Freezing (IQF) and blast freezing.
- Irradiation facilities

Pattern of Assistance

Financial assistance (grant-in-aid) under the scheme is limited to a maximum of Rs 10 crore per project in relation to technical civil works and eligible plant & machinery subject to the following:

- For storage infrastructure including Pack House and Pre-cooling unit, ripening chamber and transport infrastructure, grant-in-aid @ 35% for General Areas and @ 50% for North East States, Himalayan States, ITDP Areas & Islands, of the total cost of plant & machinery and technical civil works will be provided.
- For value addition and processing infrastructure including frozen storage/ deep freezers associated and integral to the processing, grant-in-aid @ 50% for General Areas and @ 75% for North East States, Himalayan States, ITDP Areas & Islands, will be provided.
- For irradiation facilities grant-in-aid will be provided @ 50% for General Areas and @ 75% for North East States, Himalayan States, ITDP Areas & Islands.

Pattern of Release of Grant

The grant-in-aid under the scheme is released in three instalments of 25%, 40% and 35% as per following schedule:

- 1st instalment of 25% of the total grant under the scheme is released after ensuring that 25% of the promoter's contribution and 25% of the term loan has been spent on the project;
- 2nd instalment of another 40% of the total grant is released after ensuring that utilization of first instalment of grant, 65% of promoter's contribution & 65% of term loan;
- 3rd and final instalment of remaining 35% of the grant assistance is released after ensuring utilization of the second instalment and 100% of promoter's contribution and 100% of term loan.

5.6.3 Agro Processing Cluster

The scheme aims at development of modern infrastructure and common facilities to encourage group of entrepreneurs to set up food processing units based on cluster approach. Under the scheme, effective backward and forward linkages are created by linking groups of producers/farmers to the processors and markets through well-equipped supply chain consisting of modern infrastructure for food processing closer to production areas and provision of integrated/complete preservation infrastructure facilities from the farm gate to the consumer.

Each agro processing clusters under the scheme have two basic components i.e. Basic Enabling Infrastructure (roads, water supply, power supply, drainage, ETP etc.), Core Infrastructure/Common facilities (ware houses, cold storages, IQF, tetra pack, sorting, grading etc) and at least 5 food processing units with a minimum investment of Rs. 25 crore. The units are set up simultaneous along with creation of common infrastructure.

The Project Execution Agency (PEA) which is responsible for overall implementation of the projects undertakes various activities including formulation of the Detailed Project Report (DPR), procurement/ purchase of land, arranging finance, creating infrastructure, ensuring external infrastructure linkages for the project etc. PEA may sell/ lease plots in agro-processing cluster to other food processing units but the common facilities in the cluster cannot be sold or leased out.

Agro processing clusters set up by Govt./ PSUs/ Joint Ventures/ NGOs/ Cooperatives/ SHGs/ FPOs/ Private Sector/ individuals etc. and are eligible for financial assistance subject to terms and conditions under the scheme guidelines.

Project Components

Basic enabling infrastructure: Includes site development, development of industrial plots, boundary wall, roads, drainage, water supply, electricity supply including power backup, effluent treatment plant, parking bay, weigh bridges, common office space etc.

Core infrastructure: Includes food testing laboratory, cleaning, grading, sorting and packing

facilities, steam generation boilers, dry warehouse, cold storage, pre-cooling chambers, ripening chambers, IQF, specialized packaging, other common processing facilities, etc.

Pattern of Assistance

The Scheme envisages grants-in-aid @ 35% of eligible project cost in general areas and @50% of eligible project cost in the North East States including Sikkim and difficult areas namely Himalayan States (i.e. Himachal Pradesh, Jammu & Kashmir and Uttarakhand), State notified ITDP areas & Islands subject to max. of Rs. 10.00 crore per project. The grants-in-aid will be credit linked but not back-ended. The eligible project cost will exclude cost of land, pre-operative expenses and margin money for working capital from the total project cost

The registered value of the land would be taken as part of the total project cost. The GoI grant shall not be used for procurement/purchase of land. In case of land acquired by PEA on lease, such cost may not be part of project cost and may be considered part of operating cost.

Pattern of Release of Grant

- First instalment of 35% of the total approved grant is released to the PEA after incurring an expenditure of 35% of the bank term loan and 35% promoters contribution/ equity;
- Second instalment of 40% of the total approved grant is released after incurring an expenditure of 75% of the bank term loan and 75% of promoters' contribution / equity;
- Third & final instalment of 25% of the approved is on completion of the project and submission of requisite documents

5.6.4 Scheme for Creation of Backward and Forward Linkages

The objective of the scheme is to provide effective and seamless backward and forward integration for processed food industry by plugging the gaps in supply chain in terms of availability of raw material and linkages with the market. Under the scheme, financial assistance is provided for setting up of primary processing centers/ collection centers at farm gate and modern retail outlets at the front end along with connectivity through insulated/ refrigerated transport.

The Scheme is applicable to perishable horticulture and non-horticulture produce such as fruits, vegetables, dairy products, meat, poultry, fish, Ready to Cook Food Products, Honey, Coconut, Spices, Mushroom, Retail Shops for Perishable Food Products etc. The Scheme would enable linking of farmers to processors and the market for ensuring remunerative prices for agri produce. The scheme is implemented by agencies/ organizations such as Govt./ PSUs/ Joint Ventures/ NGOs/ Cooperatives/ SHGs / FPOs / Private Sector / individuals etc.

Project components

Backward Linkage includes

- Integrated Pack-house(s) (with mechanized sorting & grading line/ packing line/ waxing line/ staging cold rooms/cold storage, etc.)
- Milk Chilling Centre(s) /Bulk Milk Cooler(s)
- Pre Cooling Unit(s)/ Chillers
- Reefer boats
- Machinery & equipment for minimal processing and/or value addition such as cutting, dicing, slicing, pickling, drying, pulping, canning, waxing, etc.
- Machinery & equipment for packing/ packaging.

Forward Linkage includes

- Retail chain of outlets including facilities such as frozen storage/ deep freezers/ refrigerated display cabinets/cold room/ chillers/ packing/ packaging, etc.
- Distribution center associated with the retail chain of outlets with facilities like cold room/ cold storage/ ripening chamber.

Transport: Refrigerated/ Insulated transport / Reefer Vans in conjunction with backward and forward linkages.

Pattern of Assistance

The maximum grant extended per project is Rs 5.00 crore @ 35% of the eligible project cost for general areas and @ 50% for North East States, Himalayan States, ITDP Areas and Islands respectively, subject to maximum of Rs. 5.00 crore per project. The grant is provided only in respect of technical civil work and eligible plant & machinery.

Pattern of Release of Grant

The grant-in-aid under the scheme is released in three installments of 25%, 40% and 35% as per following schedule:

- The first installment of 25% of the approved grant is released after ensuring that 25% of the promoter's contribution and 25% of the term loan is spent on the eligible project cost;
- The second installment of 40% of grant is released after ensuring utilization of first installment of grant released, 65% of promoter's contribution and 65% of term loan;
- The third and final installment of remaining 35% of the approved grant under the scheme is released after ensuring utilization of the second installment, 100% of promoter's contribution and 100% of term loan.

Chapter 6

Conclusions

6.1 Key Insights

The cold chain industry in India is still at a nascent stage considering the huge amount of agri produce and pharmaceutical products marketed in India. Despite the large production of perishables, yet, the cold chain potential remains untapped due to multiple reasons like high share of single commodity cold storage; high initial investment (for refrigerator units and land); lack of Basic Enabling Infrastructure (roads, water supply, power supply, drainage, ETP, etc.); lack of awareness for handling perishable produce and lapse of service either by the storage provider or the transporter leading to reduced life cycle of the produce.

India is a huge potential market for cold chain industry due to the following salient points:

- Fastest growing economy in the world
- Largest producer of several agri commodities
- Second largest Consumer market
- Significant investments in world class ports, logistics & supply chain infrastructure
- Proactive Government policies
- Investor friendly incentives

Potential need for cold chain in India

- India produces more than 400 million MT of perishables every year (horticultural produce+ dairy+ meat+ poultry + fish).
- The wastage levels in perishables in India are significantly high- 4.6- 15.9% in fruits, 5.2% in inland fish, 10.5% in marine fish, 2.7% in meat and 6.7% in poultry.
- Estimated annual value of losses of agri produce currently stands at INR 92,651 crores. Annual value of losses in fruits and vegetables, meat, fish and milk are estimated at INR 50,473 crores.
- Adequate and efficient cold chain infrastructure from farm gate to consumers is required to arrest the high losses in supply chain of perishables.
- The total cold storage capacity in India is at 34.95 million MT and as per NCCD, the current requirement in cold storage infrastructure is estimated to be around 70 million MT.

- Overall average capacity utilization in cold storage is 75%- showing sustainability of the cold chain business in India.

Innovations in packaging, fruit and vegetable coatings, bio-engineering (controlled ripening), and other techniques reducing the deterioration of food products have helped shippers extend the reach of perishable products. For food products such as fruits and vegetables, time has a direct impact on their shelf life and therefore on the potential revenue a consignment may generate.

Concomitantly, new transport technologies have permitted the shipment of perishable products over longer distances. Various parameters have been recognized by the Indian government and 100% FDI in the cold chain has already been permitted country needs to ensure that their production does not go waste and returns fair value to producers and consumers There must be a better linkages and way of transportation between growers, storage and customers. There is absence of a single dedicated perishables gateway or fast track corridor for perishable cargoes. Consumer food retail sector is the fastest growing in the country, worth around 15 billion USD 40 percent of fresh produce is wasted due to lack of satisfactory handling in the supply chain Indian cold chain business is fragmented in a big way.

Emerging Trends in cold chain industry

- Focus shifting to end to end cold chain and not just storage
- Modernization of existing stores
- Better and more sophisticated machinery and equipment
- Setting up of multipurpose cold storages rather than conventional single commodity storage
- Modern pack houses
- Ripening Facilities
- Farm-gate or source point Cold storage
- Energy Efficient technology and new storage technology
- Integrated cargo complexes are being planned at major airports in India which will be equipped to handle all kinds of goods, including perishables

6.2 Road Map

As per National Centre for Cold Chain Development (NCCD), there is a huge investment requirement in the cold-chain industry for the next few years estimated to be around USD 6 to 10 billion based on current costing norms and projections. This investment estimate does not include cost of land and added cold chain ancillary requirements.

More than 50 percent of this investment (USD 5 billion) would be in terms of storage infrastructure, since, the current gap in cold storage infrastructure is estimated to be around 40 million MT. Investments will additionally be required in developing farm gate level pack houses with pre-coolers as initiators of cold chain, specifically for horticulture produce.

Further investments would be needed for upgrading technology of existing cold storages involving thermal integrity, refrigeration installation, handling systems, etc. Specialized storage systems like Controlled Atmosphere cold stores would involve a higher investment cost. All these cost estimates are linked to norms for minimum design standards as established by the Government.

In refrigerated transport, the capacity is required to grow three-fold to fully service the existing and more for growing storage capacity. The current estimate of refrigerated transport indicates an available on road capacity of only 3.6 million MT. An estimated more than USD 1 billion investment would be required for long haul refrigerated transportation.

On an average, each cold storage employs close to 10 direct employees and approximately 50 to 100 temporary staff for handling the produce. Currently, the country has around 7600 + cold storage (34.95 million MT) and this is expected to double in capacity in next 5 to 10 years. This would require an added investment of over \$ 300 million for training approximately 1 million skilled and semi-skilled employees in this sector.

Similarly, there will also be investment requirements to train refrigerated transport operators and technicians (air, road and rail). For example, each road transport employs two drivers, one helper and shared maintenance technical staff.

The cold chain cannot be completed without the front-end investment required at the retail end, both for walk-in buffer storage and vending platforms or shelf space. The other investment needs are in testing and certification labs, research and protocol development centres, specialized training centres, transaction-based IT networks, handling and packing equipment.

6.3 Government Initiatives

The development of cold chain is a key thrust area under the Ministry of Agriculture. The National Centre for Cold-chain Development (NCCD) was constituted under the Department of Agriculture and Cooperation (DAC) as an autonomous body on 9 Feb 2012 and since then NCCD has functioned as a dedicated institution pioneering excellence for development of cold-chains in India by assisting the Government with framing policies and also recommending standards and protocols for cold chain infrastructure including post-harvest management such that the Indian Cold-chain sector meets with international standards. Today, cold-chain is treated a part of the second green revolution as it addresses “end to end” connectivity from farm gate to consumers in a seamless manner.

The Ministry of Agriculture & Farmers Welfare has taken an initiative to launch the Reefer Vehicle Call-in Center (RVC) which is a 24/7 call-in facility operated by Mahindra Logistics for National Centre for Cold-chain Development (NCCD) to help transport drivers to register on-road concerns regarding extortion, transit bottlenecks or any other issues which may later be used in developing future policy interventions.

In September 2017, the Government of India asked the states to focus on strengthening single window clearance system for fast-tracking approval processes, in order to increase Japanese investments in India.

The Ministry of Commerce and Industry, Government of India has eased the approval mechanism for foreign direct investment (FDI) proposals by doing away with the approval of Department of Revenue and mandating clearance of all proposals requiring approval within 10 weeks after the receipt of application.

India and Japan have joined hands for infrastructure development in India's north-eastern states and are also setting up an India-Japan Coordination Forum for Development of North East to undertake strategic infrastructure projects in the northeast.

India is expected to achieve the ambitious goal of doubling farm income by 2022. A total of Rs 14.34 lakh crore (US\$ 225.43 billion) will be spent for creation of livelihood and infrastructure in rural areas. The agriculture sector in India is expected to generate better momentum in the next few years due to increased investments in agricultural infrastructure such as irrigation facilities, warehousing and cold storage.

A Fisheries and Aqua culture Infrastructure Development Fund (FAIDF) and an animal Husbandry Infrastructure Development Fund (AHIDF) will be started with a total corpus of Rs 10,000 crore (US\$ 1.57 billion). An Agri-Market Infrastructure Fund will be started with a corpus of Rs 2,000 crore (US\$ 314.41 million).

Going forward, the adoption of food safety and quality assurance mechanisms such as Total Quality Management (TQM) including ISO 9000, ISO 22000, Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP) by the food processing industry is expected to offer several benefits.

6.4 Key Fiscal Incentives

- Under Income Tax Act 1961, deduction @ 150% permitted for expenditure on capital investment.
- Cold chain projects eligible for External Commercial Borrowings.
- Concessional rate of custom duty @ 5% on imported equipment under the project import benefits.

- Refrigeration machineries and parts used for installation of cold storage, cold room or refrigerated vehicle, exempt from Excise Duty.
- Loans to food & agro-based processing units and Cold Chain have been classified under Agriculture activities for Priority Sector Lending (PSL).
- Apart from being a critical driver of economic growth, foreign direct investment (FDI) is a major source of non-debt financial resource for the economic development of India. Foreign companies invest in India to take advantage of relatively lower wages, special investment privileges such as tax exemptions, etc.

6.5 Plans and Strategies

In order to achieve the ambitious plans, the Government needs to proactively strategize to

- Ease the import rules for cold chain equipment including refrigerated vans
- Develop FPOs & FIGs and enable them to develop direct market links
- Develop improved business models by promoting producer owned supply chains
- Amendments to APMC aimed at enabling direct market driven supply chains and opening alternate market options
- Continue to extend grants and subsidies for cold chain infrastructure development and also extend the schemes to include sectors like logistics and transport.
- Develop multi-modal cold chain links through rail and highways, aimed at a fast track corridor for perishables.
- Promote the use of Negotiable Warehouse Receipts for notified perishable goods stored in WDRA accredited cold storages.
- Promote skill development programs for all levels of cold chain; farm-gate aggregation and pre-cooling, storage, transport, handling, packaging, etc.
- Establish produce specific protocols linked with domestic FSSAI and ATP Legislation for the export markets.
- Promote energy efficiency and low carbon imprint technologies and operational processes in the cold-chain.
- Promote development of a national virtual network or grid of cold warehousing and transport available to public lease.
- Establish NCCD as a centre of excellence to promote an integrated approach to cold-chain development, spanning agricultural and non-agricultural products.

ASSOCHAM

THE KNOWLEDGE ARCHITECT OF CORPORATE INDIA

EVOLUTION OF VALUE CREATOR

ASSOCHAM initiated its endeavour of value creation for Indian industry in 1920. Having in its fold more than 400 Chambers and Trade Associations, and serving more than 4,50,000 members from all over India. It has witnessed upswings as well as upheavals of Indian Economy, and contributed significantly by playing a catalytic role in shaping up the Trade, Commerce and Industrial environment of the country.

Today, ASSOCHAM has emerged as the fountainhead of Knowledge for Indian industry, which is all set to redefine the dynamics of growth and development in the technology driven cyber age of 'Knowledge Based Economy'.

ASSOCHAM is seen as a forceful, proactive, forward looking institution equipping itself to meet the aspirations of corporate India in the new world of business. ASSOCHAM is working towards creating a conducive environment of India business to compete globally.

ASSOCHAM derives its strength from its Promoter Chambers and other Industry/Regional Chambers/Associations spread all over the country.

VISION

Empower Indian enterprise by inculcating knowledge that will be the catalyst of growth in the barrierless technology driven global market and help them upscale, align and emerge as formidable player in respective business segments.

MISSION

As a representative organ of Corporate India, ASSOCHAM articulates the genuine, legitimate needs and interests of its members. Its mission is to impact the policy and legislative environment so as to foster balanced economic, industrial and social development. We believe education, IT, BT, Health, Corporate Social responsibility and environment to be the critical success factors.

MEMBERS – OUR STRENGTH

ASSOCHAM represents the interests of more than 4,50,000 direct and indirect members across the country. Through its heterogeneous membership, ASSOCHAM combines the entrepreneurial spirit and business acumen of owners with management skills and expertise of professionals to set itself apart as a Chamber with a difference.

Currently, ASSOCHAM has more than 100 National Councils covering the entire gamut of economic activities in India. It has been especially acknowledged as a significant voice of Indian industry in the field of Corporate Social Responsibility, Environment & Safety, HR & Labour Affairs, Corporate Governance, Information Technology, Biotechnology, Telecom, Banking & Finance, Company Law, Corporate Finance, Economic and International Affairs, Mergers & Acquisitions, Tourism, Civil Aviation, Infrastructure, Energy & Power, Education, Legal Reforms, Real Estate and Rural Development, Competency Building & Skill Development to mention a few.

INSIGHT INTO 'NEW BUSINESS MODELS'

ASSOCHAM has been a significant contributory factor in the emergence of new-age Indian Corporates, characterized by a new mindset and global ambition for dominating the international business. The Chamber has addressed itself to the key areas like India as Investment Destination, Achieving International Competitiveness, Promoting International Trade, Corporate Strategies for Enhancing Stakeholders Value, Government Policies in sustaining India's Development, Infrastructure Development for enhancing India's Competitiveness, Building Indian MNCs, Role of Financial Sector the Catalyst for India's Transformation.

ASSOCHAM derives its strengths from the following Promoter Chambers: Bombay Chamber of Commerce & Industry, Mumbai; Cochin Chambers of Commerce & Industry, Cochin; Indian Merchant's Chamber, Mumbai; The Madras Chamber of Commerce and Industry, Chennai; PHD Chamber of Commerce and Industry, New Delhi.

Together, we can make a significant difference to the burden that our nation carries and bring in a bright, new tomorrow for our nation.

D. S. Rawat

Secretary General

d.s.rawat@assocham.com

The Associated Chambers of Commerce and Industry of India

ASSOCHAM Corporate Office:

5, Sardar Patel Marg, Chanakyapuri, New Delhi-110 021

Tel: 011-46550555 (Hunting Line) • Fax: 011-23017008, 23017009

Email: assocham@nic.in • Website: www.assocham.org

ASSOCHAM's REGIONAL & OVERSEAS OFFICES

ASSOCHAM REGIONAL OFFICES

SOUTHERN Regional Office

#F1, First Floor, Richmond Plaza
No. 10 & 10/1, Raja Ram Mohan Roy Road,
Bangalore - 560 025
Phone : 080-4113 2467/4113 1891
4113 4838
Mobile : 9036333975
E-mail : umasnair@assocham.com

EASTERN Regional Office

18, Ballygunge Circular Road,
Kolkata - 700019
Phone : 91-33-4005 3845/41
Fax : 91-33-4000 1149
Mobile : 9674312234
E-mail : perminder.kaur@assocham.com
kolkata@assocham.com

ASSOCHAM Regional Tamil Nadu Office

International Law Centre,
61-63, Dr. Radhakrishnan Salai
Mylapore, Chennai - 600 004
Phone : 044-28120000
E-mail : vs@lawindia.com
intellect@lawindia.com

ASSOCHAM North Eastern Regional Office

Global Express Group, House No.7
Bye No. 2, Chandan Nagar
Survey, Beltola, Guwahati - 700 028
Phone : 09957999367
E-mail : ner@assocham.com

ASSOCHAM Western Regional Office

608, 6th Floor, SAKAR III
Opposite Old High Court, Income Tax
Cross Road, Ashram Road
Ahmedabad - 380014, Gujarat
Phone : 079-27541728-29
Fax : 079-27546352
Mobile : 9810825894
E-mail : vipul.bg@assocham.com

ASSOCHAM Regional Office Ranchi

503/D, Mandir Marg-C
Ashok Nagar, Ranchi - 834 002
Phone : 0651-6555601/6555801
Mobile : 9470135367
E-mail : sksingh@assocham.com

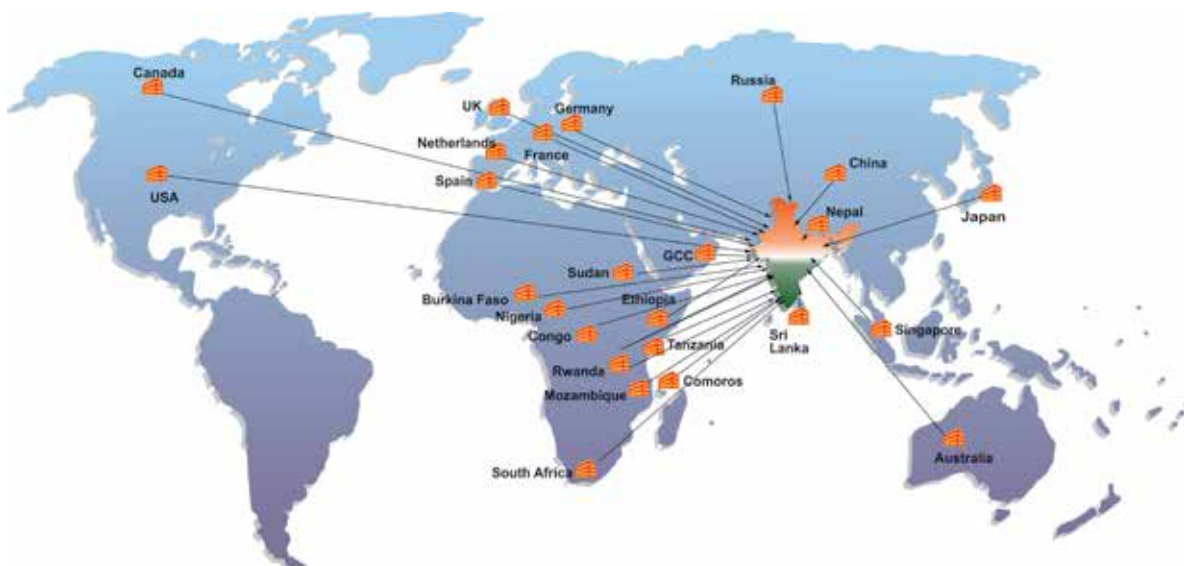
ASSOCHAM Regional Office Chandigarh

SCO: 55, 56, 57, II Floor, Sector-8,
Madhya Marg, Chandigarh - 160008
Phone : 0172-4800855
Mobile : 9915776327
E-mail : director.chd@assocham.com

ASSOCHAM Regional Office Uttarakhand

Plot No. 152, Nand Nagar Industrial
Estate, Phase II, Mahua Khera Ganj,
Kashipur - 244 713
Dist. Udham Singh Nagar,
Uttarakhand
Phone : 05947-226146
E-mail : assocham.uttarakhand@gmail.com

ASSOCHAM OVERSEAS 28 OFFICES



The pictorial presentation of the world map does not purport to be the political and geographical maps of the world and India and is not drawn to scale. This is only indicative.

ASSOCHAM International Department



The Associated Chambers of Commerce and Industry of India

Corporate Office: 5, Sardar Patel Marg, Chanakyapuri, New Delhi-110 021

Tel: 011-46550555 (Hunting Line) | Fax: 011-23017008, 23017009

Email: energy@assocham.com | Website: www.assocham.org



MRSSIndia.com

Corporate Office: No. 601 & 701, Trellis, Plot No. 202/203, LBS Marg,
Near Asha Petrol Pump, Kurla West, Mumbai – 400070

Tel./Fax No.:022-26502751/52 | Email: info@mrssindia.com

Web site: www.mrssindia.com