Project Report on

Analysis of the Cold Chain Sector in India with special focus on Cold Stores in Delhi NCR Region

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CERTIFICATE

This is to certify that Apar Chopra, student of MBA, Delhi School of Management has worked on the project "Analysis of the Cold Chain Sector in India with special focus on Cold Stores in Delhi NCR", under the able guidance and supervision of Dr. Richa Mishra, Associate Professor at Delhi School of Management, Delhi Technological University.

No part of this report been reproduced from any other report and the contents are based on original research to the best of my knowledge.

Date:

Signature of the Guide

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DECLARATION

I, Apar Chopra – 2K11/MBA/69, student of Delhi School of Management would like to state that I have worked on the project, "Analysis of the Cold Chain Sector in India with special focus on Cold Stores in Delhi NCR" under the guidance of Dr. Richa Mishra, Associate Professor - DTU; at Delhi School of Management, DTU and have submitted a satisfactory report of the project. This work has not been submitted in part or full to this or any other university as part of project work to the best of my knowledge.

Apar Chopra – 2K11/MBA/69

DSM, DTU

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EXECUTIVE SUMMARY

India is the second largest producer of vegetables and fruits after China. India on an average produces 85 million tonnes of vegetables and 45 million tonnes of fruits annually. But India's overall contribution in world trade is quite dismal as the country loses about 30 to 40 per cent of its fruits and vegetables due to improper cold storage facilities. Also, the location of cold storages in India is highly concentrated to a few states. Uttar Pradesh, West Bengal, Punjab, Gujarat etc., are the hub of cold storages in India.

This dissertation includes the study of the cold storage sector in India with emphasis on the evolution of cold stores in terms of number of cold stores, the capacity of cold stores as well as the technological advancement that has been brought about.

A primary interview based research was conducted that gives a snapshot of the status of cold stores in Delhi NCR. These cold stores have clients such as McDonald's, KFC, Amul, Vadilal, McCain Foods, Vista Foods, Kwality etc.

Also, a comparative study is drawn between the Cold Chain Management (CCM) in India with that of the developed nations like USA.

The major objectives of this dissertation can be summarized as:

a) Evolution of the cold chain sector in India and the current statistics.
b) Focus on cold stores in Delhi NCR with their standard operating procedures.
c) Comparative analysis of the CCM in India with that of developed countries.

For the Research, data collected was both primary as well as secondary.

Primary data pertaining to the cold sores in Delhi NCR was collected through face to face interviews with the cold store supervisors and operators on the basis of a questionnaire.

Secondary data comprises of the statistics of the Indian cold chain industry as well as that of developed countries like USA and this data was collected from the government websites and other approved agencies.

The research work is divided into four phases:

1. **Data Collection Phase:** After the understanding of the project, the first phase involved preparing the questionnaire and then collecting information from the cold chain supervisors of various cold storage providers.
2. **Compilation:** The next phase after data collection involved compiling the entire data in the form of a checklist.
3. **Analysis and Recommendation:** Compilation of data was followed by analysis of the data which is done in the form of bar graphs and pie-charts. On the basis of the analysis recommendations were made. (The data collected is qualitative in nature)
4. **Conclusions:** In the last phase the project report was concluded.

Various observations that came out during this research work highlighted the backwardness of the Indian cold storage sector even though India is the largest milk producer and second largest in F&V, which attributes to its annual wastage to the tune of 30-40%.

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Chapter 1

INTRODUCTION

1. Introduction to Cold Chain

Cold chain refers to the management of temperature-sensitive products as they move through the supply chain. It is a term used to describe the series of interdependent operations in the production, distribution, storage and retailing of perishable products.

Cold chain logistics is the logistics system that provides ideal condition to the temperature sensitive perishable goods from the point of production to the point of distribution through refrigerated reefers and the logistical planning to protect the integrity of these shipments. In simple terms, a cold chain is a temperature-controlled supply chain. It is used to help extend and ensure the shelf life of products such as fresh agricultural produce, seafood, frozen food, photographic film, chemicals and pharmaceutical drugs.

The principal aims of Cold Chain Management are optimization of product quality and product safety and minimization of wastage. In practice Cold Chain Management means often temperature monitoring at each step within the production, storage and transportation chain on inner- and inter-operation levels.

With growing demand of the fast food, ready meal and frozen products organization are seeking for the better cold chain solutions. There are several temperature levels to suit the different items. Frozen (-18°C to -23°C), chilled (0°C to 4°C) and fresh chilled (10°C to 18°C) are some of the frequently used nomenclature with specified product range, depending on the product, weather it is meat, or ice-cream or banana or potatoes. The main feature of the cold chain is that if any of the links is missing the whole system fails.

1.1 Objectives of the Cold Chain

The temperature controlled supply chains or cold chains are a significant proportion of the retail food market. The market shares of fast foods, ready meals and frozen products have increased in recent years. There are several food temperature levels to suit different types of products. Frozen, cold chilled, medium chilled, and exotic chilled are some of the frequently used nomenclatures with specified temperature ranges, depending on the products, whether it is meat or ice cream or potatoes or bananas.

With the growing demands to keep and distribute temperature sensitive products in potent condition, organizations are seeking better solutions to maintain and monitor cold chain. The success of implementing cold chain management involves continual monitoring of product temperature throughout distribution and having appropriate corrective action plans in place. A streamlined, well maintained cold chain helps to:

- Reduce costs
- Improve product integrity
- Increase customer satisfaction
- Reduce wastage and returns of expired stock

1.2 Cold chain segments

Cold chain market comprises of two segments - surface storage and refrigerated transport

- Surface Storage consists of Refrigerated warehouses for storage of the perishable product in consideration
- Refrigerated transport involves the usage of refrigerated transport vehicles (Reefer trucks, containers, ships and trains) for transportation of perishable products

1.3 Cold Chain Infrastructure

The Cold chain logistics infrastructure generally consists of:

- Pre-cooling facilities
- Cold Storages
- Refrigerated Carriers
- Packaging
- Warehousing
- Information Management System (Traceability and Tracking etc.)

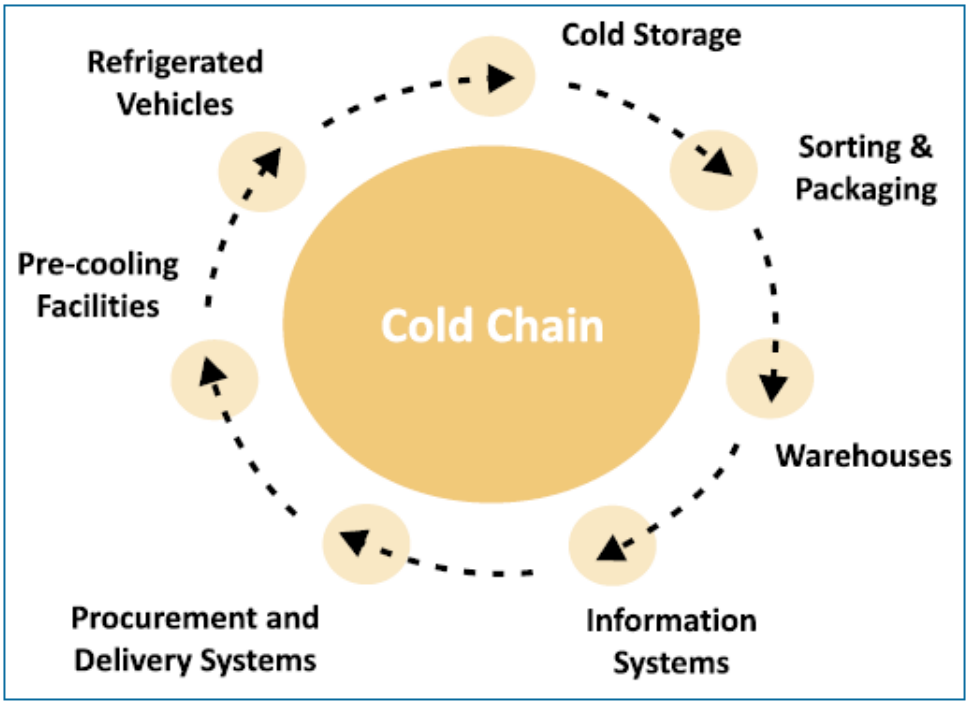


Figure1.1: Cold chain logistics infrastructure

A typical cold chain network comprises of –

i) The food products, after production are frequently brought to a **pre-cooling** centre, which is located not too far from the production zone. Pre-cooling, carried out within a short period after procurement, prepares the fruit or vegetable for transportation over long distances.

ii) The role of **packaging** can provide a buffer against variations in the distribution network. Packing that includes insulation, temperature-tracking equipment, and some form of coolant creates additional insurance in the cold chain. Packaging can be done using dry ice, thermocol, insulated boxes etc. Packaging using dry ice should be done such that there is no contact of the dry ice with food.

iii) **Refrigerated or reefer trucks** are used to transport these food products at controlled temperatures from the pre-cooling centre to the cold storages. The size of these trucks could vary from one tone to more than 15 tonne.

iv) **Cold storages** are generally centrally located warehouses built to cater to multiple production zones. Here, depending on factors like how long the product needs to be stored and what use it is going to be put to, the product is stored at a sub-zero temperature using methods like chilled storage, freezer storage etc.

v) From the cold store the likely destination for the food product would be to a wholesaler or retailer. This transportation is again done in reefer trucks. At the retail store, these food products would again be stored at low temperatures in large refrigeration units, to delay the advent of decay.

1.4 Cold Chain Technologies

The major cold chain technologies involve:

- **Dry ice**. Solid carbon dioxide 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. Dry ice does not melt, instead it sublimates when it comes in contact with air.
- **Gel packs**. Large shares of pharmaceutical and medicinal shipments are classified as chilled products, which mean they must be stored in a temperature range between 2 and 8°C. The common method to provide this temperature is to use gel packs, or 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 packs 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.
- **Eutectic plates**. The principle is similar to gel packs. Instead, plates are filled with a liquid and can be reused many times.
- **Liquid nitrogen**. An especially cold substance, of about -196°C, used to keep packages frozen over a long period of time. Mainly used to transport biological cargo such as tissues and organs. It is considered as a hazardous substance for the purpose of transportation.

- **Quilts**. 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. Quilts can also be used to keep temperature sensitive freight at room temperature while outside conditions can substantially vary (e.g. during the summer or the winter).
- **Reefers**. Generic name for a temperature controlled container, which can be a van, small truck, a semi or a standard ISO container. These containers, which are insulated, are specially designed to allow temperature controlled air circulation maintained by an attached and independent refrigeration plant. The term increasingly applies to refrigerated forty foot ISO containers. Technological advances are making them much less prone to defects.

1.5 Cold Store Classification

As per today's scenario, Cold stores can be classified as follows:

1. **Bulk Cold Stores** – Generally for storage of a single commodity, which mostly operate on a seasonal basis e.g. stores for Potato, Chillies, and Apples etc.

2. **Multipurpose Cold Stores** designed for storage of variety of commodities which operate, practically, round the year. The products stored in these types of cold stores are Fruits, Vegetables, Dry Fruits, Spices, Pulses, and Milk Products etc. These units have been mainly located near the consuming centres.

3. **Small cold stores** with pre-cooling facilities for fresh fruits and vegetables, mainly, for export oriented items like Grapes etc.

4. **Frozen food stores** with or without processing and freezing facility for fish, meat, poultry, dairy products and processed fruits and vegetables. These units have helped the promotion and the growth of frozen foods sector, both in the domestic and the export markets. However the percentage of foods so processed is extremely low and a great potential exists for growth in this category.

5. **Mini units / Walk-in cold stores** located at hotels, restaurants, malls, supermarkets etc.

1.6 Temperature control of the Cold Chain Logistics

Temperature-sensitive foods are very fragile in which even small temperature fluctuations can have a direct visual or taste or even bacterial effect. This is the one of the reason why temperature control is very important of perishable products. A temperature rise will increase the risk of food poisoning and food spoilage. Each product needs a special temperature controlled environment in the distribution process for delivering the product to the store. The temperature control is a key role in the CCL, and to maintaining quality and integrity of the products.

Temperature	Kind of foods
20°C	Storage and transportation of the fruits and vegetables cannot tolerate low temperature.
10°C ~ 0°C	Pro-cooling process of fruits, vegetables, fresh seafood and white meat and red meat.
0°C ~ -5°C	Storage and transportation of slightly cooling food.
-10°C ~ -18°C	Storage and transportation of slowly cooling food.
-18°C ~ -30°C	Storage and transportation of frozen seafood, ice cream.
-30°C ~ -50°C	Storage and transportation of fast frozen foods and tuna.

Table1.1: Temperature requirements for storage and transportation of various food products

There are five types of food:

- **Fruits and vegetables**

The transportation temperature of fruits and vegetables must be kept between 0°C to 4°C. But different fruits and vegetables have different transportation temperature. For example, the best transportation temperature of bananas must be kept between 12°C to 14°C.

- **Meat**

This category includes beef, lamb, pork, chicken and duck, etc. Their main nutrients are protein, fat, sugar, inorganic salt and vitamins. They consist of muscular tissue, adipose tissue, connective tissue and bone tissue. When kept below -18°C meats will reach their

dormant state for optimal cold storage, however, a temperature of -23°C can prolong its storage lifespan significantly. Therefore, many countries have made clear regulations, which follow the minimum -18°C storage guidelines, for the transportation of frozen food and aquatic products.

- **Dairy products**

The transportation temperature of dairy products must be kept below -14°C while most butter and margarine transportation should be below -8°C in order to preserve their good qualities. However, long-term storage of hard cheese only requires a temperature between 1°C to 7°C while other cheese transportation temperature between 0°C to 13°C.

- **Ice cream**

Ice cream transportation temperature must be below -25°C.

- **Chocolate**

Low temperature transport can preserve chocolate's qualities hence their transportation temperature should be kept between 8°C to 18°C.

1.7 Food Supply Chain

A food supply chain provides a series of facilities for maintaining ideal storage conditions for perishables from the point of origin to the point of consumption. The chain needs to start at the farm level (e.g. harvest methods, Pre-cooling) and cover up to the consumer level or at least to the retail level.

A well developed cold chain starts right from the harvesting of the crops, and the production of other temperature sensitive goods till it reaches for the final consumption. Cold chain logistics includes the transportation as well as the storage of the perishable food items. A well organized cold chain reduces spoilage, retains the quality of the harvested products and guarantees a cost efficient delivery to the consumer given adequate attention for customer service.

Delivering and maintaining safe, quality foods is the responsibility of all individuals and organizations involved throughout the cold chain. A cold chain is like a "relay race" where everybody needs to play their part and success relies on team effort.

For instance, frozen food is normally kept colder than -18^{o}C (or other temperature where this is specified on the packaging). Any increase in the temperature of the environment in which the product is held, above -18^{o}C, will have an adverse effect on the temperature of the product. After being held for only a few minutes in warmer air the product will start to thaw even though the product may still appear frozen. When it is again subjected to the correct environment temperature the product will only freeze slowly because the equipment in the cold chain is designed to maintain product at -18^{o}C and not freeze product down to -18^{o}C.

Several factors are considered while handling the frozen foods in the cold chain:

1. Temperature Abuse

Temperature abuse of frozen food occurs when it is allowed to warm up or when its temperature fluctuates. This becomes serious from a food safety and microbiological point of view when the product is inadvertently thawed. Temperature abuse below the freezing point could adversely affect sensory and nutritive quality. It occurs when frozen products are held at "too high a frozen temperature" or when the "frozen temperature" is allowed to fluctuate. The requirement, therefore is for a steady and suitably cold (product dependant) product temperature.

2. Temperature Control

Increasingly good temperature control is being achieved in the various sections of the frozen food chain due to improved equipment design, quality control, and by a heightened operator awareness of the importance of temperature control. However, there is no room for complacency and attention to temperature monitoring should be an integral part of total quality management programme.

3. Transfer Points

Transfer points are well known problem areas for temperature abuse and refer to points in the cold chain where products are transferred from one cold area to another, e.g. blast freezer to cold store, factory cold store to truck, truck to supermarket, supermarket cold store to display cabinets, and display cabinets to home. Frequent or prolonged door opening in vehicles during distribution and delivery is a major cause of temperature abuse. The transfer points normally involve a change of personnel and there can be periods when nobody has responsibility for the product, i.e. it may be left standing in a non-refrigerated area for considerable periods.

4. Preventive Action

- Food companies must realize that **transfer points** are potential temperature abuse areas for their products.
- The number of **transfer points** for a given product should be identified and current practices evaluated.
- The **relay system** (as in a relay race) should be introduced where the "baton" (in this case the food product) is transferred safely from one responsible person to another. The dropping of the baton or a slow hand over means a potential temperature abuse. A signing system should be introduced where the product is signed over from person to person, including monitoring and recording the product temperature.
- The **personnel** in the "relay race" must be identified and trained to ensure a fast and secure product hand over from cold area to cold area. Particular attention must be taken when new personnel are introduced.
- A **logging/reporting** system should be introduced to ensure that all temperature abuses are reported to both ends of the commercial food chain, i.e. the processor and the retailer, to ensure that appropriate action can be taken where necessary.

1.8 Objectives of the study

- To study the evolution of cold stores in India and current statistics in terms of the number of cold stores, their capacities, whether they cater to single commodity or are multipurpose etc.
- To conduct research based on certain basic parameters related to cold stores and analyzing the modernization status of cold stores in Delhi NCR
- To draw a comparative analysis of the cold chain management in India with that of developed countries like USA on the basis of technological characteristics as well as standard operating procedures.

Chapter 2

LITERATURE REVIEW

Indian cold chain industry to reach Rs 64000 crore by 2017: Assocham report

PTI Feb 6, 2013, 03.24PM IST

Hyderabad: The total market value of Indian cold chain industry is expected to reach Rs 64,000 crore by end by 2017, says an Assocham report. The, report, however, said that factors like uneven distribution of storage capacity and high capital investment may be deterrent for the growth of the industry. The report, 'Opportunities in Cold Chain-emerging Trends and Market Challenges', released during a national summit on cold chain here also said though India produced 147 million tonnes of vegetables in 2011, the country has cold chain capacity available for only 9 millions tonnes, leading to huge wastage. "During the period 2009-2017, the cold chain industry of India is expected to register a magnificent CAGR of around 25.8 per cent, which will make the value of Indian cold chain industry to reach at an astonishing figure of around Rs 640 billion by 2017," the report said. "India is the second largest producer of vegetables and fruits after China. India on an average produces 85 million tonnes of vegetables and 45 million tonnes of fruits annually. But India's overall contribution in world trade is quite dismal as the country losses about 30 to 40 per cent of its fruits and vegetables due to improper cold storage facilities," the report said. The location of cold storages in India is highly concentrated to a few states. Uttar Pradesh, West Bengal, Punjab, Gujarat etc., are the hub of cold storages in India, according to the report. "Over 65 per cent of the cold storage capacity is confined to UP and WB only. On the other hand, majority of Indian states lack investments from government as well as private players. This has made presence of modern cold chain technology minimal in such parts of the country," it said.

How to stop the rot in our obsolete cold chains

February 17, 2013:

During 2011-12, India produced about 127 million tonnes of milk, but the country has an estimated 70,000-80,000 tonnes of proper milk storage capacity. In 2011, India’s vegetables output was about 147 million tonnes, accounting for nearly 11 per cent of the world’s vegetable production. But here also the available cold chain capacity, a key requirement to stem wastage and enhance quality, is hardly 9 million tonnes.

The result — about 30-40 per cent of the production lands up in the waste bin every year, leading to higher costs for consumers and shrinking presence of India in the global vegetables export market, which has slumped to 1.7 per cent. The country ranks third in fish production, with an output of over 8.5 million tonnes. However, frail cold chain logistics again leads to wastage of about 20-30 per cent of the production.

These hard facts continue to beam the grim message that much is needed to be done to beef up cold chain logistics. This is despite the Union Government significantly sharpening its focus on this sector in the last few years by allowing 100 per cent foreign direct investment, giving infrastructure status to the industry and other incentives. It is not that there are not enough opportunities in cold storage sector for private investors. The market value of Indian temperature-controlled warehouses is expected to grow at a 26 per cent compounded annually till 2017, enlarging the market size from Rs 98 billion in 2009 to Rs 624 billion in 2017, according to estimates by Assocham and TechSri Research. By volume, the total capacity of cold chain warehouses is estimated to reach about 47 million tonnes by 2017, going by the current rate of capacity addition.

But still, there will be enormous room for further investment and business opportunities, with the spurt in output of horticulture products and growing export of processed foods and frozen items. Take the coverage under horticulture crop — it increased from 16.5 million hectares in the beginning of the decade to 21 million hectares last fiscal, with India becoming the world's second largest producer of fruits and vegetables. But various estimates show that inadequate storage is resulting in an annual wastage of about Rs 35,000-crore worth fruits and vegetables.

The biggest flaw in this chain is the obsolete technology that a bulk of the over 6,000 cold storages in India are using, with most of these facilities built in the 1960s and suitable only for potatoes. Another flaw is that most cold storages are single-product facilities, which narrows capacity utilization.

Indeed, more than 75 per cent of the cold storage capacity in India is today suitable only for potatoes, which have low economic life. By value, potato storage contributes only 20 per cent in the total revenue of cold chain storage.

"Due to higher returns from the multi-purpose facilities, the new infrastructures coming up are mostly in this sector. In multi-purpose cold storages, various temperatures can be maintained at the same time, due to which capacity utilisation is significantly higher," points out the Assocham-TechSci Research report. It estimates that to set up a 100-tonne single-commodity cold storage, an investment of about Rs 50 lakh is required, including Rs 15.8 crore on plant and machinery, Rs 24 crore on land and Rs 9.12 crore for construction.

Says Sabyasachi Ghosh, Andhra Pradesh Principal Secretary (Food Processing): "Cold storages should not be seen as a standalone business and instead be part of the supply chain system that would make better business sense for investors." Ghosh and his team are drafting a five-year action plan for the food processing sector in the State, with major thrust on cold chain infrastructure through private participation. "We would like to link some of the new facilities with our renewable energy policy," he said.

Yet another weak link is lack of sufficient temperature-controlled vehicles that are vital to keep the cold chain intact. Currently, there are an estimated 30,000 temperature-controlled vehicles plying across India, with 80 per cent used for transport of milk and milk products and 11 per cent for meat products. Huge opportunities are awaiting investors in this sector with the increasing demand for such vehicles from the retail and food services sector, especially frozen food. In the last three years, the revenue generated by these vehicles climbed from Rs 400 crore to Rs 500 crore. Assocham-TechSci believes that the revenue could jump four times from the 2009 levels to Rs 16 billion by 2017, while the number of vehicles could reach 52,000.

Beefing up the cold chain industry will not only reduce wastage and, with it, food cost for consumers, it will also ensure steady availability of food throughout the year.

"What is needed is a holistic approach by the stakeholders, focusing on each aspect of the chain. Cold chain industry players are expected to mint a lot of money in days to come as the demand rises", the Assocham report points out.

Indian market is nascent, but worth $3 billion

Tuesday, January 01, 2013 IST
Gubba Nagender Rao

The current worth of Indian cold chain market is $3 billion. The market is nascent yet increasingly demanding and expected to grow to $12.4 billion by the end of 2015.

Cumulative capacity of India is nearly 25 million tonne, resulting in loss of about 40% of agri produce post-harvest. Uttar Pradesh has maximum 1,579 cold chains followed by West Bengal at the second place with 531 cold storages, Maharashtra 460, Punjab 420, Andhra Pradesh 350, Bihar 300, Gujarat 175, Haryana 140, Madhya Pradesh 75, Karnataka 65 and Tamil Nadu 35. The current market demand is 10 times more than what we have today.

The Indian industry is definitely growing. Currently, most of the cold storages are focussed on single products. The focus is now shifting to introduce multiple products in your cold storage facility and such cold storages are coming up fast. We have observed that while most of the cold storages are owned by entrepreneurs, there is lack of corporate initiative in the cold storage industry. However, we can say that the industry is growing and new products are being stored in cold storage. While on the flipside, there are very less cold storages for vegetables and insufficient technological advancements. With advanced and organised cold chains coming up, the picture of this sector is definitely looking bright.

For the past few years, the 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. Majority of 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 focus of cold chain logistics provider has increased towards milk and milk products, frozen fruits and vegetables, meat and so on. The low profit margin in traditional items like potatoes and onions has led to increased focus on high valued items.

The Government of India has taken various initiatives to attract private investment in this sector. Even though these initiatives have not caused any dramatic changes till now but in coming years they are expected to reap the fruit. The demand for cold chain logistics from organised retail and 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.

It is anticipated that many large domestic and foreign companies will join the league in coming years to cater to the growing demand of cold chain logistics. This will inject required investment and latest technology in the Indian cold chain industry in the near future. The cold chain industry of India is also expected to witness some major mergers and acquisitions by big companies to establish their base and expand their reach.

India's Cold Storage Capacity - By Samuel Kornstein and Paul Artiuch; Jan 14, 2012

Cold storage facilities, essentially refrigerated warehouses, can reduce agricultural price volatility, helping to minimize food waste and increase income for various supply chain stakeholders. The benefits of cold storage are simple: most types of produce have shelf lives ranging from just a few days to a couple weeks when kept at room temperature. Farmers and traders are forced to quickly get their produce to consumers, even if there's too much supply in the market. This can result in low prices that often don't even cover the price of production and transport. In the most extreme cases, when the market is flooded with a particular item, it makes more economic sense for farmers to just let certain crops rot in the field, rather than spend the time and money to harvest them.

Cold storage can extend the shelf life of produce for months or longer, buying farmers and traders valuable time. Fruits and vegetables can be stored while prices are low and there's little demand, and then released into the market when prices rise again. Since this process regulates supply, it helps stabilize prices over time, which is one of the reasons produce prices in developed countries are less volatile than those in developing countries.

India lacks sufficient cold storage for the majority of the country's produce. However, in recent years there've been significant investments made by both the private sector and the government to increase capacity. While this is a positive trend, enormous challenges remain. We met with two privately owned cold storage trading companies based in Delhi, and learned something interesting. Since cold storage can be so expensive, as it requires capital investments and large amounts of energy, it's most profitable to use the capacity to store high-value imported goods that are generally consumed by the more affluent customers.

We took a tour of one facility, a giant nine story refrigerated warehouse in North Delhi, and were surprised by what we saw. Imported products such as apples from Washington State, tangerines from China, and kiwis from Italy filled the majority of the shelves. These products sell for as much as fifty times the value of many locally grown products, and as a result, paying to store them to avoid waste and maintain quality makes economic sense. There are exceptions though. One of the firms we met was investing in state of the art cold storage facilities to store and ship Indian-grown apples and other fruits from the foothills of the Himalayas to the rest of the country.

For less expensive products – such as potatoes, onions, and tomatoes – that are prone to rotting and are staples for the majority of the lower income population, the cost of cold storage can exceed the value of the goods. The government has stepped in and subsidized storage in many areas, but this support often doesn't address the problem. Potatoes are a perfect example. A couple years ago there was a potato shortage in India, and prices spiked. In response, many farmers grew potatoes in the following seasons, and as a result, there's now too much supply and prices have plummeted. Many potatoes

have ended up in subsidized cold storage facilities; however, in some regions, prices are so low it's not even worth harvesting them. In protest, many farmers have been leaving piles of rotting potatoes in the streets to show the government their dissatisfaction.

While cold storage has clear potential to reduce food waste, it's apparent that without innovation, price reductions, thoughtful policy, and subsidies, the storage capacity will not be filled with the low-value crops that are both food staples across India and are also most likely to go to waste.

Chapter 3

RESEARCH METHODOLOGY

Introduction:

It is a well known fact that the most important step in making a report is research process which is to define the problem. Choose for investigation, because a problem well-defined is half solved. That was the reason that utmost care was taken while defining various parameters of the problem. After going through brain storming session, objectives were selected.

Study Design

- PROBLEM STATEMENT

  The face to face interview was conducted in various cold stores of Delhi NCR to understand the technology and operating procedures adopted by them and analyze the status of these cold stores in terms of developments and advancements.

- METHOD OF DATA COLLECTION

  The data was collected from the cold store supervisors, operators and workers of different organizations by adopting the method of interview.

Data Collection:

Research included gathering both primary and secondary data..

Primary Data:

Primary data is the firsthand data, which are selected a fresh and thus happen to be original in character. Primary data was collected through a structured face to face questionnaire based interview of various supervisors and operators of different cold store providers. The questionnaire was carefully designed by taking into account the parameters of my study.

Secondary Data

Secondary data are those which have been collected by someone else and which already have been passed through statistical process. The data regarding the organization,

industry and competition etc. have been collected from the company/industry literature, booklets, websites, newspaper articles, case studies, white papers, and portals and also through discussion with companies' executives.

- SAMPLING UNIT

This refers of the number of items that were selected for the surveys. For this study 15 cold stores were chosen randomly from Delhi NCR.

- STATISTICAL METHOD USED

The main statistical tools used for the collection and analyses of data in this Project are:

- Questionnaire
- Pie Charts
- Tables

- PERIODIC STUDY

The time period allowed to the researcher in carrying out the project study entitled "To study the evolution of cold stores in India and current statistics in terms of the number of cold stores, their capacities, whether they cater to single commodity or are multipurpose etc. and conduct research based on certain basic parameters related to cold stores and analyzing the modernization status of cold stores in Delhi NCR" was 6 months and all the information collected has been done so with in its stipulated time.

Research Methodology

The primary objective of my project was to conduct research based on certain basic parameters related to cold stores and analyzing the modernization status of cold stores in Delhi NCR. To achieve this objective a sample consisting of Cold chain supervisors of various organizations was studied.

The answer was tabulated and the results were presented in the form of table and charts Questionnaires were given to management staff to know their opinion. Before preparing the questionnaires, I discussed with my mentors about the viability of the study and upon their consent the sample data was collected. Thus the questionnaires were confined to the subject.

- QUESTIONNAIRE METHOD

A detailed questionnaire was prepared on the basis of various common strategies adopted by corporate.

The questionnaire is designed in order to come out with effective solutions for the various gender diversity strategies being followed across the organizations. Data was collected from various other sources like references and range of employees in the organizations.

- SAMPLING TECHNIQUE

The sampling procedure employed for this project was a convenience sampling technique in which elements are based on the judgment and proximity of researcher towards the sampling units.

- SOFTWARE TOOLS USED FOR THE DATA ANALYSIS

The software tool used for data analysis is MS WORD & MS EXCEL.

- SAMPLING AREA

Delhi/NCR

Chapter 4

CASE STUDY

4.1 Introduction to the Case

1. Secondary research was conducted on the cold storage sector of India, with latest statistics highlighting the gap between the present scenario and the post-harvest requirement.
2. A questionnaire was prepared initially and based upon that various cold store providers in Delhi NCR were contacted to gather information related to what they are doing in context with Cold Store operations. (The Questionnaire is attached at the end of this report, which can be referenced easily)
3. Comparative analysis of the cold storage industry of India with that of USA.

4.2 Research Methodology (Primary Research - Organization Wide)

4.2.1 Descriptive Research - Qualitative (Ethnography/ Case Study): Detailed descriptions of activities/practices followed using interviews, observations, document review. It basically involves Describing things as they are, without any judgments and modifications.

• Sample Size - 15

• Sampling Technique - Convenience Sampling

4.2.2 Convenience Sampling - Sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher.

4.2.3 Participating Companies

S. No.	Name of the Company
1.	Snowman Logistics
2.	Mussourie Cold Storage
3.	Jaswant Cold Storage and Ice Factory
4.	Darshan Cold Storage
5.	Devbhumi Cold Storage
6.	Vidya Ice and Cold Storage
7.	S.K. Logistics
8.	Bulaki Deep Freeze
9.	Gulmarg Ice Factory and Cold Storage
10.	Radhakrishna Foodland
11.	Krishna Cold Storage
12.	Delhi Cold Storage
13.	Indraprastha Cold Storage
14.	Himachal Cold Storage
15.	Hindustan Ice and Cold Storage

Table 4.1: Names of participating cold storages

4.2.4 Data Collection:

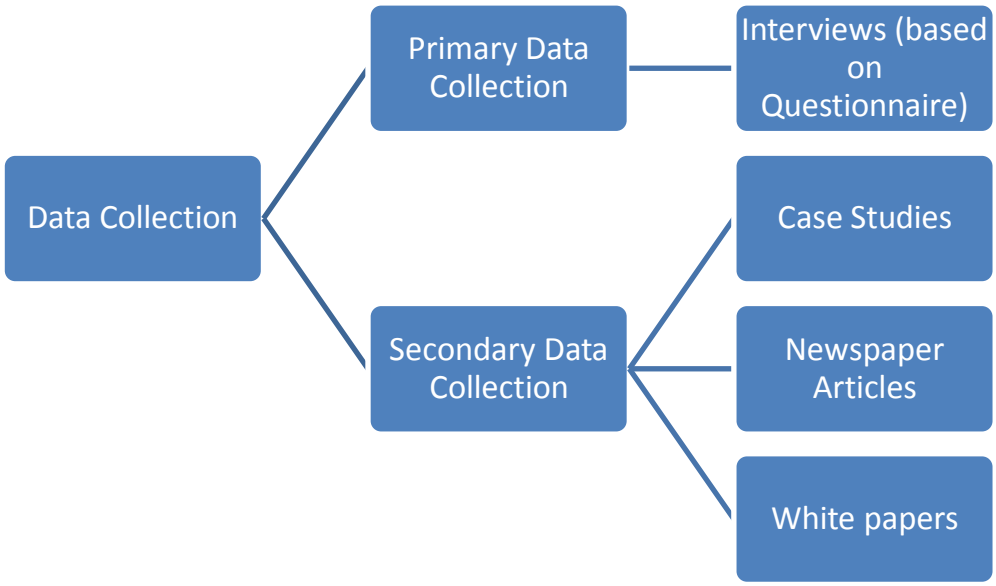


Figure 4.1: Data collection

Data Collection methods were both primary and secondary, with primary data collection focused on the interviews and secondary data collection in the form of Case studies, Newspaper articles and White/Research papers. The source of some of them can be easily seen in the literature review.

4.3 Cold Chain Sector in India

As international trade has increased drastically during the past years, the link from farmer to processing facility to transportation increasingly passes through cold storage en route to ever more distant markets. Instead of simply serving as warehouses to store overflow, Cold Stores are now expected to provide sophisticated value-added services. The industry is moving beyond the traditional freezer box approach. With the growing demands to store and distribute temperature-sensitive products in potent condition, organizations are seeking better solutions to maintain and monitor cold chain. The success of implementing cold chain management involves continual monitoring of product temperature throughout distribution and having appropriate corrective action plans in place.

Cold Chain is now recognized as a sunrise sector in India. It is true that in a country which ranks first in milk production in the world, is number 2 in fruits & vegetables production (74.877 million metric tonnes production of fruits and 146.554 million metric tonnes production of vegetables for the year 2010-11) and has substantial production of marine, meat & poultry products, the country needed a fully developed cold chain sector. However the current scenario reveals that there is a tremendous scope for the development of cold chain facilities, with post-harvest losses estimated to the tune of about Rs. 44,000 crore per annum.

Cold stores form the heart of the cold chain. An overview of the cold storage industry in India indicates that the cold stores have been established initially right from the beginning of twentieth century but the further development was fairly slow. These units were mostly designed for storage of potato and were located in areas like UP, West Bengal, Punjab, Bihar etc. It was only in sixties that the idea of multi product, multi chamber cold stores was introduced with Maharashtra taking the lead.
The cold storage sector is undergoing a major metamorphosis, with the Govt. 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 / equipments, every part of a cold chain renders itself amenable for improvement. As a result type of construction, insulation, refrigeration equipment, type of controls – all of them are witnessing changes.

4.3.1 Cold Chain Market

- Cold Chain market in India is at a nascent stage, valued at $3 billion and is expected to reach $12.4 billion by 2015 with a CAGR of over 28%,
- Majority of cold storages are located in the states of Uttar Pradesh & Uttaranchal, West Bengal, Maharashtra, Gujarat, Bihar and Punjab.

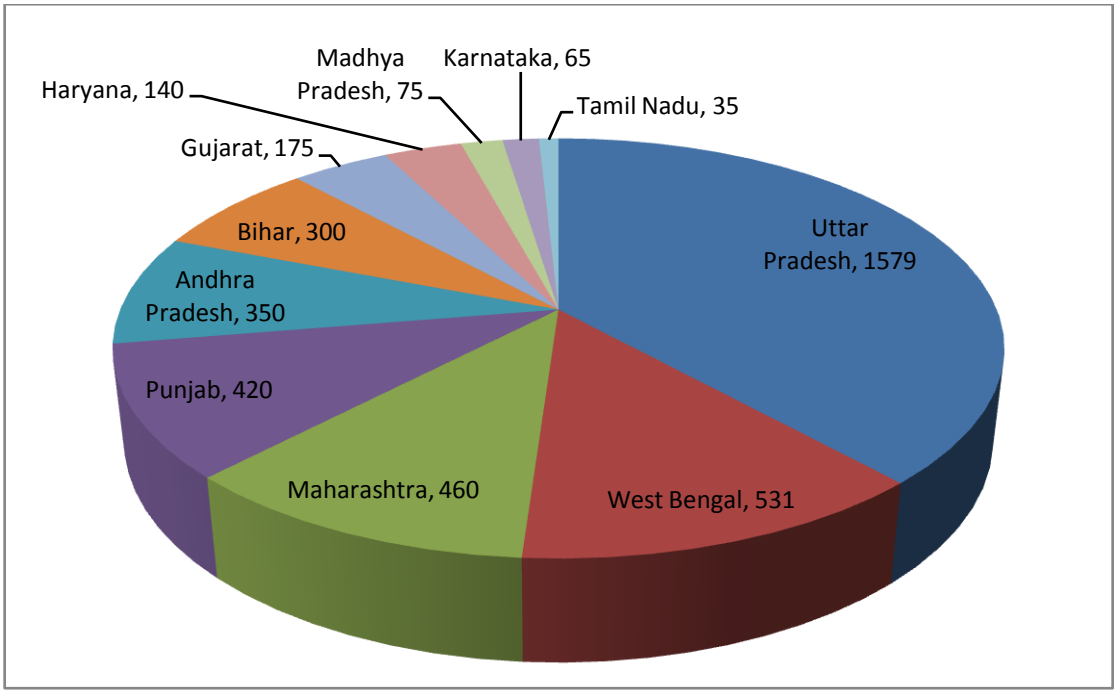


Figure 4.2 States and number of Cold Storages

- Private players, with more than 80% presence dominate the market though state owned players are also present.
- Majority of existing cold storages cater to potato storage

4.3.2 Cold Storage Development in India from 2004-2012

Year	No. of Cold Storages	Installed Capacity in lakh MT (Cumulative)
Previous years	2607	54.02
2004	4748	195.52
2007	5316	233.34
2009	5381	244.50*
2010	5837	269.03@
2011	6156	286.82@
2012#	6307	301.10

Source: *Directorate of Marketing and Inspection upto 2009

@includes only NHB and NHM assisted cold storages during 2009-10 and 2010-11

As on 01.09.2012

Table 4.2

- Of the 301.10 lakh MT cold storage capacity, nearly 140.00 lakh MT has been created between 2000 – 2011 on account of interventions by National Horticulture Board (NHB), National Horticulture Mission (NHM), Horticulture Mission on North East and Himalayan States (HMNEH), Agricultural and Processed Food Products Export Development and Authority (APEDA), Ministry of Food Processing Industries (MoFPI) and Department of Animal Husbandry and fisheries (DAHD).

Agency wise details of Cold Storages/CA/MA Infrastructure created (2009-12)*

Name of Scheme	Number of New Cold Storages/CA/MA infrastructure	Capacity created (lakh MT)	Govt. Subsidy (Rs. in crore)
NHM	4,51	24.35	3,25.91
NHB	5,28	28.28	1,64.08
HMNEH	9	0.41	7.35
NCDC	5	0.22	3.19
MoFPI	49	2.32	1,46.71
APEDA	24	0.02	12.09
Total	**1,066**	**55.60**	**6,59.33**

*up to 31.03.2012

Table 4.3

4.3.3 Requirement Scenario

National Spot Exchange (NSE) undertook a study in December, 2010. The gap in cold storage capacity in various states has been estimated as under:

State	Cold Storage Requirement in lakh MT	Present Capacity in lakh MT	Gap in lakh MT
Andhra Pradesh	23.24	9.01	14.23
Assam	9.19	0.88	8.31
Bihar	42.41	11.47	30.94
Chhattisgarh	5.43	3.42	2.01
Gujarat	27.48	12.67	14.81
Haryana	8.04	3.93	4.11
Himachal Pradesh	4.87	0.20	4.67
Jammu & Kashmir	7.37	0.43	6.94
Jharkhand	7.96	1.70	6.26
Karnataka	24.04	4.07	19.97
Kerala	27.71	0.58	27.13
Maharashtra	62.73	5.47	57.26
Manipur	0.80	0.00	0.80
Meghalaya	2.39	0.03	2.36
Mizoram	0.74	0.00	0.74
Madhya Pradesh	12.13	8.08	4.05
Nagaland	0.70	0.06	0.64
Orissa	18.35	2.91	15.44
Punjab	13.18	13.45	0.00
Rajasthan	3.91	3.24	0.67
Tamil Nadu	79.06	2.39	76.67
Tripura	1.63	0.30	1.33
UP & Uttaranchal	122.28	101.87	20.41
West Bengal	105.66	56.82	48.84
Total	**611.30**	**242.98**	**368.32**

Source: NSE& DMI (Present Capacity in Delhi- 126158 MT, Goa -7705 MT, A & N- 210 MT. Pondicherry-85MT)

Table 4.4

4.3.4 Infrastructure

The cold chain market basically comprises of two segments: Surface Storage and Refrigerated Transport.

4.3.4.1 Surface Storage

- It consists of refrigerated warehouses for storage. According to DMI, Govt. of India statistics, India currently has more than 6,000 cold storage facilities with a capacity of over 300 Million MTs but capacity utilization is only about 30-40%. UP, Maharashtra and Wes Bengal are the leading states.
- These facilities are being used at 100% utilisation rate with potatoes for about 4-5 months a year while the storage cycle for other perishable products are lower i.e. about 2 months.
- The seasonality of available storage capacity has its implications on the market potential for reefer transportation through a cold storage network. During peak storage needs, refrigerated transportation needs may be inadequate to service demand while at the other times; the overcapacity of delivery vehicles makes the business unprofitable.
- Also, more than 80% of the cold chain storage capacity in India is owned and maintained by the private sector.

4.3.4.2 Transport Infrastructure

It involves usage of refrigerated transport vehicles like Reefer Vans or Railways for transportation.

- It is estimated that just over 30000 vehicles are involved in transportation of products out of which dairy constitutes about 80%, thus leaving only about a fleet of 6000 vehicles for refrigerated transportation.
- A large sized operator like Snowman (now acquired by Gateway Distriparks Ltd) has a fleet of about 100 refrigerated transport vehicles.
- Presently, the reefer transportation business in India (Both organised and unorganised segment) is estimated at about Rs 10- 12 billion which includes reefer transportation demand, both exports and domestic as well as estimates on third party businesses and companies who are directly involved in transportation of perishable products.

4.3.5 Drivers

- Supply side policies

  -Mega Food Parks

  -100% FDI

  -100% duty exemption (cold refrigeration equipment)
- Growth in organized retail

  -Frozen food and grocery (~20% of organized retail)

  -20% growth per annum expected

  -100% FDI in multi-brand retail
- Geographic penetration

  -Tier II cities - Quick Service Restaurants (QSR's), confectionery
- Growth in disposable income
- Growth in the QSR segment

  -Estimated at USD 600mn

  -30% growth per annum expected
- Growth in the food processing industry

  -Meat exports

  -Chilled and frozen processing raw materials, outputs
- Growth in the pharma industry

  -Domestic market ~USD 12Bn, growing at 13%

  -Exports – USD 8.7Bn, growing at 22%
- Government initiatives

4.3.6 Challenges

- **Power supply -** The major issue faced by cold storage facility providers is power supply. Insufficient and irregular power supply causes problem for the operators and hence disturbs the entire cold chain. Another challenge is lack of logistic support which is must in today's scenario. The government should give subsidy on power and supply should be made uninterrupted and continuous for running a cold storage.

- **Availability of proper training & skilled human resources is big challenge –** Requisite and timely training to the personnel is very important in building appropriate human resource for the cold chain industry.

  There is a need for individual teams for technical, administration and operations. Technical team would run the cold storage plant and maintain the desired temperature levels and ensure that the product is preserved safe. The administration staff will take care of invoicing, inventory tracking, banking and accounting. Plant operations team will physically handle stock movement and inventory management.
- **Uneven distribution of capacity -** The majority of cold storages in India have been established in states like Uttar Pradesh, Maharashtra, Gujarat, Punjab, Andhra Pradesh and West Bengal. But the establishment of such cold storages needs to be more geographically diverse.

  The cold storages present in India can cater to single commodities only. Different commodities require different temperature conditions, resulting in poor capacity utilization and low financial viability.
- **Rising real estate cost -** A fully integrated cold storage facility of international standards, with one million cubic feet of storage space, will require an area of approximately an acre, which is a huge investment.
- **Location for cold storage -** Cooling units are not mobile units, so the location of such units becomes a key constraint as there are very few parcels of large land spaces available in India.
- **Lack of proper infrastructure -** The cold chain industry in India is very fragmented, with players not having the strength to invest in the technology needed to build high quality cold storage or to invest in reefer trucks. Other major challenges which make cold chains more complex are inadequate logistics infrastructure, poor road connectivity, tolls and taxes, rampant non-transparent practices, entry restrictions, inadequate IT systems and inefficient transport providers.
- **FDI restriction in retail -** Cold chain infrastructure needs huge investment. Easing restrictions on FDI in multi-brand retail could open up channels for

further fund infusion from new foreign entrants. India requires an additional 9-10 million tonne of cold storage capacity to address annual post-harvest losses of around Rs 1 trillion (US$18.6billion). Post-harvest losses of farm produce of fruits, vegetables and other perishables, have been estimated to be over Rs 1 trillion per annum, 57 per cent of which is due to avoidable wastage and the rest due to avoidable costs of storage and commissions.

4.3.7 Government Policies

- The Budget 2011-2012 provided infrastructure status to the cold chain sector.
- The Budget exempted air-conditioning equipment and refrigeration panels used in cold chain infrastructure as well as conveyer belts from excise duty.
- The Budget 2010-2011 proposed a concessional import duty of five percent with full exemption from service tax to set up and expand cold chains to preserve farm products as well as milk, meat and poultry products.
- The Budget 2010-2011 included duty-free import of refrigeration units, which is required to make refrigerated vans or trucks. It also exempted trailers and semi-trailers used in agriculture from excise duty.
- The government of India introduced tax benefits for companies investing in cold chain facilities as part of the budget 2009-2010.
- The government of India has also revised its scheme of food parks in the tenth Five Year Plan and changed to the Mega Food Park Scheme (MFPS) under the 11th Five Year Plan
- Investment from private equity funds in various cold chain projects.
- The involvement of railways and airports for transportation of cold chain products.
- The government of India has taken a decision to set up the National Centre for Cold Chain Development (NCCD) to address the issue relating to gaps in cold chain infrastructure in India.

4.3.8 FDI in Cold Chain

The Government of India has permitted 100% FDI in the cold chain sector through the automatic route in the budget of 2011-12. It included other benefits like project import status at a concessional customs duty of 5% with full exemption from service tax for the initial setting up and expansion of cold storage, cold room (including farm pre-coolers for preservation or storage of agriculture and related sectors produce) and processing units.

4.4 Data Analysis & Interpretations– Cold Stores in Delhi NCR

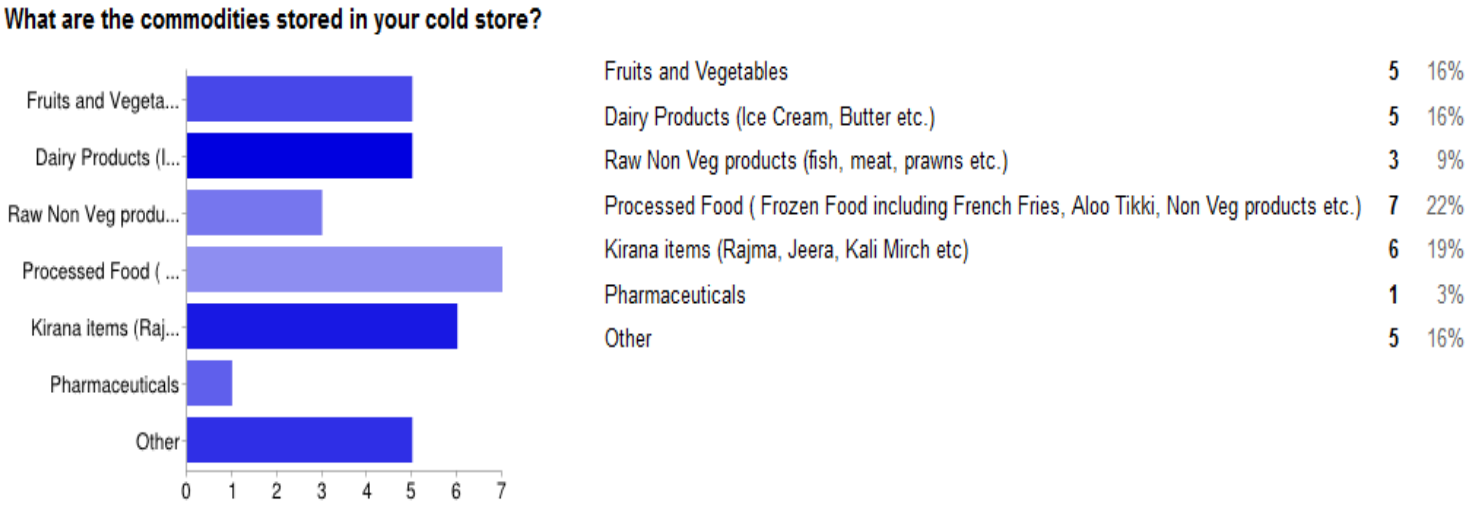
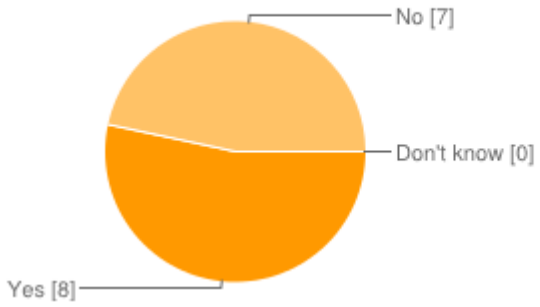


Figure 4.3

- Among the 15 cold stores in Delhi NCR Region, 22% (7) of the cold stores had storage for processed foods for companies like McCain Foods, Vista Foods, McDonald's and other local companies.
- Cold stores around Azadpur Sabzi Mandi area of Delhi are majorly dealing with Fruits and Vegetables
- Cold stores around Lawrence Road area of Delhi are majorly dealing with Kirana items

Does your cold store has an Ante Room as per standards?

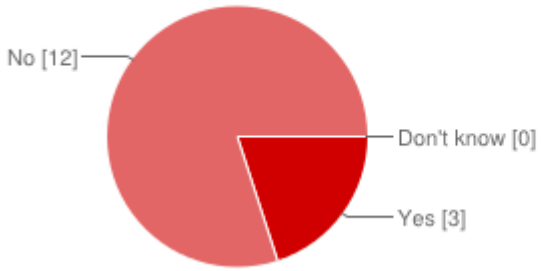


Yes	8	53%
No	7	47%
Don't know	0	0%

Figure 4.4

- Ante-Room is the area where initial loading and unloading of the goods is performed and a certain temperature has to be maintained in this area so that product temperature does not fluctuate and the product quality does not degrade.
- Around 50% of the cold stores does not have an ante room, and among those having an ante room, Snowman, RK Foodland, SK Logistics and Bulaki Deep Freeze are the ones with the standardized ante-rooms.

Does your cold store has the facility of palletization?



Yes	3	20%
No	12	80%
Don't know	0	0%

Figure 4.5

- Pallets make the storage of the products easy with proper airflow reaching the product as well as provide easy handling while loading/unloading and help maintain the quality of products.

- Among the cold stores interviewed, Snowman, RK Foodland and Bulaki Deep Freeze were the ones using pallets with Snowman having 100% palletization and RK Foodland and Bulaki having partial palletization.

Traditional Cold Store **Modern Cold Store**

(a) (b)

Figure 4.6 (a) Without Palletization (b) With Palletization

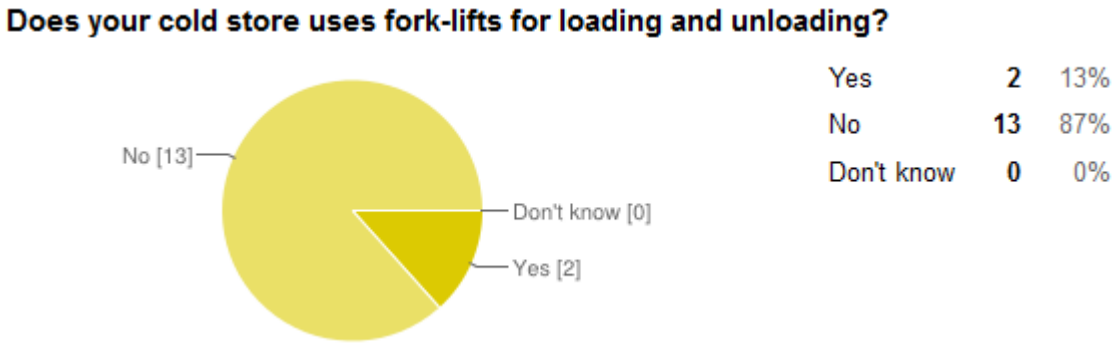


Figure 4.7

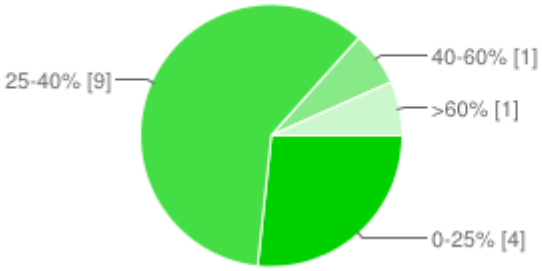
- Fork-Lifts are a type of reach trucks to handle operations in a palletized condition.
- Only Snowman and RK Foodland employ fork-lifts for handling goods and that too not all fork-lifts are battery operated, some are mechanical fork-lifts.

Traditional Cold Store **Modern Cold Store**

(a) (b)

Figure 4.8 (a) Loading/Unloading without Fork-Lift (b) Use of Fork-Lift

What are the percentage expenses of electricity in your cold store?

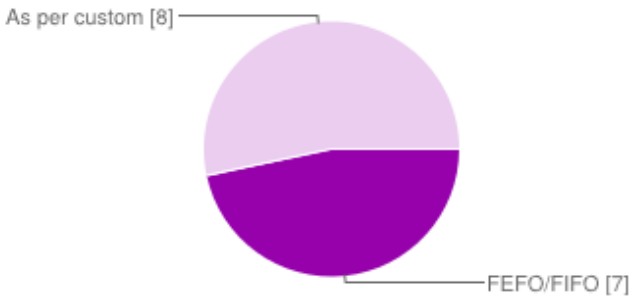


0-25%	4	27%
25-40%	9	60%
40-60%	1	7%
>60%	1	7%

Figure 4.9

- Electricity forms the major expense for the cold stores and it ranges from less than 25% in Delhi Cold Storage to over 60% in Vidya Ice and Cold Storage, which can be attributed to their insulation methods as well as their capacity utilization.

Which of the following is used during loading /unloading of products?

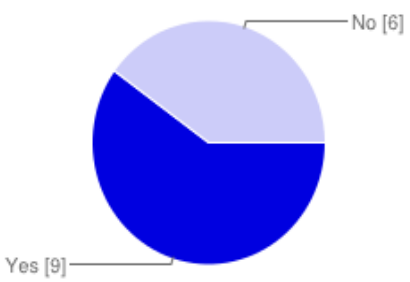


FEFO/FIFO	7	47%
As per customer orders	8	53%

Figure 4.10

- Basically this tells whether products are stored in a systematic FEFO/FIFO order or in an unsystematic way.
- Products like processed frozen foods (Aloo Tikki, French Fries etc.) are kept and dispatched as First-Expire-First-Out while kirana items that do not have a specific expiry do not follow this.

Does your cold store possess Inventory Management System / Warehouse Management System?

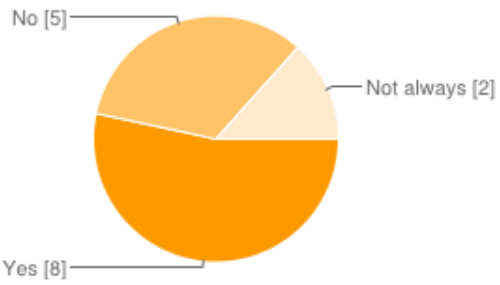


Yes	9	60%
No	6	40%

Figure 4.11

- 60% of the cold stores use an IT based Inventory Management System to keep track of the goods entered in the storages and goods going out of the storage area.
- Among all, Snowman Logistics and RK Foodland used best of the IT systems to handle operations.

Is the temperature of the product always checked before and after loading/unloading?



Yes	8	53%
No	5	33%
Not always	2	13%

Figure 4.12

- Majority of the 53% cold storages checking the product temperature before and after loading/unloading is done for processed frozen foods (-18^{o}C products).

Figure 4.13 Checking of Temperature while loading / unloading

Figure 4.14

- Only 4 out of 15 cold stores have their own reefer units and most of the cold stores use hired reefers.

Does the reefers used by your company have GPS installed?

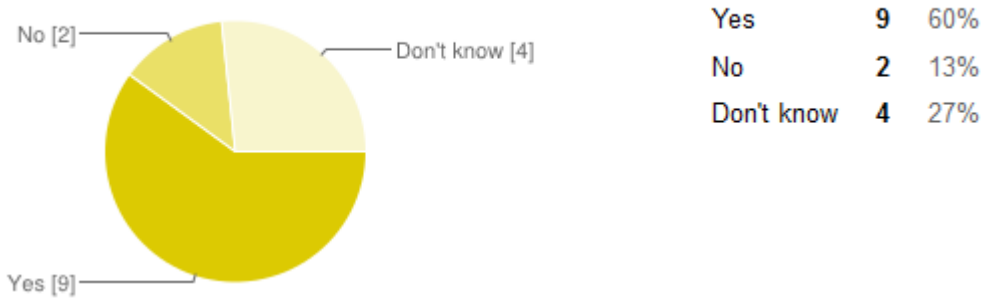


Figure 4.15

- As cold chain industry is temperature driven, hence tracking of the reefers becomes an important parameter.
- 60% of the cold stores use GPS enabled vehicles while there are cold stores that are still unaware of this technology and are highly backward in their operations.

Does the reefers used by your company have data logger installed?

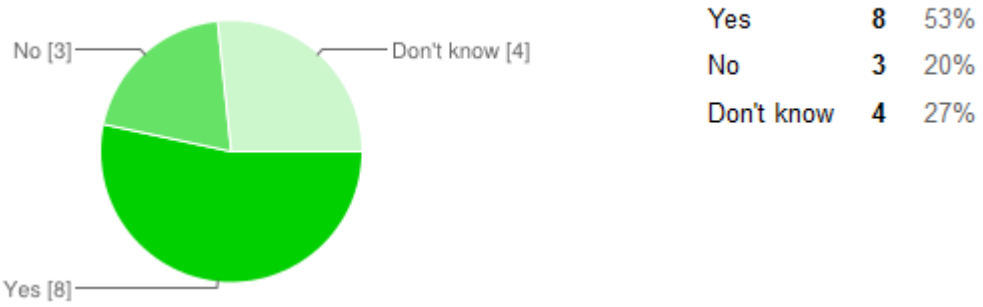


Figure 4.16

- Being a temperature driven sector, temperature records inside the reefers are an important parameter in deciding the quality of services offered and the quality of product maintained.
- Though 8 cold stores said they use data loggers, it was only Snowman who was willing to show their temperature records by connecting the data logger as a USB with the computer.

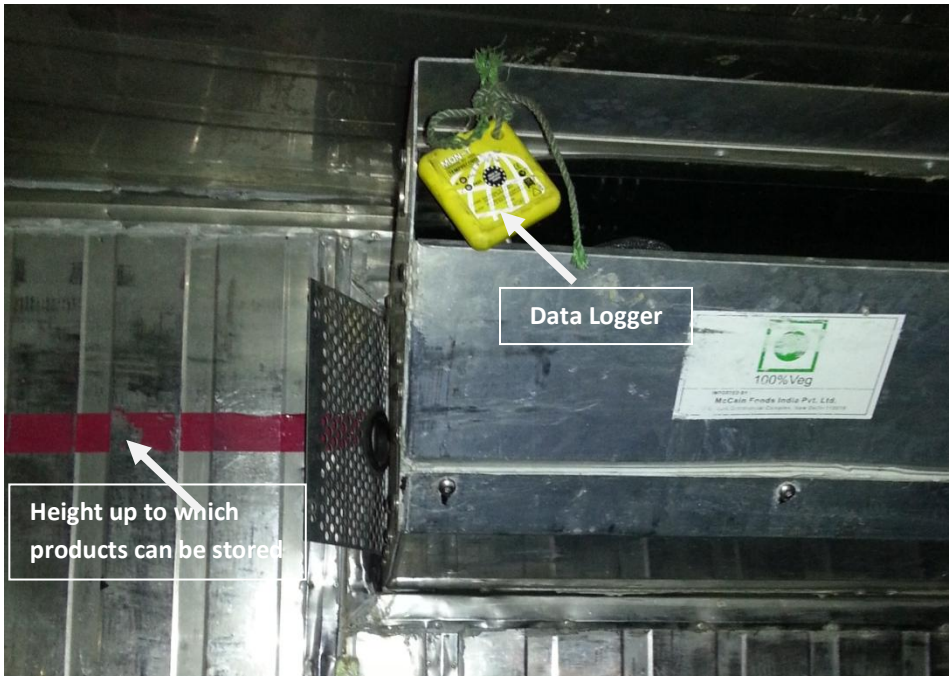


Figure 4.17 Inside the vehicle

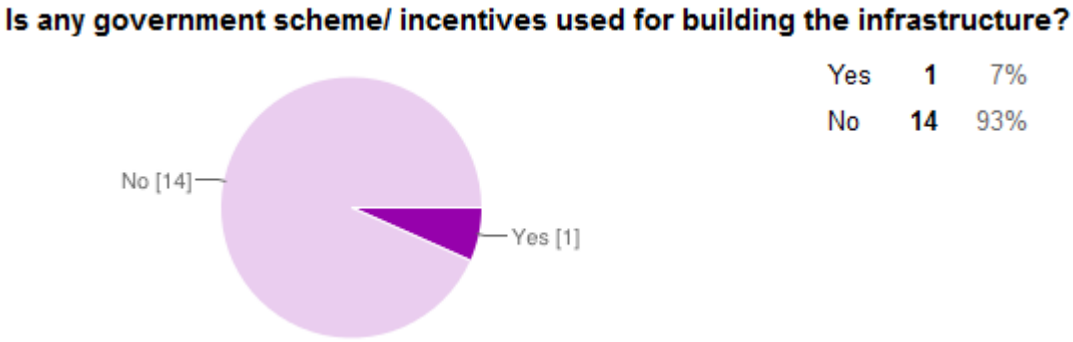


Figure 4.18

- Only Krishna Cold Storage among the 15 cold stores was sponsored by National Horticulture Board.

Is any training provided to the labour or the cold storage operators?

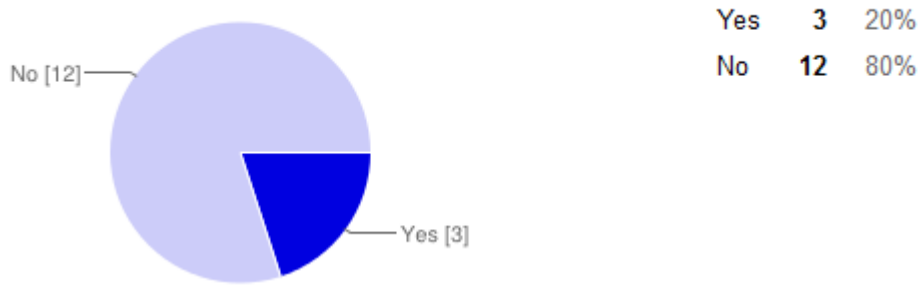


Figure 4.19

- 80% of the cold stores do not focus on the aspect of training at all.
- Labour and the supervisors of Snowman, RK Foodland and Bulaki Deep Freeze are provided training either by the cold storage or by the customers of the cold storage.

Is any use made of technologies such as RFID in your cold store?

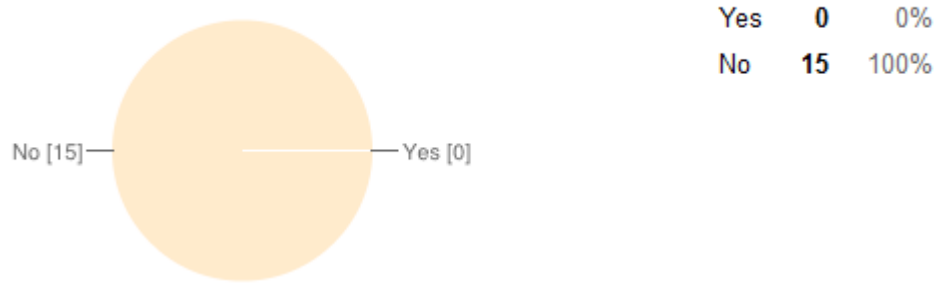


Figure 4.20

- None of the cold storages use any advanced technology like RFID in their operations.

4.5 Comparative Analysis of Cold Chain between India (developing country) and USA (developed country)

Aspect	Developed Countries (USA)	India
Cold Chain Logistics Rate	>90%	10-20%
Loss Rate	<5%	35-40%
Cold Chain Logistics Vehicle	>2,00,000 refrigerated vehicles	~30, 000 refrigerated vehicles
Cold Storage Capacity	~700 lakh MT	~301 lakh MT
Cold Chain Regulations & Standards	Well developed	Not complete

Table 4.5

- Cold Chain Logistics Rate – When the perishable products are to be moved to the refrigerated vehicles, most take place in the open air and not in a cold or insulated environment. In India, the rate of cold chain logistics is 10-20% while that in developed countries like USA, cold chain logistics has reached nearly 100%
- Loss Rate - Fruit, vegetable and other agricultural products in the picking, transportation, storage and other logistics link comprises of a loss rate of 35-40% in India, while the same loss has been controlled to less than 5% in USA.
- Cold Chain Logistics Vehicle – The United States has refrigerated vehicle quantity of about 2, 00,000 while India has just 30,000 refrigerated vehicles which is a huge deficiency as compared to the agricultural produce in India and USA.
- In India, out of the total cold storage, only 12% comprises of the refrigerated vehicles while rest 88% comprises of the cold warehouses. In USA, the storage comprises of 54% and refrigerated transport comprises of 46% which shows an equal distribution and equal importance to both storage as well as transportation.

- Cold Storage Capacity – Cold storage capacity of India is far below to that of USA, though India is the second largest producer of fruits and vegetable sin the world after China.
- Cold Chain Regulations & Standards – The cold storage regulations and standardizations by the governmental agencies is not yet complete and clear in India and was initiated in the recent years while the Cold Chain Logistics system is fully developed in countries like USA with complete regulations and governmental support.

- High Level of adoption - Developed countries like USA having a highly developed infrastructure and a highly organized retail pass as much as 85% of their produce through cold chain.
- Low Level of adoption - Countries like India who are facing significant infrastructural challenges have a small export pass as much as 10% of produce through cold chain.
- Apart from the macro factors cited above, India lacks in micro parameters as well. For a cold store in USA, provision of palletization and battery operated fork-lifts is a basic requirement while in India, the number of cold stores employing fork-lifts and pallets is restricted to only a few and that too not all amongst these use battery operated fork-lifts.

4.6 Recommendations & Conclusion

- India is the largest producer of milk and second largest producer of fruits and vegetables in the world but lags way behind in the cold chain infrastructure attributing it to the losses of more than 30, 000 crore annually in the agricultural produce
- 127 Million Tonnes of milk was produced in 2011-12, but cold storage capacity is only available for 70,000-80,000 tonnes of milk. Similarly, 20%-30% of fish production is annually wasted in India. Also, ~25,000 unregistered slaughter houses are present in India, which generally lacks chilling facilities**.** This amounts to huge wastage and losses which could have been encashed provided proper infrastructure facilities were present in India.
- Due to the short shelf life of the crops, as much as 30-35% of fruits and vegetables perish during harvest, storage, grading, transport, packaging and distribution. If the nutritive value of these fruits and vegetables could be maintained by converting them to processed food, this sector will emerge as a major value added food industry.
- Though 11% of world's total vegetables production is accounted by India alone but India's share in global vegetable trade is only 1.7%. This has although increased year-by-year but on a global scale, the share in global vegetable trade is amazingly less as compared to the produce. Similar is the situation with fruits, poultry, marine foods etc.
- These statistics show the potential India has being an agrarian economy and if cold chain infrastructure in India becomes strong, it can increase the export potential by manifolds adding to the GDP of the nation.
- There has been significant changes brought about the government and concern has been shown for this sector for previous 3-4 years. For instance, 5% concession on import duty, service tax exemption, excise duty exemption on several items and other subsidies has encouraged the participation of entrepreneurs in this sector which can be seen in the development statistics.

- Also, National Centre for Cold Chain Development was established in 2011 for looking into the matters related to cold chain infrastructure.
- Government needs to further strengthen its regulatory mechanisms for the cold chain sector with a continuous effort to reach to the levels of developed countries where losses are restricted to less than 5%.
- Though government is trying hard to boost this sector, still gaps remain in terms of single commodity cold storages (for examples potatoes) and uneven distribution of capacity with states like UP and West Bengal with maximum capacities. Different commodities require different temperature conditions, resulting in poor capacity utilization and low financial viability. Hence, the focus should shift from single commodity to multi-purpose cold storages, which will also add to revenue generation.
- Another issue faced by cold storage facility providers is power supply. Insufficient and irregular power supply causes problem for the operators and hence disturbs the entire cold chain. The government should give subsidy on power and supply should be made uninterrupted and continuous for running a cold storage.
- There is lack of proper training & skilled human resources which leads to improper handling of the products, improper checking of the temperature etc. Requisite and timely training to the personnel is very important in building appropriate human resource for the cold chain industry.
- Basic infrastructure such as pallets, fork-lifts will not only ease the handling of the products but also add to the productivity and efficiency of the operations and hence add to the revenue for the cold store.
- To cater to the erratic power supply, solar panels can be introduced and to add to the automation inside the cold storages, conveyor belts can be used for handling of the goods.
- The primary research conducted in the cold stores of Delhi NCR revealed that hardly any of the cold storages have standardized ante-rooms, extremely few are using pallets and fork-lifts and training provided to the labour as well as the operators is negligible.

- The response from the cold store operators in Delhi regarding government subsidies etc. highlights that the process of getting these subsidies is highly cumbersome and time taking, and hence cold store owners generally do not go for subsidies.

Because of the growth in organized retail, more and more penetration of the quick service restaurants (QSR) in Tier-II cities, growth in the frozen food as well as other processed food sectors, rising demand of confectionary, increase in the disposable income of people and last but not the least, 51% FDI in multi-brand retail, the cold chain industry in India is indeed a sunrise sector and is poised for exciting developments and growth within the next few years.

However, the current scenario reveals that there is tremendous scope for the development of cold chain facilities and if designed properly to handle and preserve the substantial quantity and excellent quality of food products, a cold chain would turn into a 'Gold Chain' for the country.

4.7 Limitations

1. The secondary research conducted on cold chain statistics in India is restricted to internet and reports published by the government bodies like NHB, MOFPI etc., and do not provide the latest data of 2013.
2. The primary research conducted in the cold stores of Delhi NCR was restricted to 15 cold stores and hence, a generalized projection is drawn for other cold stores as well.
3. All information could not be shared by the cold store operators due to confidentiality issues.
4. Among the various stages of a cold chain, emphasis is laid only on the cold storages and not on other aspects.

Chapter 5

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Chapter 6

ANNEXURE

ANNEXURE 1 - QUESTIONNAIRE

Name of the Cold Store

What are the commodities stored in your cold store?

- ☐ Fruits and Vegetables
- ☐ Ice Cream
- ☐ Raw Non Veg products (fish, meat, prawns etc.)
- ☐ Processed Food (Frozen Food including French Fries, Aloo Tikki, Non Veg products etc.)
- ☐ Pharmaceuticals
- ☐ Other:

Does your cold store have an Ante Room as per standards?

- o Yes
- o No
- o Don't know

Does your cold store have the facility of palletization?

- o Yes
- o No
- o Don't know

Does your cold store use fork-lifts for loading and unloading?

- o Yes
- o No
- o Don't know

What are the percentage expenses of electricity in your cold store?

- 0-25%
- 25-40%
- 40-60%
- >60%

Which of the following is used during loading /unloading of products?

- FEFO/FIFO
- As per customer orders

Does your cold store possess Inventory Management System / Warehouse Management System?

- Yes
- No

Is the temperature of the product always checked before and after loading /unloading?

- Yes
- No
- Not always

Does your company own the reefer trucks or they are hired?

- Own
- Hired
- Some are owned and some are hired

Do the reefers used by your company have GPS installed?

- Yes
- No
- Don't know

Does the reefers used by your company have data logger installed?

- Yes
- No
- Don't know

Is any government scheme/ incentives used for building the infrastructure?

- Yes
- No

Is any training provided to the labour or the cold storage operators?

- Yes
- No

Is any use made of technologies such as RFID in your cold store?

- Yes
- No

ANNEXURE 2 - Responses

Name of the Cold Store	What are the commodities stored in your cold store?	Does your cold store has an Ante Room as per standards?	Does your cold store has the facility of palletization?	Does your cold store uses fork-lifts for loading and unloading?	What are the percentage expenses of electricity in your cold store?	Which of the following is used during loading /unloading of products?	Does your cold store possess Inventory Management System / Warehouse Management System?	Is the temperature of the product always checked before and after loadingunloading?	Does your company own the reefer trucks or they are hired?	Untitled Question	Does the reefers used by your company have GPS installed?	Does the reefers used by your company have data logger installed?	Is any government schemel incentives used for building the infrastrueture ?	Is any training provided to the labour or the cold storage operators?	Is any use made of technologies such as RFID in your cold store?
S.K. Logistics	Processed Food	Yes	No	No	40-60%	FEFO/FIFO	Yes	Not always	Some are owned		Yes	Yes	No	No	No
Snowman	Dairy Products	Yes	Yes	Yes	25-40%	FEFO/FIFO	Yes	Yes	Own		Yes	Yes	No	Yes	No
Radhakrishna	Dairy Products	Yes	Yes	Yes	0-25%	FEFO/FIFO	Yes	Yes	Own		Yes	Yes	No	Yes	No
Gulmarg Ice	Kirana items	No	No	No	25-40%	As per customer	No	No	Hired		Don't know	Don't know	No	No	No
Darshan Cold	Raw Non Veg	No	No	No	25-40%	As per customer	No	Not always	Hired		No	No	No	No	No
Vidya Ice and	Dairy Products	Yes	No	No	>60%	FEFO/FIFO	Yes	Yes	Hired		Yes	No	No	No	No
Bulaki Deep	Processed Food	Yes	Yes	No	0-25%	FEFO/FIFO	Yes	Yes	Own		Yes	Yes	No	Yes	No
Jaswant Cold	Fruits and	Yes	No	No	25-40%	FEFO/FIFO	Yes	Yes	Own		Yes	Yes	No	No	No
Hindustan Cold	Kirana items	No	No	No	25-40%	As per customer	No	No	Hired		Don't know	Don't know	No	No	No
Mussourie Cold	Kirana items	No	No	No	25-40%	As per customer	No	No	Hired		Don't know	Don't know	No	No	No
Devbhumi COld	Fruits and	Yes	No	No	0-25%	As per customer	Yes	Yes	Some are owned		Yes	Yes	No	No	No
Delhi Cold	Fruits and	Yes	No	No	0-25%	As per customer	Yes	Yes	Hired		Yes	Yes	No	No	No
Krishna Cold	Fruits and	No	No	No	25-40%	As per customer	No	No	Hired		No	No	Yes	No	No
Indraprastha	Dairy Products	No	No	No	25-40%	FEFO/FIFO	Yes	Yes	Hired		Yes	Yes	No	No	No
Himachal Cold	Fruits and	No	No	No	25-40%	As per customer	No	No	Hired		Don't know	Don't know	No	No	No

ANNEXURE 3 - NCCD

National Centre for Cold Chain Development (NCCD)

The gap in the Cold Chain infrastructure necessitates focused interventions of its establishment at par with global standards and protocols so that F&V produce has a longer shelf life, benefitting not only producers (farmers, processors), consumers and exporters but also enabling a specialized industry to come up with a host of allied and ancillary activities and service providers. With this perspective, during 11th Plan Period, National Centre for Cold Chain Development (NCCD) has been promoted jointly with stake-holders for promotion of quality regime in cold chain infrastructure development and management. NCCD has been mandated to:

(a) Provide an enabling environment for the cold chain sector to gain prominence and invite the much needed private sector involvement.

(b) To establish standards and protocols related to cold chain testing, verification, certification and accreditation as per international standards.

(c) To provide technical assistance to financial institution, government departments/agencies, and industry for selection of cold chain component such as refrigeration units, refrigerated transport equipment, display cabinets, milk tanker etc.

(d) To offer HRD and technical advisory services to personnel engaged in this sector.

NCCD has been constituted as an autonomous body and has been registered as a Society under the Societies Registration Act, 1860.

The aims and objectives of the Society are:

i. To recommend standards and protocols for cold chain infrastructure/building including post harvest management so as to harmonize with international standards and best practices and suggest mechanism for bench marking and certification of infrastructure/building, process and services provided by cold chain industry.

ii. To suggest indicative guidelines for preparation of project reports for potential investors/entrepreneurs.

iii. To assess and develop appropriate IT-based management information system for the cold chain infrastructure

iv. To undertake and coordinate Research and Development (R&D) work required for development of cold chain industry in consultation with stakeholders.

v. To undertake and coordinate the task of Human Resource Development (HRD) and capacity building. It may also conduct in-house training, short-term/long courses relevant for cold chain development.

vi. To launch publicity campaign to educate the stakeholders including awareness building about the benefits of integrated cold chain.

vii. To recommend appropriate policy framework relating to development of cold chain.

viii. To facilitate and foster the development of multi-modal transportation facilities for perishable agricultural, horticultural and allied commodities and establishment of National Green Grid Perishable Commodities.

ANNEXURE 4

Estimate of economic value of harvest and post harvest losses in India

S. No.	Crop / commodity	*Production (million MT)	*Price Rs/MT	Losses estimated (%)	Estimate of economic value of the losses (₹ in crores)
(i)	**Cereals**	**211.61**	**51,676.5**		**12,593**
(ii)	**Pulses**	**11.974**	**1,27,229.7**	**4.3 – 6.1**	**1,735**
(iii)	**Oilseeds**	**31.66**	**1,25,367.3**	**2.8 – 10.1**	**5,107**
(iv)	**Fruits**				
1	Apple	1.622	47,771.6		953
2	Banana	20.858	9,262.5		1,275
3	Citrus	7.097	18,774.6		839
4	Grapes	1.668	31,364.2		434
5	Guava	1.856	12,194.5		407
6	Mango	13.501	19,232.2		3,298
7	Papaya	2.405	8,833.3		157
8	Sapota	1.191	10,727.5		74
	Total	**50.198**	**1,58,160.4**	**5.8 – 18**	**7,437**
(v)	**Vegetables**				
1	Cabbage	5.724	5,498.9		217
2	Cauliflower	5.524	8,211.7		308
3	Green Pea	2.37	23,010.8		562
4	Mushroom	0.037	33,475.0		15
5	Onion	10.655	7,349.9		587
6	Potato	30.195	9,679.4		2,630
7	Tomato	9.878	8,139.1		997
8	Tapioca	8.429	6,725.5		556
	Total	**72.812**	**1,02,090.3**	**5.8 – 18**	**5,872**
(vi)	**Spices and plantation crops**				
1	Arecanut	0.0559	71,866.8		32
2	Black Pepper	0.069	1,13,106.0		30
3	Cashew	0.62	1,27,192.7		87
4	Chilli	0.0117	14,380.8		1
5	Coconut	4.06	29,591.0		649
6	Coriander	0.2332	20,571.2		35
7	Sugarcane	355.52	1,489.59		4,607
8	Turmeric	0.837	52,102.1		323
	Total	**361.4068**	**4,30,300.2**		**5,764**
(vii)	**Livestock produce**	**163.358**	**3,14,105.6**		**5,635**
Total					**44,143**

* Period of study is 2005-2007

**Values are at May, 2009 price index.

Source: CIPHET Report

ANNEXURE 5

SECTORWISE DISTRIBUTION OF COLD STORAGES AS ON 31/12/2009

Sl.No.	State/UT	PRIVATE SECTOR		COOPERATIVE SECTOR		PUBLIC SECTOR		TOTAL NO.	TOTAL CAPACITY IN MTs
		No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity
1.	Andaman & Nicobar Islands (UT)	01	170	00	00	01	40	02	210
2.	Andhra Pradesh	269	885557	11	11598	10	3451	290	900606
3.	Arunachal Pradesh	01	5000	00	00	00	00	01	5000
4.	Assam	19	85948	01	1000	04	1120	24	88068
5.	Bihar	236	1100641	10	46400	00	00	246	1147041
6.	Chandigarh (UT)	05	11216	01	1000	00	00	06	12216
7.	Chhatisgarh	67	341815	01	29	01	41	69	341885
8.	Delhi	77	103277	02	5201	16	17680	95	126158
9.	Gujarat	372	1230198	21	30669	05	6437	398	1267304
10.	Goa	29	7705	00	00	00	00	29	7705
11.	Haryana	234	378319	04	3403	06	11399	244	393121
12.	Himachal Pradesh	09	12896	02	767	07	6195	18	19858
13.	Jammu & Kashmir	15	40689	03	2134	01	46	19	42869
14.	Jharkhand	37	142733	08	27415	00	00	45	170148
15.	Kerala	176	55335	06	1080	11	1690	193	58105
16.	Karnataka	135	390882	18	6689	17	9594	170	407165
17.	Lakshadweep (UT)	00	00	00	00	01	15	01	15
18.	Maharashtra	379	507678	55	25346	32	13724	466	546748
19.	Madhya Pradesh	172	704270	20	101348	05	2434	197	808052
20.	Manipur	00	00	00	00	00	00	00	0
21.	Meghalaya	01	1200	00	00	02	2000	03	3200
22.	Mizoram	00	00	00	00	00	00	00	0
23.	Nagaland	01	5000	01	1150	00	00	02	6150
24.	Orissa	81	248739	16	38100	04	4200	101	291039
25.	Pondicherry(UT)	02	35	01	50	00	00	03	85
26.	Punjab	404	1306101	18	39092	00	00	422	1345193
27.	Rajasthan	100	320380	09	3832	01	14	110	324226
28.	Sikkim	00	00	00	00	01	2000	01	2000
29.	Tamilnadu	130	225712	13	7562	05	5262	148	238536
30.	Tripura	03	12750	01	5000	07	11700	11	29450
31.	Uttar Pradesh	1505	9842000	84	276000	00	00	1589	10118000
32.	Uttarakhand	12	60499	00	00	03	8000	15	68499
33.	West Bengal	413	5380000	50	302000	00	00	463	5682000
	TOTAL	4885	23406745	356	936865	140	107042	5381	24450652

*Source DMI

Commodity wise distribution of cold storages

COMMODITYWISE DISTRIBUTION OF COLD STORAGES AS ON 31/12/2009

Sl. No.	State/UT	POTATOES 1		MULTIPURPOSE 2		FRUITS & VEG. 3		MEAT & FISH 4		MILK & MILK PRODUCTS 5		OTHERS 6		TOTAL NO. (1+2+3+4+5+6) 7	TOTALCAPA-CITY IN MTs 8
		No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity
1.	Andaman & Nicobar Islands (UT)	00	00	00	00	00	00	02	210	00	00	00	00	02	210
2.	Andhra Pradesh	00	00	212	839456	11	9843	44	26068	15	6838	08	18401	290	900606
3.	Arunachal Pradesh	00	00	01	5000	00	00	00	00	00	00	00	00	01	5000
4.	Assam	00	00	24	88068	00	00	00	00	00	00	00	00	24	88068
5.	Bihar	228	1069841	18	77200	00	00	00	00	00	00	00	00	246	1147041
6.	Chandigarh (UT)	01	1000	04	11131	00	00	01	85	00	00	00	00	06	12216
7	Chhatisgarh	14	39242	52	302543	00	00	00	00	03	100	00	00	69	341885
8.	Delhi	00	00	54	117373	01	53	04	1239	09	4757	27	2736	95	126158
9.	Gujarat	213	967000	97	265574	02	1063	60	22211	25	11440	01	16	398	1267304
10.	Goa	00	00	01	3633	00	00	26	4004	02	68	0	0	29	7705
11.	Haryana	172	225991	66	165787	00	00	00	00	06	1343	00	00	244	393121
12.	Himachal Pradesh	05	9748	05	3837	06	6100	01	78	01	95	00	00	18	19858
13.	Jammu & Kashmir	05	11281	12	31473	00	00	00	00	02	115	00	00	19	42869
14.	Jharkhand	08	27415	37	142733	00	00	00	00	00	00	00	00	45	170148
15.	Kerala	00	00	08	13200	00	00	178	43815	06	1080	01	10	193	58105
16.	Karnataka	09	16530	96	378244	09	3870	34	5141	15	3128	07	252	170	407165
17.	Lakshadweep (UT))	00	00	00	00	00	00	01	15	00	00	00	00	01	15
18.	Maharashtra	0	0	189	413885	115	47914	62	63263	70	18407	30	3279	466	546748
19.	Madhya Pradesh	114	564600	67	237737	04	2577	00	00	11	3125	01	13	197	808052
20.	Manipur	00	00	00	00	00	00	00	00	00	00	00	00	00	00
21.	Meghalaya	00	00	03	3200	00	00	00	00	00	00	00	00	03	3200
22.	Mizoram	00	00	00	00	00	00	00	00	00	00	00	00	00	00
23.	Nagaland	00	00	02	6150	00	00	00	00	00	00	00	00	02	6150
24.	Orissa	39	139630	35	130060	04	13737	22	6412	00	00	01	1200	101	291039
25.	Pondicherry(UT)	00	00	00	00	01	15	01	20	01	50	00	00	03	85
26.	Punjab	344	1097609	76	236994	00	00	00	00	02	10590	00	00	422	1345193
27.	Rajasthan	19	65896	79	256445	00	00	00	00	08	1781	04	104	110	324226
28.	Sikkim	00	00	01	2000	00	00	00	00	00	00	00	00	01	2000
29.	Tamilnadu	00	00	67	213966	03	7675	59	11908	13	4512	06	475	148	238536
30.	Tripura	03	11000	08	18450	00	00	00	00	00	00	00	00	11	29450
31.	Uttar Pradesh	1286	8719533	294	1390021	04	3580	02	4027	02	801	01	38	1589	10118000
32	Uttrakhand	00	00	15	68499	00	00	00	00	00	00	00	00	15	68499
33.	West Bengal	402	5460000	61	222000	00	00	00	00	0	0	0	0	463	5682000
	TOTAL	2862	18426316	1584	5644659	160	96427	497	188496	191	68230	87	26524	5381	24450652

*source DMI