Channel Distribution Performance in Cold Chain Management : A Comparative Scenario Between Two States of India

** Shantanu Saha*
*** K. Mukherjee*
**** B. Chandra*

Abstract

This paper attempted to study the performance of channel distribution in cold storage operations and inter-alia issues in an attempt to give new insights into cold storage operations. An exploratory study was carried out by interviewing, interacting, and sharing of experiences by as many as 64 cold storage operators spanning from various districts of Punjab and Uttar Pradesh. The comparison of operations of cold storage in these two states brought forth that channel distribution plays an important role in maintaining and delivery of perishable products from cold storage to retail markets. The study is expected to assist in creating insights on issues relevant to the involvement of channel intermediaries in cold storage operations.

Keywords : **Cold storage units, direct channel, indirect channel, intermediaries' performance, supply chain management**

Paper Submission Date : July 13, 2014; Paper sent back for Revision : October 2, 2014 ; Paper Acceptance Date : December 2, 2014

The first decade of the 21st century saw India as a progressively growing economy in the world. However, this growth is energized by growth in infrastructure, booming of manufacturing sectors, export and import trade developing in agricultural related activities and in the allied retail industry. Logistics assumes the central activity in these growth areas. With rising dispensable incomes, changes in lifestyle, attention on rural and agricultural related activities by both the government and private sectors (Saravanan, 2012), cold chain logistics have received special attention in recent years. Cold chain management may be distinguished as equipment and procedure or set of approaches meant to preserve perishable goods like vegetables, fruits, flowers, meat, dairy products, blood, and so forth (Van Donselaar, van Woensel, Broekmeulen, & Fransoo, 2006) and distribution of these under a controlled environment on a priority basis (Lan, 2008 ; Montanari, 2008 ; Samant, Lanjewar, Parker, Block, Tomar, & Stein, 2007 ; Xia, 2007). A controlled environment may be created by controlling temperature, moisture, and other factors in sustaining usability of these items (McLean, 2009). The controlled specified environment for cold storage operations ranges between ± 20 degree Fahrenheit. However, when we talk about channel distribution in cold chain management, it highlights each unit in each of the channel systems, creating different levels of revenues with access to different segment of target consumers.

Managements of cold storage operations must make decisions on channels of distribution carefully, incorporating current needs with future prospects and the prevailing trend / environment. In the past decade, many cold storage units largely reduced their inventories and related costs through "Just-In-Time" logistics systems.

* *Junior Research Fellow,* Department of Management Studies, Indian School of Mines, Dhanbad- 826 004, Jharkhand.
E-mail: shantanu.ismjrf@gmail.com
** *Professor,* Indian Institute of Management Kashipur, Kashipur, Uttarakhand- 244 713.
E-mail: Kampan_m@hotmail.com
*** *Assistant Professor,* Department of Management Studies, Indian School of Mines, Dhanbad- 826 004, Jharkhand.
E-mail: Chandra_bibhas@yahoo.co.in

Through "Just-In-Time" logistic systems, producers and retailers carry only small inventories of parts or merchandise. New stock arrives exactly when needed, rather than being stored in inventory for long periods as far as it being used. Although, just in time systems require authentic forecasting along with fast, frequent, and flexible delivery so that the new supplies will be available when needed, these systems result in substantial savings in inventory storage, carriage, and handling costs. Operators who are in the business of distribution of perishable goods can find a direct correlation between cold chain performance and the quality delivered to the retail market and hence, to the customers.

In this paper, we will discuss the performance of channels in operation of cold storage units in India. Various issues are analyzed relating to the management of cold storage operations on the ground account of field surveys conducted on cold storage units in various districts of Punjab and Uttar Pradesh in India.

Cold Storage Operations : A Review

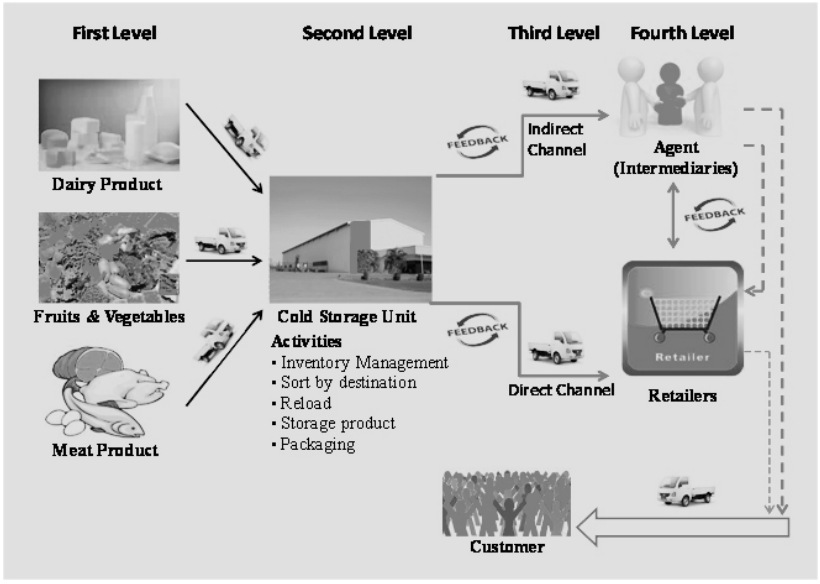
Many research papers in the past have investigated and have brought out some vital points on cold chain management, optimization of product quality, product well being, and minimization of wastage. Cold chain management is the flow of goods and services from a point of origin / production to storage, transportation, distribution, and consumption involving the process of planning, controlling, and efficient implementation in order to meet general needs and customer satisfaction on a worldwide scale (Bogataj, Bogataj, & Vodopivec, 2005). In a global market, it is important to get the right stuff, in the right amount, at the right time, and at the right place (Baldiwala, 2001). Logistics assume the central activity, and channel distribution in cold chain management highlights that each unit in channel systems creates different levels of revenues with access to different segments of consumers.

According to C. H. Robinson Worldwide and Iowa State University (2001), cold chains are more important and complex phenomenon in comparison to ordinary retail supply chains. The cold chain is also known as refrigerated and frozen products. In general, these are those products which require room temperature to be cooler as compared to control room temperature; moreover, these products are very sensitive to temperature variation on both sides of the storage. All together, cold chain management is an important part of supply chain management. In practice, cold chain management implies regular temperature screening at each stage of production, storage, transportation, and distribution chain and between each operation level. During interoperations, temperature monitoring is done through time - temperature - indications and RFID frameworks with integrated temperature sensors embedded in the product. Thus, in a cold chain management system (China Bio/Pharmaceutical and Clinical Supply Chain Convention, 2013), perishable products are managed in a temperature sensitive zone of ± 20 degree Fahrenheit to keep the products fresh in a chain of distribution from the producer to the consumer (for examples, in case of bananas, from the harvest country of Philippines to end consumers in mainland China) (Sterling Solutions, 2013).

Other than temperature aspects, product management, operations of specialized gear such as technical equipment, and facilities with respect to temperature control, storage & handling, laws & regulations, and supply chain management are also essential. Well organized cold chain procedures and management decreases deterioration, holds the quality of produce, and assures a cost efficient transportation to the consumer. The Figure 1 depicts a cold storage unit linkage. Cold storage functions are needed because a production and consumption cycle varies. For example, produce of seasonal fruits like apples are stored in a cold storage for round the year availability. Operations of cold storage overcome differentials in volume of production and demand in the consumer market. Thus, in any cold storage operation, if any one link in the chain malfunctions or is mismanaged, the entire system is affected, leading to loss of revenue. Therefore, a cold storage operator must decide on how many and what types of warehouses its chain needs and their corresponding locations. The firm might use either storage warehouses or distribution centers.

According to Rangasamy (2013), storage warehouses store goods for moderate to long periods. Distribution centers are designed to move goods instead of just storing them. Distribution centers are large and highly

Figure 1. Cold Storage Unit Linkage



modernized warehouses designed to receive products from various clients and other suppliers, take orders, fill them efficiently and deliver (transportation) products to customers as soon as possible. For instance, Kissan cold storage of Amritsar in Punjab operates huge distribution centers. This center serves the daily requirement of the local markets of Amritsar. The warehouse is spread over 4000 square yards, under a single roof. Laser scanners mark as many as 8,000-10,000 boxes in a day. The warehouse is fully automated; employing just 30-35 laborers who unload 50-60 trucks per day.

Inventory levels also affect customer satisfaction. There has to be a delicate balance between housing too many inventories vis-a-vis too little. Storing too many inventories results in higher input / storage costs and stock obsolescence; while too little may result in shortage of stock, resulting in costly emergency shipment and customer dissatisfaction. While deciding on stock level in a warehouse, the management must balance the input costs such as electricity bill, handling costs, wages, salary, own profit, and loan interest against resulting consumer demand. The formula generally worked for inventory holding cost is:

Inventory holding cost = Electricity bill + wages + salary + own profit + loan interest (if loan acquired)

Overall performance and operations of cold chain management are adversely affected by variation in time, distance, and temperature (Da Silva & Filho, 2007). It would be eloquent to draw a comparison between developed and developing nations on the basis of operations and performance of the cold chain management systems. Comparison of the results exhibited in the Table 1, that has been investigated between India, China, and European Union on certain parameters with references from Brewer and Hensher (2001), Henstra and Woxenius (1999), McKinnon (1989), China Bio/Pharmaceutical and Clinical Supply Chain Convention (2013), A. T. Kearney (2005), Ruijgrok (2001), Subin (2011), Likar and Jevšnik (2006), Montanari (2008), Yu and Nagurney (2013), Joshi, Banwet, and Shankar (2010), Melo, Nickel, and Saldanha-da-Gama (2009), and Lambert and Cooper (2000) reflects a tremendous growth opportunity for India. As per Way2Wealth's (2008) report, Europe and other developed nations like Australia, Japan, and North America have excelled in the technology of food processing and infrastructure as compared to Latin America and Asia.

In lieu of the report, Gilmour and Cheng (2004) observed that the processed food markets in developed countries have been categorized by companies that consolidate foods from a farm processor network of cold storage warehouses and then distribute them to regional and local warehousing for delivery to retailers and

Table 1. Comparative Analysis of Cold Storage Operators Worldwide

Elements	INDIA	CHINA	EUROPEAN NATIONS
Transportation	Changes needed in transportation and logistics of temperature sensitive food distribution.	Changes needed in the logistics of temperature sensitive food distribution.	Already have controlled temperature sensitivity of distribution.
IT	Transactions are primarily paper based and computer based.	Transactions are computer based.	Fully automatic.
Intervention	Requires government & private investment to reduce the risk of participants.	Requires shared investment to reduce risk for all participants.	Existence of shared investment.
Progressive Approach	Obstacles in optimization of transport	Developed after the 2008 Beijing Olympics and after 2010 Shanghai World Expo	The European market is at an advantage for removal of border control.
Connectivity	Lack of backward & forward linkages to supplement cold chain.	The supply chain is dominated by logistic service providers.	The adoption of a hub - satellite system has increased the volume of parcel movement.
People	Lack of trust on people concerning the viability of cold chain projects, unskilled manpower.	Improvement in skilled management.	Improved skilled management.
Cost	High operational costs due to high cost of power.	High cost persist for logistics service providers, operate in 'silos'.	Centralization of inventory has been one of the pronounced trends in logistics in Europe.
Handling	Lack of knowhow and trained manpower for handling products.	15 % of temperature controlled products are handled.	85 % of temperature controlled products are handled.
Infrastructure	Improvement needed in infrastructure and skilled management.	Infrastructure is developed, but in some cases, it is fragmented and underfunded.	Improved infrastructure with stockholding capacity and bulk operations become centralized.
Operations	High capital investment in cold chain operations.	Achieving cost efficiency in cold chain operations.	Low cost of operations due to favourable conditions and standard design in cold chain operations.

consumers. However, the developing countries focus more on production and pre-harvest practices than on preserving the final goods (Rathore, 2013). Moreover, India has a future because of its huge potential market, increase in purchasing power, and investment in this sector.

Direct and Indirect Channels in Cold Storage Operations

↳ **Direct Channels :** This is the oldest, shorter, and simpler channel of distribution, and in context of direct channels, the producer sells the product directly, without any involvement of the cold storage units. Certain perishable goods such as vegetables and fruits can also be sold directly.

↳ **Indirect Channels :** In this method, the product is passed onto the customers through intermediaries, known as cold storage operators, retailers, and agents. The various forms of this channel have been described below :

↳ **Producer -> Cold Storage Operator-> Retailer -> Customer**

It is a commonly practiced channel of distribution. It is also known as a traditional or normal channel of distribution or a two way channel process. This channel is useful for small producers with small means. The

channel is used for distributing consumable dry fruit products to customers. The common practice is that the manufacturer distributes perishable products in great quantity to cold store operators, who sell commodities to retailers in low measures. Hence, goods are sold to customers in pieces.

Producer -> Cold Storage Operator -> Agent -> Retailer -> Consumer

In this channel, a single firm sets up two or more marketing channels to gain one or more customer segment (Armstrong & Kotler, 2000). In this channel, perishable products are sold to the agent in bulk. The agent distributes perishable items to cold store operators, who again distribute it to retailers of particular goods and then the goods are sold by retailers to customers in pieces (Grover, Singh, Singh, & Kumar, 2014). This channel is suitable where the retailers are many and are geographically uncentered. This is the longest channel of distribution, and this channel is useful when the producers desire to be alleviated of the problem of distribution. This channel is usually employed in case of agricultural products.

Producer -> Retailer -> Customer

Under this channel, the producer directly distributes produce to the retailers; this distribution takes place in *mandis* and *haat* bazaars, where these perishable products directly come from farms and are sold to the retailers, who sell it to the customers (Dutta, 2011). This channel is popular for those having less time to venture into local markets. This channel is also known as administered VMS (Armstrong & Kotler, 2000), which coordinates successive stages of output and distribution, not through common ownership or contractual ties, but through the size and power of one of the parties.

The Indian Scenario

India is an agriculture - based economy. More than 52% of the available land is cultivable, compared to the global average of 11% (Subin, 2011). With reference to 2009 data, as reflected in the Table 7, our country produced an average of 96.5 thousand million tonnes of fruits and vegetables in total every year. Moreover, worldwide, India is also noted as the largest producer of milk at an average of 68.2 thousand million metric tonnes per year and normally produces 1.9 million tonnes of meat, poultry, and fish every year (Executive summary of Dr. Saumitra Chaudhuri Committee report for encouraging investment in supply chains including provision for cold storages for efficient distribution of farm products (n.d.) ; Report of Dr. Saumitra Chaudhuri Committee (n.d.)), and the country is also counted as the second largest producer of fruits and vegetables in the world as well as is the largest retail market in terms of food and grocery, which accounts for about 62% of the total market share. However, according to Khan (2005), at the present level of production, losses occurred at the rate of an average of USD 7,000 million per year , which is approximately equal to the total production of Great Britain. However, the country has the potential to become one of the world's major food suppliers, but for its incompetent cold storage and cold chain network, resulting in around 40% losses of complete agricultural production (Gyesley, 1991).

The Table 2 shows a yawning gap in cold storage capacity in various states of the country. With reference to these gaps, the demand and supply of cold storage facilities are a matter of great concern, and need to be addressed on priority. Furthermore, the Table 3 shows that the growth of cold storage industries in the year 2012 in India was 301.1 million tonnes, but at present, the cold storage facilities, which are available for only 10% of the greengrocery, result in a loss of 18-40% of the greengrocery. In the present scenario, only 2% of the greengrocery of our country is stored in temperature-controlled environment, against 8% in the Asia-Pacific sector, and 85% in case of the European nations and North-America (NMCC, 2011).

In India, an average of 35-40% of the input cost of perishable greengrocery is spent on production and handling costs due to inadequate cold storage, ineffective cold chain facilities, poor logistics, and lack in other backup support (Viswanadham, 2006). Considerably, if we see encouragement of development activity as depicted in Table 4 (National Centre for Cold Chain Development, 2012), government agencies like NHB, NHM, HMNEH,

Table 2. Cold Storage GAP Analysis

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	5	0.2	4.67
Jammu & Kashmir	7.37	0.43	6.94
Jharkhand	7.96	1.7	6.26
Karnataka	24.04	4.07	19.97
Kerala	27.71	0.58	27.13
Maharashtra	62.73	5.47	57.26
Manipur	0.8	0	0.8
Meghalaya	2.39	0.03	2.36
Mizoram	0.74	0	0.74
Madhya Pradesh	12.13	8.08	4.05
Nagaland	0.7	0.06	0.64
Orissa	18.35	2.91	15.44
Punjab	13.18	13.45	0
Rajasthan	3.91	3.24	0.67
Tamil Nadu	79.06	2.39	76.67
Tripura	1.63	0.3	1.33
UP & Uttarakhand	122.28	101.87	20.41
West Bengal	105.66	56.82	48.84
Total	**611.3**	**242.98**	**368.32**

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

Source: National Stock Exchange and Directorate of Marketing and Inspection of India (2012). Retrieved from http://nseindia.com and http://www.nccd.gov.in/PDF/ComprehensiveNote.pdf

NCDC, MoFPI, and APEDA created storage infrastructures at a rapid pace during the period from 2009 to 2012, and simultaneously, in this context, the government promoted other private agencies to set up new cold storage units with additional facilities on subsidies. Moreover, the expected size of the cold - chain market in India is expected to touch USD 8 billion latest by 2015 (India's logistics industry, 2011) through increase in investments, modernization of existing facilities, and establishment of new ventures via public - private partnership.

The Indian agricultural sector is witnessing a major shift from traditional farming to horticulture, meat, poultry and dairy products, all of which are perishable varieties. The demand for fresh and processed fruits & vegetables is increasing due to rise in urban populations and change in consumption habits. Thus, increases in demand, diversification, and value addition are the keywords in Indian agriculture nowadays. These changes, along with the emergence of an organized retail food sector, spurred by changes in foreign direct investment laws are creating opportunities in the domestic food industry, which lets in the cold chain sector. It is surprising and good to know that in India, Punjab is the state with surplus storage facilities ; while the largest gap exists in Tamil Nadu, followed by Maharashtra, and West Bengal (see Table 7). Logistics in cold storage operations assumes central roles in these progressive areas and has received special attention in recent years.

Table 3. Growth of Cold Storage Industry in India

Year	No. of Cold Stores	Installed Capacity in '000 MT
1955	83	0.43
1960	359	3.05
1965	600	6.82
1970	1218	16.38
1975	1615	19.94
1979	2266	33.48
1986	2607	54.02
2004	4748	195.52
2006	5101	216.94
2007	5316	233.34
2009	5381	244.50*
2010	**5837**	**269.03 @**
2011	**6156**	**286.82@**
2012#	**6307**	**301.1**

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

As on 01.09.2012

Source: * Directorate of Marketing and Inspection upto 2009. Retrieved from http://agmarknet.nic.in

Table 4. 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 (₹ 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**	**55.6**	**6,59.33**

*up to 31.03.2012

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), Department of Animal Husbandry and fisheries (DAHF).

Source: Comprehensive note on creation and management of cold chain infrastructure for agriculture & allied sectors (n.d.). Retrieved from http://nccd.gov.in/pdf/ridf.pdf

Research Methodology

The present study is recent in the Indian context to understand channel performance among partners integrated with cold storage units. Thus, for developing and analysis of framework, exploratory data were collected. The Table 8 shows a list of 64 cold storage units that were surveyed and interviews were carried out in all. Besides, the objective of data collection was also to identify the activities within the various systems of cold storage units and their interlinkages. In this study, we followed the interview based method, to give us an insight into channel performance and value proposition in context of customers and various other businesses involved in cold storage. As the study is exploratory in nature, we decided to focus upon the channel performance phenomenon in multiple

cold storage units and collected as much interview data as possible to conduct the study. The time period of the study is from March 2013 to June 2014.

Excerpts of Interviews with Owners of Cold Storage Units

Cold storage units basically comprise of warehousing units to store perishable products under one roof. Moreover, in cold storage units, each channel system creates a different level of revenue, reaching a different segment of target consumers. Managements of cold storage operations must make decisions on channels of distribution carefully, incorporating current needs with future prospects and the prevailing trend / environment. Some cold storage operators pay too little attention to their distribution channels, but others use imaginative distribution systems to gain competitive advantage.

The Table 2 reveals that Punjab has a sufficient number of cold storage units. However, Uttar Pradesh is the largest state in India, but in comparison to Punjab, the gap is very high as reflected. In India, changes in climate play an important role in maintaining temperature ranges of such units. The Table 5 shows differences in various elements between Punjab and Uttar Pradesh. However, both the states (in majority) have three types of cold storage units, namely: (a) potato / hard variety (requiring very low temperature) ; (b) grocery ; (c) meat.

In Punjab, goods are kept at a temperature zone of 32 degrees Fahrenheit in winters and 28 degrees Fahrenheit in summers; whereas, in Uttar Pradesh, the same is 30 degrees Fahrenheit and 31 degrees Fahrenheit, respectively. The structure of cold storage units is basically of 3 to 4 chambers, including 1 to 3 floors in each chamber. The construction of cold storage units requires special material like husk, PUF panels, and thermocol (PUF, 2013). The Table 6 shows the excerpts of the interviews with cold storage operators and the interview findings.

Analysis of the Outcome

Based on the available information extracted from the Table 6 (excerpts of the interviews), an exploratory business framework in Figure 2 was designed and is described for the cold storage operations. Subsequently, with this framework, an integrated process of storage operations can easily be understood. Moreover, in cold storage

Table 5. Analysis of Two States (Punjab & UP)

Element	PUNJAB	U.P.
Function	Automatic/ Manual Approach on Product handling	Manual approach on product handling
Temperature	32 to 34^0 F	30 to 32^0 F
Size of Bag	70 to 90 kg (Large), 25 to 50 kg (Small)	90 to 100 kg (Large), 50 kg (Small)
Loading Time	30 minutes approx	40 to 50 minutes approx
Capacity of Warehouse (2000 sq yard)	35 to 40,000 units (Inside), 50 to 60,000 units (outside)	30 to 35,000 units (Inside), 60 to 70,000 units (outside)
Peak season	January, February, & September	February to April
Packaging	As per requirement of client	Not done
Outsourcing	Labour on Contract basis	Labour on Contract basis
Distribution method	As per requirement of client	Only by client
Threat	Pest attack (Rodents)	Pest attack (Rodents)

Table 6. Excerpts of Interviews and Findings

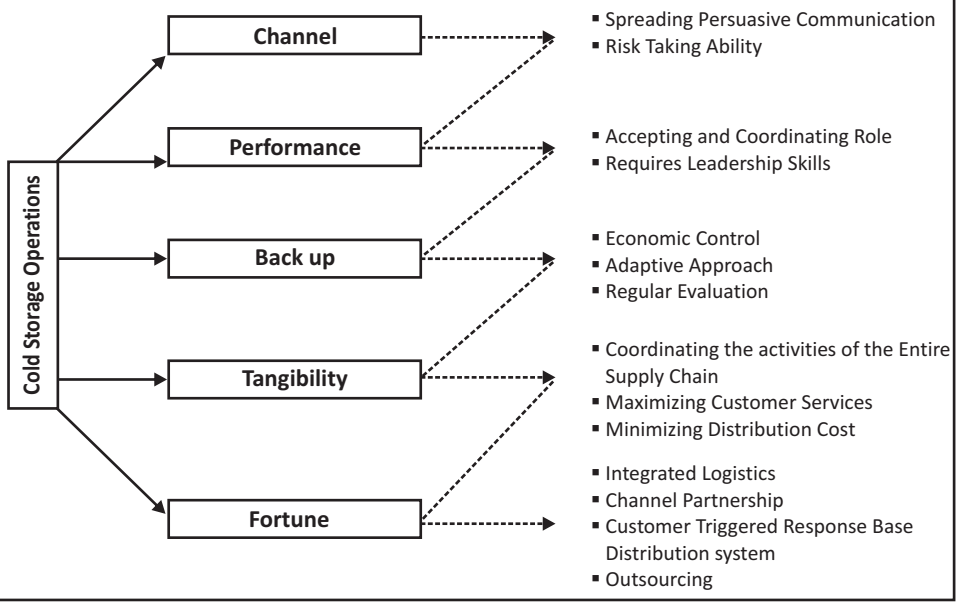
Interview Questions	Responses = 32 (Punjab)	Responses = 32 (Uttar Pradesh)
Explain why cold storage units need marketing channels and how these channels perform?	✓	✓
How channel partners interact and how they are organized to perform the work of the channel.	✓	✓
The major channel alternatives to a cold storage operation.	✓	✓
The importance of physical distribution in cold storage units.	✓	✓
How integrated logistics may be achieved and what are its benefits to the cold storage units.	✓	✓

Constructs	Dimension	Key Findings Based on Interview Response
Channel	Information, communication	Help in completing the order process by gathering and distributing information.
Performance	Contacts	Contacts help in finding and communicating, matching and fittings the offers by entering into negotiation to reach an agreement on price and other terms with prospective clients for distribution.
		Help to fulfil the completed transaction through physical distribution by offering storing of goods and transporting.
Synergy between Channel members	Co-ordination	Coordination among channel members effectively helps in serving and satisfies the particular target market.
	Leadership	Leadership helps in assigning roles and managing conflicts.
Channel alternatives	Channel design	Helps in assessment of client needs, channel objectives, and constraints; identify alternative ways, such as horizontal, vertical, and hybrid distribution systems to reach its market.
	Channel Evaluation	It helps to evaluate channel distribution on the basis of economic, control, and adaptive criteria.
Distribution	Physical Distribution	Helps in achieving potentially high cost savings and improved customer satisfaction.
		It involves coordinating the activities of the entire supply chain to deliver maximum value to customers and minimize distribution costs.
		Cold storage, logistics functions include order processing, inventory management, warehousing, and transportation.
Integrated Logistics	Achievement and Benefit	Proper teamwork helps in achievement of integrated logistics in the form of close working relationships across the functional areas in the units and across various channels outside.
	Anticipatory based distribution to Response based distribution	Channel intermediaries can initiate to have a shared project and information sharing systems. Through such partnerships, many units have switched from anticipatory based distribution to customer triggered response based distribution systems.
		Helps to save costs, increases efficiency, leads to faster gains, and more effective access to entire markets.

operations, there are two channels that work, first is the direct channel, and the second is the indirect channel. A short description about the direct channel is given at the beginning of the paper. However, this particular channel is less relevant for the present research. Thus, we will focus more on the indirect channel, since it plays a significant role in cold storage operations. The analysis part also discusses about cold storage operations through many key elements such as channel, performance, back-up, tangibility, and fortune.

↳ **Channel :** The Channel is also described as an interdependent firm involved in the process of making a product or service available for use or consumption by the consumer or business users. Moreover, in channel performance,

Figure 2. Elements and Process of a Storage Operation in CCM (Framework Based on Interviews)



key functions are gathering and distributing information, planning and aiding exchange by spreading persuasive communication, storing goods, and transportation. However, channel member interaction is effective only when each member is assigned the tasks it can do best.

↳ **Performance :** It is necessary to understand that these channel members must accept their responsibility to coordinate their goals and activities and comply with the same to attain overall channel goals. Traditionally, these distribution channels have lacked in assigning roles and manage conflict in cold chain management. However, in the future, new type of channel organizations have to appear strongly on leadership along with improved performance.

↳ **Back-Up :** In channel distribution, channel alternative has an importance over channel cooperation, competition, and conflict. The cold storage units then identify the channel alternative in terms of the type of intermediaries and must be evaluated on the ground of economic control and adaptive criteria and hence, these individual channel members must be evaluated regularly.

↳ **Tangibility :** Physical distribution or marketing logistics are getting much attention from cold storage units these days. Despite the activities of the entire supply chain, marketing logistics need to deliver maximum value to customers and its goal is to provide a targeted level of service at minimum costs.

↳ **Fortune :** Fortune is entirely interdependent on integrated logistics, channel partnership, outsourcing, and customer triggered response based on the distribution system through partnerships and information sharing systems that focus on teamwork and improved close working relationships both inside and outside the unit to maximize the performance of the entire distribution system.

Table 7. Commodity Wise Distribution of Cold Storages in Various States of India

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

Source: Reproduced from Commodity wise distribution of cold storages as on 31.12.2009. Retrieved from http://agmarknet.nic.in/commcold3112009.htm

Table 8. List of Surveyed Cold Storage Units in Punjab & Uttar Pradesh

S.No	Name	Location	Capacity in MT	Sector	Product stored
	In State of Punjab				
1	Shah Cold Storage	Amritsar	3840	Private	Multipurpose
2	Kissan Cold Storage	Amritsar	5687	Private	Multipurpose
3	Nijjar Horticulture Ltd.,Nijar Farms, P.O. Jandiala,Gurut	Amritsar	2280	Private	Multipurpose
4	Hargovind Cold Storage ,Guniyara Road	Bhatinda	2800	Private	Multipurpose
5	India Cold Storage & Ice Factory, Pakhra	Bhatinda	2560	Private	Multipurpose
6	Canary Cold Storage, Bhatinda	Bhatinda	2690	Private	Multipurpose
7	Harnam Cold Storage	Bhatinda	8000	Private	Multipurpose
8	Sawan Cold Storage	Bhatinda	5200	Private	Multipurpose
9	Anil cold Storage Pvt. Ltd.	Bhatinda	3582	Private	Multipurpose
10	Dhawan Cold Storage	Faridkot	2400	Private	Multipurpose
11	J.S. Cold Storage	Fatehgarh Saheb	2800	Private	Multipurpose
12	S.M. Cold Warehome (P) Ltd.	Jallandhar	4000	Private	Multipurpose
13	Doaba Cooperative Milk	Jallandhar	350	Private	Milk Product
14	Dheeraj Cold Storage	Jallandhar	4218	Private	Multipurpose
15	Ladhar Cold Storage	Jallandhar	4000	Private	Multipurpose
16	Toor Agro Cold Storage	Jallandhar	3600	Private	Multipurpose
17	Tara Cold Storage	Kapurthala	3500	Private	Multipurpose
18	Jagrao Co-op cum Processing Society & Cold Store	Ludhiana	1600	cooperative	Multipurpose
19	Fateh Cold Store	Ludhiana	8192	Private	Multipurpose
20	Ramkripa Cold Storage	Ludhiana	2240	Private	Multipurpose
21	Machchiwara Agro Cold Storage Pvt Ltd.	Ludhiana	3200	Private	Multipurpose
22	Kwality Ice cream & Company	Ludhiana	10240	Private	Milk Product
23	Kakkar Cold Store	Ludhiana	4724	Private	Multipurpose
24	Khaila Cold Storage	Mausa	2400	Private	Multipurpose
25	Govind Cold Storage	Moga	2800	Private	Multipurpose
26	Gagan Cold Storage	Moga	2000	Private	Multipurpose
27	Brar Cold Storage	Moga	3040	Private	Multipurpose
28	Maan Cold Storage	Patiala	2968	Private	Multipurpose
29	Multipurpose Cold Storage	Patiala	4800	Private	Multipurpose
30	Manav Cold Storage	Patiala	4166	Private	Multipurpose
31	Baba Shiva Papers	Patiala	2240	Private	Multipurpose
32	Rakesh Agro Tech	Patiala	1744	Private	Multipurpose

	In State of Uttar Pradesh				
33	Mishra Cold Storage	Hardoi	3970.583	Private	Multipurpose
34	R.M. Sheetgrah	Hathras	6749.938	Private	Multipurpose
35	Devraha Bawajee & Cold Storage	Hathras	7027.51	Private	Multipurpose
36	Maa Bhagwati Ice & Cold Storage	Hathras	7576.71	Private	Multipurpose
37	Bholenath Sheetgrah P Ltd.	Hathras	7318.425	Private	Multipurpose
38	Shri jai Shiv Durga & Dhamodra Sheetgrah Pvt. Ltd	Firozabad	7078.51	Private	Multipurpose
39	Marutinandan Cold Storage Pvt. Ltd.	Firozabad	7209.587	Private	Multipurpose
40	Laxmi Sheetgrah Pvt. Ltd.	Firozabad	5830.13	Private	Multipurpose
41	Sri Hubb Lal Sheetgrah Pvt. Ltd.	Firozabad	7464.729	Private	Multipurpose
42	R.K. Cold Storage	Firozabad	6653.912	Private	Multipurpose
43	M/s Neeraj & Durga & Dheeraj Onion, Godown	Azamgarh	447.15	Private	Multipurpose
44	M/s Gorlia Agro Storage Pvt. Ltd.	Mathura	5614.84	Private	Multipurpose
45	Shree Durga Ice & Cold Storage	Agra	5127.262	Private	Multipurpose
46	M/s Kalaji Sheetalgarh Pvt. Ltd.	Agra	7306.035	Private	Multipurpose
47	Shushila Ice & Cld Storage P. Ltd.	Agra	6429.24	Private	Multipurpose
48	M/s Ram Kripa Cold Storage P. Ltd.	Agra	6575.494	Private	Multipurpose
49	Keswalwa Cold Storage	Ghazipur	4840.55	Private	Multipurpose
50	Shri Gurukripa Sheetalaya P. Ltd.	Ghazipur	8904.044	Private	Multipurpose
51	GG Ice & cod Storage Pvt. Ltd.	Aligarh	6611.39	Private	Multipurpose
52	Sanjay Ice & Preservation India Pvt. Ltd.	Aligarh	6361.26	Private	Multipurpose
53	M/s Satish Cold Storage	Kannauj	9267.279	Private	Multipurpose
54	Mishra Cold Storage	Mau	5905.059	Private	Multipurpose
55	Maa Poomagiri Sheetgrah P Ltd.	Etahwah	7032.556	Private	Multipurpose
56	M/s Shabnam Cold Storage	Etahwah	2322.608	Private	Multipurpose
57	Rura Cold Storage & Ice Factory Pvt. Ltd.	Kanpur	6302.4	Private	Multipurpose
58	M/s RPS Cold Storage Pv Ltd.	Kanpur	10247.609	Private	Multipurpose
59	Maa Sharada Devi Ice & Cold Storage	Kanpur	7144.971	Private	Multipurpose
60	M/s Rajwati Porush Sheetgrah Pvt. Ltd.	Kanpur	6031.118	Private	Multipurpose
61	Himalaya Cold Storage & Iron Industries	Allahabad	1122.263	Private	Multipurpose
62	Jamidar Cold Storage Pvt. Ltd.	Pratapgarh	5117.647	Private	Multipurpose
63	Pahlawal Ice and Cold Storage P. Ltd	Pratapgarh	6187.788	Private	Multipurpose
64	R.K. Cold Storage	Shahijaharpur	2232	Private	Multipurpose

Conclusion and Implications

Indian cold storages need a major impersonation of character for achieving cost effective operations for user industries like retail, consumer goods, pharmaceuticals, and food & beverages. However, examining the marketing channels shows the following interdependent factors, which shape the cold storage industry :

(a) Expand & Consolidate : Mergers and acquisitions of units are leading to formation of entities having the capability to provide a single point of contact to manage the supply chain for their clients. Expansion of traditional business is driving the logistics industry to address considerations like market expansion, new sources of supply, global trade, and so forth.

(b) Increased Outsourcing : Cold storage units are utilizing logistics outsourcing more and more in order to increase flexibility and responsiveness in their supply chain. Cold chain management is getting increasingly complex to manage, and operators are focusing on core competencies.

(c) Security and Risk Management : Cold chain security and risk management will be a key area to prevent disruption due to factors like weather, labour issues, power shortages, and poor infrastructure.

(d) Technological Advancements : Rapid advancement in RFID enabled cold chain technology has lead to increased functionality and greater potential to improve performance of cold chains.

The need of the hour is upgrading the logistics infrastructure to world class standards. Opportunities and a facilitative role needs to be provided to SME players in the cold chain sector to improve their services and level of competitiveness. Government initiatives to encourage investment in cold storage operations like development of infrastructure buildings, transport operations, loan facilities, and so forth (Surange, 2013) will further lead to greater demand for logistics services. All together, cold storage management is an important part of cold supply chain management.

This paper provides necessary inputs to pertinent decision makers, stakeholders, and budding entrepreneurs to calibrate the strategy components that can possibly augment the overall business in the competitive business milieu. Moreover, it will help in strengthening the current level of services to satiate the customers. Marketing strategy in cold chain logistics services has led to growth, and the cold chain management industry will continue to expand in the upcoming years. This paper is an exploratory research aimed at gaining insights into the problems, challenges, and opportunities integrated in cold storage management with specific reference to the channel distribution phenomenon, which is also a limitation of the study. The outputs of this study may be empirically validated through conclusive research.

References

A.T. Kearney. (2005). *China cold chain is heating up*. Retrieved from http://www.atkearney.com/documents/10192/5c547263-b227-431b-b96e-3c69a3a7307f

Armstrong, G., & Kotler, P. (2000). *Marketing: An introduction* (5th edition, pp. 365 - 366). Upper Saddle River: NJ: Prentice Hall.

Baldiwala, Q. (2001). Developing a global supply chain. *Logistics Spectrum, 35* (4), 25-29.

Bogataj, M., Bogataj, L., & Vodopivec, R. (2005). Stability of perishable goods in cold logistic chains. *International Journal of Production Economics, Volumes 93 - 94*, 345-356. DOI: 10.1016/j.ijpe.2004.06.032

Brewer, A. M., & Hensher, D. A. (2001). Identifying the overarching logistics strategy of business processes: An exploratory analysis. *International Journal of Logistics Research and Applications : A Leading Journal of Supply Chain Management, 4* (1), 1- 41. DOI: 10.1080/13675560110037717

C H Robinson Worldwide /Iowa State University. (2001). *Temperature controlled logistics report 2001-2000* (pp. 22 - 47). C H Robinson Worldwide, Iowa State University, Eden Prairie, IA.

China Bio/Pharmaceutical and Clinical Supply Chain Convention. (2013). *Article on cold supply chain management, China*. Retrieved from http://www.clinicaltrialssupply.com/Event.aspx?id=790390

Commoditywise Distribution of Cold Storage as on 31.12.2009. (2009). Retrieved from http://agmarknet.nic.in/commcold3112009.htm

Comprehensive note on creation and management of cold chain infrastructure for agriculture & allied sectors (n.d.). Retrieved from http://nccd.gov.in/pdf/ridf.pdf

Da Silva, C. A., & Filho, S. M. D. (2007). *Guidelines for rapid appraisals of agri - food chain performance in developing countries*. Agricultural management, marketing and finance occasional paper. FAO, Rome. Retrieved from www.fao.org/AG/agS/publications/docs/AGSF_OccassionalPapers/agsfop20.pdf

Directorate of Marketing and Inspection. (2009). Retrieved from http://agmarknet.nic.in

Dutta, P.K. (2011). Agricultural rural marketing in India. *Indian Journal of Marketing, 41* (7), 9-19.

Executive summary of Dr. Saumitra Chaudhuri Committee report for encouraging investment in supply chains including provision for cold storages for efficient distribution of farm products. (n.d.). Retrieved from http://www.nccd.gov.in/PDF/DrSaumitraChoudhuriCommitteereport1.pdf

Gilmour, B., & Cheng, G. (2004). Enabling China's Agri-Food Sector: Responding to Challenges with foresight, infrastructure, institutional and enterprise reform. *Pacific Food System Outlook*. Retrieved from http://www.pecc.org/resources/infrastructure-1/368-enabling-chinas-agri-food-sector-responding-to-challenges/file

Grover, D.K., Singh, J.M., Singh, J., & Kumar, S. (2014). Impact of emerging agribusiness establishments on potato marketing in Punjab. *Indian Journal of Marketing, 44* (6), 37-50.

Gyesley, S. W. (1991). Total systems approach to predict shelf life of packaged foods. *ASTM STP*, pp. 46-50.

Henstra, D., & Woxenius, J. (1999). *Intermodal transport in Europe*. Report within the EU-project, TRILOG Europe, TNO Inro, Delft.

India's logistics industry. (2011, May 13). Retrieved from http://www.taiwantrade.com.tw/MAIN/en_front/searchserv.do?setLangCode=en&method=listNewsDetail&information_id=33846&locale=2

Joshi, R., Banwet, D. K., & Shankar, R. (2010). Consumer link in cold chain: Indian scenario. *Food Control, 21* (8), 1137-1142. DOI: 10.1016/j.foodcont.2010.01.008

Khan, A. U. (2005, September). The domestic food market: Is India ready for food processing. *In Conference on SPS towards Global Competitiveness in the Food Processing Sector* (Vol. 5). Retrieved from http://www.idfresearch.org/pdf/dommarket.pdf

Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial Marketing Management, 29* (1), 65-83. DOI: 10.1016/S0019-8501(99)00113-3

Lan, W. (2008, October). A research on related questions of Chinese food cold chain development. In *Management of e-Commerce and e-Government, 2008, ICMECG'08*. (pp. 18-21). IEEE. DOI: 10.1109/ICMECG.2008.76

Likar, K., & Jevšnik, M. (2006). Cold chain maintaining in food trade. *Food Control, 17* (2), 108-113. DOI: 10.1016/j.foodcont.2004.09.009

McKinnon, A.C. (1989). The growth of road freight in the UK. *International Journal of Physical Distribution and Materials Management, 19* (4), 3-13. DOI : http://dx.doi.org/10.1108/EUM0000000000312

McLean, D. (2009). *Cold chain shipping: Protecting temperature sensitive products*. Retrieved from http://www.pda.org/Chapters/North-America/Metro/Presentations/Cold-Chain-Shipping--Protecting-Temperature-Sensitive-Products-Diane-McLean-102-MB.aspx

Melo, M. T., Nickel, S., & Saldanha-da-Gama, F. (2009). Facility location and supply chain management : A review. *European Journal of Operational Research, 196* (2), 401-412. DOI: 10.1016/j.ejor.2008.05.007

Montanari, R. (2008). Cold chain tracking: A managerial perspective. *Trends in Food Science & Technology, 19* (8), 425-431. DOI: 10.1016/j.tifs.2008.03.009

National Centre for Cold Chain Development. (2012). *Comprehensive note on creation and management of cold chain infrastructure for agriculture & allied sectors*. Retrieved from http://nccd.gov.in/PDF/ComprehensiveNote.pdf

National Manufacturing Competitiveness Council (NMCC). (2011). *Methodology for measuring the logistics cost for major manufacturing exports and assessing its impact on their competitiveness.* Retrieved from http://nmcc.nic.in/pdf/NMCC_FinalReport_June2011.pdf

National Stock Exchange and Directorate of Marketing and Inspection of India. (2012). Retrieved from http://nseindia.com and http://agmarknet.nic.in

PUF. (2013). *PUF application in cold storages*. Retrieved from http://www.acme.in/defence/puf-applications.html

Rangasamy, N. (2013). Performance of agri-warehousing in Maharashtra and market potential for negotiable warehouse receipts finance in India. *Indian Journal of Marketing, 43*(12), 5-11.

Rathore, J. (2013). Cold chain management for perishable food: Issues and scope for India. *The IUP Journal of Supply Chain Management, 10* (1), 7-14.

Report of Dr. Saumitra Chaudhuri Committee. *Action to be taken by various departments/organisations*. (n.d.). Retrieved from http://www.nccd.gov.in/PDF/DrSaumitraChoudhuriCommitteereport2.pdf

Ruijgrok, C. E. E. S. (2001). European transport: Insights and challenges. In A.M. Brewer, K. J. Button, & D. A. Hensher (Eds.), *Handbook of logistics and supply chain management* (pp. 29-46). Amsterdam : Elsevier.

Samant, Y., Lanjewar, H., Parker, D., Block, L., Tomar, G. S., & Stein, B. (2007). Evaluation of the cold-chain for oral polio vaccine in a rural district of India. *Public Health Reports, 122*(1), 112 - 121.

Saravanan, S. (2012). Problem of vegetable producing farmers in Erode, Coimbatore and Tiruppur districts of Tamil Nadu. *Indian Journal of Marketing, 42*(10), 22-30.

Sterling Solutions. (2013). *Cold chain management*. Retrieved from http://www.sterlingsolutions.net/index.php?option=com_content&view=article&id=13&Itemid=71

Subin, R. (2011). *Country: India's cold chain industry*. Retrieved from https://www.iaccindia.com/userfiles/files/India's%20Cold%20Chain%20Industry.pdf

Surange, A. (2013). *Cold chain development in India - Modernization of the infrastructure of cold storage of perishables*. Retrieved from http://acrconsultants.net/pdf/Cold%20chain%20development%20in%20India%20for%20Colombia%20R3.pdf

Van Donselaar, K., van Woensel, T., Broekmeulen, R. A. C. M., & Fransoo, J. (2006). Inventory control of perishables in supermarkets. *International Journal of Production Economics, 104* (2), 462-472. DOI: 10.1016/j.ijpe.2004.10.019

Viswanadham, N. (Ed.) (2006). Can India be the food basket for the world? In *Achieving rural & global supply chain excellence : The Indian Way* (pp.3-13). Retrieved from http://lcm.csa.iisc.ernet.in/nv/Mypublications/Books/GLAMSBook.pdf#page=13

Way2Wealth. (2008, April 15). *Indian processed food industry: Opportunities galore*. Retrieved from http://way2wealth.com/reports/RR150420084.PDF

Xia, Z. Y. (2007). Study of countermeasures relating to developing food cold chain logistics. *Logistics Sci-Tech, 16* (7), 137 - 139.

Yu, M., & Nagurney, A. (2013). Competitive food supply chain networks with application to fresh produce. *European Journal of Operational Research, 224* (2), 273-282. DOI: 10.1016/j.ejor.2012.07.033