

COLD CHAIN MANAGEMENT
INDIA-SINGAPORE INITIATIVE

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1. INTRODUCTION

The main aim of this paper is to explore synergies for business collaboration between businesses in Singapore and India in the area of cold chain management. India is a fast growing economy with a large agricultural base. But lack of transport infrastructure, cold chain facilities and non-application of supply chain management principles is making the agri-business in general and the food processing sector in particular very inefficient. Recognizing this, the Government of India has initiated several steps including creation of a separate ministry for food processing industries, opening up the agriculture sector for foreign direct investment through the agri export zones and special economic zones, and in several other ways. India aims to be the food factory of the world and increase its share in global food trade from 1% to 3%.

Singapore is a leading sea cargo and air cargo logistics hub. It has world class logistics as well as IT infrastructure. Several leading third party logistics providers and supply chain software vendors have headquarters in Singapore. Over the years, Singapore has also developed a good knowledge base in logistics and supply chain management. Also it has competencies in the cold chain management particularly in the storage and transport of food items and in managing their supply and demand networks. There are players with expertise in cold chain logistics, food retailing, refrigerated transport, temperature controlled container handling in the airport and sea port. Also some companies have

developed standards for dairy and meat, and training courses in cold chain logistics. Proof-of-concept tests are now going on for use of RFID in the food supply chain. Thus, Singapore companies have world class expertise in the area of cold chain logistics and Food supply chain management.

Singapore and India enjoy a very friendly political and economic relationship and Singapore has already a good presence in India. Singaporean investments in cold chain projects in India look mutually beneficial. In this report, we outline several possible joint initiatives between India and Singapore in the area of cold chain management. High growth prospects for the food processing industry along with attractive government incentives make cold chain business in India a lucrative proposition for foreign investors.

There are several models possible for Singapore companies investing in India. Foreign participation in this business can take any of the following forms:

- Joint Venture with a Local Company
- Investment In Public-Private Partnership Projects
- Investment in an Agri export zone
- Investment in a Special Economic Zone
- Government lead consortium
- Technical Collaboration

In the rest of this document we identify emerging opportunities in the food and cold chain sector in India and present ways in which existing market challenges in India can be overcome using technology and experience, available through Singaporean companies. In particular, we identify opportunities for collaborative efforts in Real estate and cold chain infrastructure, Establishing food processing plants, Wholesale, Retail, Third party logistics and Technology.

In Section 2, we discuss the current state of the agricultural sector in India, followed by a discussion on the Indian food processing industry Section 3. Subsequently, in Section 4, we present the current challenges facing the food sector and summarize the state of cold chain and retail sectors in India. We study the initiatives promoted by the Government and the Private sector in Sections 5, and 6. In Section 7, we highlight Singapore's strengths and expertise in the cold chain sector and demonstrate in Section 8 how these might be deployed in India through collaborative arrangements with Indian companies. We wrap up our analysis with conclusions presented in Section 9 and References in Section 10.

For the interested reader, we also present in Appendix A an overview of the various elements that have to come together to implement an effective and efficient food supply chain cluster.

2. INDIAN AGRICULTURAL INDUSTRY: CURRENT STATE

India is the fastest growing free-market democracy in the world with a record high 8.2% GDP growth in the year ended March 31, 2004. Agriculture grew by 9.1% in the year, Manufacturing, which had posted a healthy 6.7% rise in 2002-03, grew by 7.3% in 2003-04. Other sectors with more than 5% growth included electricity, gas and water supply (5.5%); construction (6.2%); trade, hotels, transport, real estate and business services (6.8%); community, social and personal services (6%). Further, the Foreign exchange reserves have grown to over US\$ 120 billion (July 2004).

In India, 52% of total land is cultivable as against 11% in the world. All 15 major climates of the world, snow bound Himalayas to hot humid southern peninsula; Thar Desert to heavy rain areas all exist in India. There are 20 agro-climatic regions and nearly 46 out of 60 soil types in the country. Sunshine hours and day length are ideally suited for round the year cultivation of crops. India is the centre for biodiversity in plants, animals, insects, micro-organism and accounts for 17% animal, 12% plants and 10% fish genetic resources of the globe. In the live

stock sector, India has 16% of cattle, 57% of buffalo, 17% of goats and 5 % of sheep population of the world. Agriculture contributes 24.2% to GDP, 15.2% of total exports and provides employment to 58.4% of country's work force.

India is an agro based country and as per the recent FICCI report of October 2004 [1], is the

- Second highest fruit and vegetable producer in the world (134.5 million tones) with cold storage facilities available only for 10% of the produce.
- Second highest producer of milk with a cold storage capacity of 70,000 tonne.
- Fifth largest producer of eggs. Investments in cold chain required to store 20% of surplus of meat and poultry products during 10th plan requires Rs 500 Crore (US\$ 100M)
- Sixth largest producer of fish with harvesting volumes of 5.2 million tones. Investment required is estimated to be Rs 350 Crore (US\$ 70M)

In the next ten years, food production is expected to double. These produces, if processed and marketed smartly, can make India a leading food supplier of the world. In spite of the vast natural resources and abundant agricultural produce India ranks below 10th in the export of food products. The single most important problem facing the Indian agricultural industry perhaps is the very inefficient supply chain. By building an efficient and effective supply chain using current day management techniques it is possible to serve the population with value added food while simultaneously ensuring remunerative prices to the farmers. The surplus production of cereals, fruits, vegetables, milk, fish, meat and poultry etc., can be processed as food products and marketed aggressively both locally and internationally.

The sixties witnessed the beginning of the green revolution in some parts of India. In Punjab, Haryana and western Uttar Pradesh, agricultural output per hectare rose markedly due to the enhanced canal and well irrigation, widespread adoption

of new and improved seed varieties, enlarged inputs of chemical fertilizers and use of pesticides. However, limited growth was registered in the development of post harvesting technologies, transport of perishables, food processing, and food marketing areas in all sectors including marine products, fruits and vegetables, flowers etc. Despite the surpluses and 20-30% wastages of raw fruits and vegetables, the levels of processing that will increase the shelf life and also add value has been low. Conservative estimates put processing levels in the fruits and vegetables sector at 2%, meat and poultry at 2%, milk by way of modern dairies at 14%, fish at 4%, bulk meat de-boning is to the tune of 21%. In the areas of food grains, oilseed, tea, coffee, etc. a higher percentage of raw products are processed. Currently, the food processing sector, though in the nascent stage, constitutes 14% of manufacturing GDP amounting to products value of Rs.2, 80,000 Crores. It employs 130 lakh persons and is supposed to increase at an annual rate of 7%.

India does not have a comprehensive cold-chain network. Even the few existing cold storages are found to be under-utilized. Also, refrigerated transportation as a system is almost non-existent in India. The farmers use mostly open trucks to send their produces to the mandis at a high percentage loss, probably because of the high cost of refrigerated transport. This is a big opportunity for infrastructure builders, cold chain operators, logistics companies and food manufacturers both from inside and outside of India for investment.

Retailing, one of the largest sectors in the global economy (USD 7 Trillion), is going through a transition phase in India. Retail sales (Estimated at Rs7, 400 billion in 2002) expanded at an average annual rate of 7% during 1999-2002. With the upturn in economic growth during 2003, retail sales are also expected to expand at a higher pace of nearly 10%, a large chunk of consumer expenditure is on basic necessities, and especially food related items. Hence, it is not surprising that food, beverages and tobacco accounted for as much as 71% of retail sales in 2002. The remaining 29% of retail sales are non-food items. Sales through supermarkets and department stores are small compared with overall retail sales.

However, their sales grew much more rapidly (about 30% per year during the last few years). As a result, their sales almost tripled during this time. This high acceleration in sales through modern retail formats is expected to continue during the next few years with the rapid growth in numbers of such outlets in response to consumer demand and business potential

In India 100 % FDI in retailing is not allowed. But foreign retailers can operate in India through joint ventures, where the Indian partner is a export house, franchising/local manufacturing/sourcing from small-scale sector, or cash and carry operator. A liberal FDI policy on investments in the retail sector will not only benefit the consumer and create job opportunities for many but also lead to upgradation of its agriculture and food processing sectors. In short, the food processing as well as the food retail sector will go through radical changes in the near future and provides immense business opportunities for local as well as international players.

The Indian agriculture industry suffers from the ancient mind set and produces are not cropped for demand but are cropped from history. Thus farmers try to push what they produce rather than produce to the quality and quantity demands of a particular industry customer or for a particular market. In the process, they suffer huge uncertainty and losses. The situation is slowly changing with the springing up of Agri export zones and also with the emergence of contract farming. Certain items such as tea, coffee, grapes, etc are treated as industrial products. But this is not enough and the quality and quantity revolution need to sweep through the entire agribusiness. Furthermore, the post harvest technology research and best practices for storage, transport, and handling need to be developed. Currently, farmers are anxious to sell their produce at whatever price before it perishes and the market dealers factor the cost of wastage in to their pricing. The result is higher price to the consumer and lower yield to the farmer.

3. INDIAN FOOD PROCESSING INDUSTRY

The Food processing industry has an important role to play in linking the farmers to the final consumers in the domestic as well as the international markets. A strong and dynamic food processing sector thus plays a vital role in diversification and commercialization of agriculture, ensures value addition to the agricultural produce, generates employment, increases shelf life, enhances income of farmers and creates surplus for export of agro-foods. Food processing combined with marketing has the potential of solving the basic problems of agricultural surpluses, wastages, rural jobs, and better remuneration to the growers. This industry also generates significant employment not only in the production line but all along the supply chain: storage of produce, distribution and in retailing. It is expected [6] that by 2008, the food processing industry would reach Rs 250,000 Crores or USD 50 Billion. It is currently at INR 200,000 Crores.

The Indian Government gives considerable importance to the food-processing sector. The Ministry of Food Processing Industries is concerned with the formulation and implementation of the policies and plans for the Food Processing Industries within the overall national priorities and objectives. Besides the Ministry of Food Processing Industries there are various other organizations like Agricultural and Processed Food Products Export Development Authority (APEDA), Marine Products Export Development Authority (MPEDA) and National Horticulture Board which are under different Ministries dealing with the food processing sector.

India with a population of 1.08 billion (growing at about 1.7 % per annum) provides a large and growing market for food products. Food products are the single largest component of private consumption expenditure, accounting for as much as 49% of the total spending. Furthermore, the upward mobility of income classes and increasing need for convenience and hygiene is driving demand for (a) perishables and non food staples and (b) processed foods. Also, eating out is a booming practice in urban India and processed foods are accepted as alternative to

the home cooked food because of the convenience it offers. Also, with the globalization of trade and availability of high speed logistics, food retailers in developed countries are sourcing an year-round supply of fruits and vegetables from developing countries. Thus, both for local consumption as well for export there is an year round opportunity for fruits and vegetables, meat and poultry products and ready to eat processed foods.

The processed food industry should introduce innovative new products of high quality at low cost in small package sizes in ready to eat format to cash on this booming opportunity. HLL, ITC, MTR and others have introduced some innovative heat and eat dishes with reasonably good packaging. But there is lots of manual handling and hence food hygiene and quality are suspect. Multinational companies have entered the food value chain in India, Cargill and Conagra in agri-inputs, Tropicana in food processing and Metro in wholesaling. Local companies like Dabur, MTR, ITC, Godrej, and Amul are aggressive across the value chain. Multiple restaurant chains such as McDonalds, Pizza Hut, Dominos, Coffee day, Qwiky's and Saravana Bhavan, and Sagar Chains are growing rapidly. However, the pace is slow in the food sector compared to the other sectors such as IT and Pharma. There are no billion dollar players in India in the food industry where as China and Philippines have several large players with sales exceeding US \$ 1 billion.

India has a huge opportunity to become a leading global food supplier if only it has the right marketing strategies and of course agile, adaptive and efficient supply chain. India has diversity in terms of its population with several religious groups with different food habits and culture. This diversity should be used to advantage to become the “Halal Food Hub”, the “Organic food hub”, the “Vegetarian food hub” the “Sea food hub” among others. We look at some of the initiatives below.

3.1 Value added Food Export

There is a high demand, both locally and internationally, for food products such as rotis, subzis, rice preparations, pickles, etc that are central to the Indian palate. The taste, quality and freshness are critical in these products which are traditionally cooked at home. Developing these products, mass producing them, packaging them for distribution, storage and convenient use and finally marketing them requires significant effort. India should take advantage of this huge opportunity. Global retailers such as Tesco have announced their decision to source food from India.

3.2 Organic Food hub

India is well suited for organic farming since only 30% of India's total cultivable area is covered with fertilizers where irrigation facilities are available and in the remaining 70% of arable land, which is mainly rain-fed, negligible amount of fertilizers is being used. Farmers in these areas often use organic manure as a source of nutrients that are readily available either in their own farm or in their locality. The northeastern region of India with 18 million hectare of such land provides considerable opportunity for organic farming due to least utilization of chemical inputs. With the sizable acreage under naturally organic/default organic cultivation, India has tremendous potential to grow crops organically and emerge as a major supplier of organic products in the world's organic market[14].

There is an Indian government initiative in the organic food sector. Also there are several companies in the ready to eat food sector. There are no initiatives in place from the Indian government for creating a vegetarian hub, a halal hub or a sea food hub. Such initiatives will help direct the resources towards a business objective of produce goods for specific market segments.

The processed food sector is facing serious problems in obtaining finances for the projects. The food processing industries are considered high risk investments with a long gestation period and small returns. As a result, the projects in this sector

are not favorites of the financial institutions. Considering the demands from the industry and keeping in view of the vast potential of the growth of the agro-processing sector, the Government has included agro-processing sector within the definition of 'Priority Sector for bank lending'.

From our discussions and studies on the food processing sector, we also find the following additional lacunae which need immediate attention and correction. The Government need to

- a. Set up laboratory scale processing plants to enable the food manufacturers to test their new products as well as the development processes.
- b. Develop manufacturing processes for some of the products such as breakfast cereals using dry fruits and vegetables by reverse engineering.
- c. Evolve certification processes for Halal, Vegetarian and Organic foods.
- d. Developing food packaging materials is a priority issue. Currently good packing materials are imported at high cost and high import duty. The consequence of this is the high cost of the processed food items.
- e. Currently, the processed food is treated as an elitist item by the government and the taxes are high (8-16%). The mass production of the processed food items and their distribution in the rural areas need to be encouraged. Reduction of the taxes is also a necessity.

4. INEFFICIENCIES IN THE FOOD SUPPLY CHAIN: CHALLENGES & SOLUTIONS

The agriculture and food sector faces several challenges which make it difficult to meet the high demand both from domestic and international consumers. A long and fragmented supply chain is the single largest bottleneck facing the sector. In addition, lack of awareness of correct harvesting techniques, lack of post-harvest infrastructure, a complex distribution chain, non-availability of appropriate packaging technology and lack of communication between various stake holders make the supply chain very inefficient. Comprehensive supply chain solutions are

imperative to achieving sustainable development of the food processing sector in India.

The present system has 5 to 6 intermediaries between the farmers and the retailers.[11] The main markets for this produce are village markets, wholesale markets, assembly markets and terminal markets. Margins and markup in this long marketing chain are very high. Further the unorganized and unscientific handlings of the produce along the chain results in substantial wastage. These factors increase the cost without any value addition. The wastage is estimated to be approximately 50% and the mark up is approximately 100% of the farmer's price. Therefore, it is important that the entire chain from farmers to the retailers is managed in an integrated manner. This should be based on principles of supply chain management. wherein various activities will be interlinked to provide best possible solution through R & D, better harvesting techniques, contract farming, processing, pre-cooling cum cold storage and other processing infrastructure with an aim to assure regular supply to food processing units retail outlets through coordinated logistics.

There are several advances in industrial supply chains which can be applied to the food supply chain. Using IT, the visibility of the product journey through the supply chain can be increased to reduce the lead time, cost, inventories and also wastage. There are attempts to bring awareness of the benefits of use industry supply chain practices to the farming sector. Recently the National Task Force on Food Processing (NTFFP) has laid out a supply-chain management structure that combines models of corporations like Hindustan Lever Ltd (HLL) and ITC, Colamajors like Coke and Pepsi and co-operative success stories like Amul from the Gujarat Co-operative Milk Marketing Federation (GCMMF) and 'Safal' from the National Dairy Development Board (NDDB).

4.1 State of cold chain in India

With a warm tropical climate for most of the year, high ambient temperature and high humidity conditions, preservation techniques involving pre-cooling at the farm level, low temperature storage and refrigerated transportation system are mandatory in India for slower aging, extending shelf life and inhibiting the growth of spoilage organisms. The transportation of produces from farm to pre-coolers, pre-coolers to cold storages and cold storages to market place are very crucial cold chain links. Refrigerated transportation ensures that the produce is transported under the required conditions. Unfortunately, as pointed in the FICCI report [1], India does not have a comprehensive cold-chain network. More than 50% of produce is transported using bullock carts or trucks with no packaging or packaged in gunny bags. Also most of the transportation is done in un-refrigerated open trucks. The farmers resort to this means at the cost of a high percentage loss probably because the price they get from the wholesalers hardly covers the cost they incur in refrigerated transport.

Lack of cold chain infrastructure breeds lots of inefficiencies [FICCI report (1)]:

- About 20 per cent of all foods produced in India (Rs. 500 b) are wasted -- six times the food subsidies
- The producer's share in the domestic consumer's retail price is only 25 % where as it is 50% in developed countries
- Only 25 % of food grains use modern storage facilities
- Annual post-harvest losses are estimated to total 10 % of total food grain production, which equals Australia's annual food grain production.
- India produces a wide range of both tropical and temperate fruits and vegetables. But only less than 2 % of these are processed and more than 25% is lost as "wastage"

Good cold chain management should result in the consumer receiving fresh and high quality products, leading to greater customer satisfaction and increased demand. The export of fresh produce often involves long journey times and frequent handling. This makes effective cold chain management more difficult since the breakdown in temperature control at any stage will effect the final quality of the product. Tighter temperature controls are mandatory to ensure the product offered for final sale retains maximum freshness.

The biggest hurdle in the way of India becoming a global food export hub is its inability to provide quality infrastructure, which is available in other competing locations[2,3,8]. Foreign investors rate power facilities and roads as ‘bad’ in India. With regard to other infrastructure facilities such as water, transport, airports and ports the foreign investors also have expressed their dissatisfaction. There are isolated attempts to correct the situation. For example, the Indian Railways has started investing in special refrigerated carriages. Container Corporation of India is also setting up a nation-wide cold storage chain. By 2005, there will be three controlled atmosphere stores operational in Delhi, Mumbai and Bangalore with a combined capacity of 37,370 tonnes. Concor plans 14 CA stores across the country by 2008 (www.concorindia.com). APEDA is also planning to set up cold storage facilities abroad so Indian exporters can use these as bases to store consignments overseas.

Also, ICICI Bank has started a pilot project for apple farmers in Himachal Pradesh in which they were advised to set up integrated cold chain to reduce post-harvest wastages and realize better price for their crops. A similar plan would be implemented for the banana farmers of Maharashtra, whose raw consignments are largely sent to Delhi. The farmers have been advised to set up a ripening centre in Delhi so that the value-addition fetches better prices.

4.2 State of retailing in India

Retail, one of the largest sectors in the global economy (USD 7 Trillion), is going through a transition phase in India. One of the prime factors for non-competitiveness of the food processing industry is because of the cost and quality of marketing channels. Globally more than 72% of food sales occur through super stores. In India there are 12 million outlets selling food and related items including push carts, wet markets and neighborhood kirana stores. The kirana stores are generally located in small space and have no cold storage facilities. They also have restricted capital resulting in lack of shopping variety. The Indian retail sector is estimated to have a market size of about \$ 180 billion; but the organized sector represents only 2% share of this market. A strong retail front-end can also provide the necessary fillip to agriculture and food processing, and other industries

India is poised for a very rapid growth in the retail sector. The set of determinants of the growth of supermarkets elsewhere in the world including socioeconomic factors -- rapid urbanization, income growth, women entering the away-from-home workforce, growth in ownerships of cars, and improvement in domestic infrastructure such as refrigerators and microwave ovens are all present in India now[5-8]. Over the last decade, a number of retail formats such as super markets and hypermarkets have appeared. Supermarket chains such as Food world, Subiksha and Nilgiris are expanding their reach. Hypermarkets such as the big bazaar Giant, Super Sabka Bazaar have also emerged. Also, several enterprising second-generation kirana owners have begun transforming their outlets into mini supermarkets to take on the growing threat from food and grocery retail chains. Several kirana shops have started accepting credit cards from customers and are also coming together to form associations to source their purchases collectively for higher discounts from manufacturers

As mentioned before, in India 100 % FDI in retailing is not allowed and foreign retailers can operate only through joint ventures. One of the prime reasons for not

allowing foreign direct investment in retail is the fear that they will displace the kirana stores and cause high levels of unemployment. However, experience in USA and China suggests that emergence of large retail chains will result in higher employment levels in the retail sector.

5. GOVERNMENT INITIATIVES TO PROMOTE FOOD EXPORTS

The Government of India (GOI) has accorded high priority to the establishment of cold chains and encourages major initiatives in this sector.

- Foreign equity participation of 51% is permitted for cold chain projects.
- There is no restriction on import of cold storage equipment or establishing cold storages in India.
- National Horticulture Board (NHB) operates a capital investment subsidy scheme (CISS) which provides 25% (maximum Rs.50 lakhs) subsidies to the promoter.

Furthermore, to handle the expected higher agricultural production during the Tenth Plan Period, the Inter Ministerial Task force on Agricultural Marketing Reforms constituted by Ministry of Agriculture, Government of India has recommended the creation of additional cold chain facilities at an investment cost of Rs. 2500 crore of which Rs. 625 crore are to be provided as subsidy and the rest has to come as private investment. They have also suggested modernization of existing facilities with an investment cost of Rs. 2100 crore of which Rs. 525 crore are to be subsidy and the balance to come as private investment.

The state governments also have initiatives in the food processing and cold chain sectors. For example the Gujarat government has accorded priority to agro processing and horticulture, in view of the high export potential for fruits like mango, banana and chikoo. The government supports the sector by providing assistance to farmers for agricultural inputs, developing systems like drip irrigation and encouraging development of infrastructure facilities like warehousing, cold chain, etc for better pre-harvest and post-harvest crop

management. Gujarat also has good logistical infrastructure such as airport, seaport and extensive road & railway network. Other states such as Maharashtra, Andhra Pradesh, Kerala and Punjab have similar schemes in place.

5.1 Agri Export Zones (AEZs)

The concept of the *Agri Export Zone* [19, 20] attempts to take a comprehensive look at a particular produce/products located in a contiguous area for the purpose of developing and sourcing the raw materials, their processing and packaging, finally exporting them. Thus, the entire effort is centered on a cluster approach of identifying the potential products, the geographical region in which these are grown and adopting an end to end approach of integrating the entire process, right from the stage of production till it reaches the market. The government helps in sourcing for raw materials, the setting up of processing facilities, providing finance at low interest rates and even matching with international buyers. The export zones mooted by the Agricultural and Processed Food Products Export Development Authority (APEDA) to increase international trade in agri-commodities are an attempt to take a holistic approach to encouraging trade in specific commodities located in contiguous areas. For instance, in Tamil Nadu, the AEZs would focus on grapes, mangoes and chikkoo, in Kerala -- vegetables, in Punjab and Haryana -- kano, wheat and rice, Karnataka -- vegetables and flowers, Maharashtra -- mangoes, grapes and flower, Gujarat -- bananas, mango, castor and garlic, and in Uttaranchal -- litchi and medicinal plants.

A new breed of entrepreneurs, supported by these newly developed Agri Export Zones is helping India become the food basket to the world. Since their inception in 2001-02, the AEZs have notched up total exports of US\$ 100 million, expected to grow to US\$ 2.8 billion by 2007. More than 32,000 farmers are currently undergoing training in food export processes and procedures. If this trend continues, there is a good chance that more and more Indian food items will find place on the shelves of the international food retail chains like Walmart, Tesco and Sainsbury's.

5.2 Special Economic Zones (SEZs)

Special Economic Zones (SEZs) [19,20] are specifically delineated duty-free enclaves treated as a foreign territory for the purpose of industrial, service and trade operations, with exemption from customs duties and a more liberal regime in respect of other levies, foreign investment and other transactions. Domestic regulations, restrictions and infrastructure inadequacies are sought to be eliminated in the SEZs for creating a hassle-free environment. The SEZ Scheme seeks to create a transparent system by introducing simplified procedures for enhancing productivity and making it easier to do business.

According to Government of India guidelines, SEZs can be developed in the public, private or joint sectors, or by the State Governments. They are expected to promote establishment of large, self-contained areas supported by world-class infrastructure oriented towards export production. Exploiting the full potential of the concept, SEZs would bring large dividends to the Governments in term of economic and industrial development and generation of new employment opportunities.

6. PRIVATE SECTOR INITIATIVES

There are several private sector initiatives in the food processing and service sector. A number of companies are actively working on integrating the agriculture supply chain. Here we mention a few of them. These show the feasibility of operating efficient cold chains in the India scenario. They could be treated as pilots and other projects can be built emulating them. Here we consider the following cases

- McDonalds-India, a fast food service operator growing its own ingredients such as lettuce, potatoes, etc;
- Amul which is a highly successful cooperative dairy in Gujarat.
- E-choupals which is an ITC success story of procurement of produce from small farmers is an example of supply chain management Indian style.

There are other examples such as Bombay dabba walah which is an excellent example of six-sigma forward and reverse logistics delivery. Also, ITC, Mahindra and Rallis together are creating a network of service providers who offer information on weather and prices, credit, transport and assured demand.

6.1 McDonalds- India

McDonald's entered India in October 1996. There are a number of restaurants in Mumbai, Delhi, Pune, Ahmedabad, Vadodara, Ludhiana, Jaipur, Noida Faridabad, Doraha, Manesar, and Gurgaon. McDonald has set up the Cold Chain by transferring the state-of-the-art food processing technology from McDonald's and its international suppliers to pioneering Indian entrepreneurs. The Indian partners have now become an integral part of McDonald's Cold Chain. McDonald's India today purchases more than 96% of its products and supplies from Indian suppliers. Even the restaurants are constructed using local architects, contractors, labor and with maximum local content in materials. The relationship between McDonald's and its Indian suppliers is mutually beneficial. As McDonald's expands in India, the supplier gets the opportunity to expand his business, have access to the latest in food technology, get exposure to advanced agricultural practices.

6.2 Amul

Starting with a single shared plant at Anand and two village cooperative societies for milk procurement, the dairy cooperative movement in the State of Gujarat had evolved into a network of 2.12 million milk producers (called farmers) who are organized in 10,411 milk collection independent cooperatives (called Village Societies). These Village Societies (VS) supply milk to thirteen independent dairy cooperatives (called Unions). AMUL is one such Union. Milk and milk products from these Unions are marketed by a common marketing organization (called Federation). Gujarat Cooperative Milk Marketing Federation (GCMMF) is the marketing entity for products of all Unions in the State of Gujarat [4]. GCMMF has 42 regional distribution centers in India, serves over 500,000 retail outlets and

exports to more than 15 countries. All these organizations are independent legal entities yet loosely tied together with a common destiny! The Gujarat movement spread all over India and similar structures was replicated in other states.

Today AMUL is a symbol of the triumph of indigenous technology and also of making a strong business proposition out of serving a large number of small and marginal suppliers by developing and coordinating a vast co-operative network.

6.3 E-Choupals

The ITC group of companies has a yearly turnover of Rs 7.5 billion (US\$162 million), and its activities span tobacco and cigarettes, paper and packaging, paperboard, hotels and tourism, information technology, and agricultural exports. For its agri-export division, ITC procures various agricultural commodities such as soybeans, coffee, and oil seeds. Typically, a farmer sells his produce to a small trader called a *kaccha adat*, who sells the produce to a larger trader called the *pakka adat*, who in turn takes the produce to a local mandi, where from a larger trader buys the produce. The mandi traders then operate through brokers to negotiate sales to companies such as ITC. This long supply chain results in high procurement costs and long delays for ITC, in lost profit opportunities for the farmers and also deterioration in the quality of the products.

The e-choupal system was introduced by ITC in June 2000[9]. A choupal was converted into an e-choupal by setting up a computer and Internet connectivity. An investment of Rs 40,000 is needed to establish an e-choupal with dial-up connectivity. If a VSAT (Very Small Aperture Terminal) has to be mounted, the investment moves up to Rs 100,000. E-choupals are operated by a *sanchalak* (operator), a literate person who is elected from among the farmers of the village. He acts as an interface between the computer and the illiterate farmers, and retrieves information on their behalf.

Information that can be accessed from an e-choupal includes crop prices, weather, scientific farming practices, farmer peer groups, and soil-testing services. This

online information is made available in Hindi. For the farmer, the selling process works as follows: The farmer carries a sample of his produce to a local kiosk and receives a spot quote from the sanchalak. If the farmer accepts the quote, he can then transport the produce directly to an ITC collection center and get payment within two hours. The intermediaries are not removed from the value chain. Their roles are redefined to *samayojaks* (coordinators), who assist ITC in setting up new e-choupals by conducting village surveys and by identifying the best sanchalaks. They manage the physical transportation of sales made at the e-choupal, collect price data from local auctions, and maintain records.

The project has come a long way since its inception, and is today recognized as India's largest Internet-based initiative, covering 1,300 choupals, linking 7,500 villages, and serving almost 1 million farmers. This is an example of e-procurement- the Indian way.



Figure 1: State of Indian Food Sector

It must be noted all the developments described above are just scratching the surface and are beginnings of change. To make impact, one need to consider the

food supply chain in its entirety and make it efficient and adaptive. We summarize the state of Indian food sector in Figure 1.

7. SINGAPORE COMPETENCIES IN THE COLD CHAIN SECTOR

Agriculture plays a very minor part in Singapore's economy. For an island with four million inhabitants, there is very little agricultural production. This leaves the domestic populace largely dependent on imports from, among others, Malaysia, Australia, and New Zealand to meet the local demand for Agro-products. The role of local enterprises is limited to imports, break-bulk, repackaging, home branding, and marketing through the large super/hyper market channels that control the distribution. There is however a gamut of companies active in the food processing sector. Dairy products, seafood, oils and fats, chocolates and confectioneries as well as other processed foods are some examples of this sector's output. Singapore has great potential as the region's gateway and a potential hub with its excellent shipping, marketing, and other service offerings.

Singapore's food manufacturing sector comprises approximately 680 establishments, most of them SMEs. It generated about \$3.7 billion revenue and \$11 billion in trade in 2002. Strategic location, complemented by efficient shipping, packaging, finance and other supporting industries bring Singapore to the forefront of the Food Trade that passes through the region [16].

7.1 Logistics and SCM in Singapore

Logistics has always been a key part of Singapore economy. It is both an industry and also an enabler. As an industry, logistics accounts for more than 8 % of Singapore GDP. As an enabler, it gives industries operating out of Singapore a significant competitive advantage.

Singapore is one of the most well connected countries in the world, with excellent sea-air cargo links and telecommunications infrastructure. Port Singapore

Authority (PSA), manages the busiest container port in the world, offers shippers a choice of 200 shipping lines with links to some 700 ports in 130 countries. Its Singapore terminals handle 25 per cent of the world's transshipment volume. Changi International Airport is linked to 140 cities in 50 countries, with more than 3,250 weekly flights ferrying passengers and cargo to and from all parts of the world. Building on its traditional strengths in its seaport and airport, it implemented two specialized logistics infrastructure projects - the Airport Logistics Park of Singapore in the airport free trade zone, and Banyan LogisPark on Jurong Island. These provide ideal logistics environment at competitive costs. Singapore has signed numerous free trade agreements (FTAs) with countries in the world. FTAs remove the barriers to trade and investment, thus creating a freer flow of goods, services and people.

Strategic location, efficient 24/7 operations, reliable physical and IT infrastructure, and excellent connectivity have made Singapore a compelling global logistics hub and supply chain management (SCM) nerve centre. Many global logistics leaders have set up operations here. In fact, more than half of the world's top 25 third party logistics providers (3PLs) including UPS, Exel, DHL and Bax Global have set up significant operations here. Manufacturers like IBM and Motorola have also built up strong SCM competence teams in Singapore to orchestrate and coordinate the flow of goods, information and funds for their global supply chains from here.

Singapore has long been a key regional financial centre, with more than 500 local and foreign financial institutions offering a wide range of financial products and services. Every possible form of financial activity performed or needed by a business is available here including the agriculture and food processing and distribution businesses.

7.2 Food Supply Chain Sector in Singapore

7.2.1 Retail:

NTUC Fairprice and Cold Storage are the two leading supermarket chains in Singapore. They follow world class supply chain management principles such as category management, shelf space optimization, refrigerated container and vehicle transport, etc. NTUC Fairprice has formed strong relationships with its strategic partners following a cluster development strategy (close to the cold chain hub described in the Appendix) to improve supply chain efficiencies. The cluster development approach aims to strengthen and connect all players across the supply chain, including suppliers, service providers, distribution channels and retailers, to create a community of enterprises through which products and services flow seamlessly. In the retail sector, suppliers and retailers can forge strategic alliances to increase efficiency in the distribution process and trim procurement costs.

Cold Storage is the island's oldest established supermarket operator with over 100 years of experience in Singapore, constantly introducing new store concepts that set clear industry standards. Partnering with SingaporeONE (the nationwide broadband network), Cold Storage is the first supermarket to offer its merchandise in cyberspace in 1997. The number of regular customers has since then grown from 6,000 in 1998 to currently over 15,000; ranging from housewives, working parents to professionals and secretaries. Cold storage has created a premium brand range of its own, and has developed over 1,500 products ranging from fresh food to beverage, grocery to household products. Cold storage is already present in India and has 49% stake in the retailer Food World.

There are also fast food outlets McDonalds, Burger King, KFC and host of others with hundreds of outlets on the Island. Refrigerated warehouses, temperature controlled containers and trucks are all part of the infrastructure that maintains the high levels of food safety standards demanded by Singapore.

7.2.2 Logistics providers

There are several logistics companies with expertise in cold chain logistics in Singapore. They include SembCorp Logistics, Keppel Logistics, APL Co Pte Ltd (NOL group), BaxGlobal, Translink, CWT, and WLNA to mention a few. Both SembCorp and APL have already operations in India. The port and airport operators in Singapore handle cold chain cargo.

7.2.3 Standards

SPRING Singapore, the national agency for standards and productivity promotion, has partnered with ECR Singapore to promote standardization. Two projects have been completed successfully. The first was a project on Pallet Standardization. A one-year pilot study was carried out by four companies (Grocery Logistics of Singapore, Unilever Singapore Pte Ltd, YHS (Singapore) Pte Ltd, LHT Holdings Ltd) in fast moving consumer goods industries to demonstrate the benefits of using the ECR Standard Pallet.

The second project was Cold Chain Management for Milk and Dairy Products. Working with the industry, SPRING Singapore developed a technical reference prescribing best practices for managing the entire supply chain of milk and dairy products – from processing to handling, storage, distribution and retailing. The objective was to improve the hygiene, freshness and quality of milk and dairy products for consumers. This is called the Singapore Standard CP95: November 2002 Code of Practice for Cold Chain Management – Milk and Dairy Products. All retailers and suppliers in Singapore are implementing this standard. Also ECR Singapore, in collaboration with SPRING Singapore to planning to develop a Technical Reference for Cold Chain Management of Chilled Pork throughout the cold chain.

7.2.4 Training: Cold Chain Center at Singapore Management Association

The Singapore Cold Chain Centre will be the resource centre for cold chain management of a wide range of perishable products including milk and dairy products, chilled meat, vegetables and fruits and pharmaceutical products. This

Cold Chain Centre will also collaborate with the industry and Institutes for Higher Learning to provide training courses to build a pool of expertise for the cold chain management arena. It will house standards on cold chain management for a range of products including milk and dairy products, chilled pork, fruits and vegetables and pharmaceutical products.

7.2.5 Food Packaging Industry

Packaging is an important industry in Singapore, since good packaging will enhance the quality and competitiveness of Singapore's industrial and consumer products. Singapore's rapid development into an industrialized economy ensured concurrent growth in the packaging industry [18]. Over 200 companies in Singapore are involved in converting various forms of materials into packaging products. An equal number of them also provide services to the packaging industry including materials traders, machinery suppliers, and software services.

The industry comprises of companies dealing in packaging materials, equipment, machinery, design, and consultancy. These companies provide essential products and services to other companies from a broad cross-section of manufacturing sectors, which include food, beverage, electrical, electronics, pharmaceuticals, chemicals, cosmetics, etc.

Keeping abreast with the changes in consumer demands and the latest in packaging technology to meet global trends has enabled the industry to provide better-designed and environmentally friendly packaging products and materials. Singapore food manufacturers are well tuned to the shift in consumer preferences towards convenience food, environmentally-friendly food, healthier food, and smaller servings. They provide very sophisticated and hygienic packaging for food products.

7.2.6 Quality Control

Reliable quality is the hallmark of Singapore food and beverage industry. This quality has attracted many leading international food and beverage companies to

entrust their production to Singapore companies. Several US and Japanese companies have used Singapore's contract services for many years now.

Most companies deploy stringent in-house quality controls to ensure hygienic and safe output of processed foods and beverages. Consultancy services on food hygiene and sanitation monitoring, plant setup and layout and implementation of Hazard Analysis and Critical Control Point (HACCP) program are available from Spring Singapore. Spring Singapore has helped a number of food companies to establish HACCP systems in their production processes. These include food manufacturers and central kitchens of caterers.

8. JOINT INDIA SINGAPORE PROJECT IN COLD CHAIN MANAGEMENT

Traditionally, India and Singapore are two friendly nations with many things in common between them. In various national and international forums, both the countries have supported each other's cause. People of Indian origin have contributed significantly to the economic development of the Singapore economy. Similarly, Singapore's FDI has contributed immensely to India's recent development initiatives. At present India and Singapore are examining the possibility of an FTA agreement. Both the governments have undertaken this crucial initiative at the highest political level [15]. There is great possibility for wide ranging cooperation in joint venture (JV) activities.

Singapore has a strong industrial base and the performances of these industries have been impressive over the years. If such industries have strong technical capabilities in terms of R&D, it would be worthwhile to examine the possibilities of initiating joint venture between the two countries.

In the past 10 months, Temasek Holdings has been snapping up chunks of some of India's most promising companies [17]. It bought a 9% stake in one of India's most dynamic ICICI Bank; a 5% stake in the hi-tech hospital chain Apollo

Hospitals Enterprise; and a stake in outsourcing company ICICI OneSource. It has also invested hundreds of millions into other funds that specialize in technology and power-sectors in India.

Given the cordial political and economic relationship between the two countries, it looks Singapore investing in cold chain projects in India looks mutually beneficial. High growth prospects for the food processing industry along with attractive Indian government incentives makes cold chain business in India a lucrative proposition for foreign investors.

8.1 Models for Collaboration

There are several models possible for Singapore companies investing in India. Foreign participation in this business can take any of the following forms:

- Joint Venture With A Local Company
- Investing In Public-Private Partnership Projects
- Technological Collaboration
- Investing in a Agri export zone
- Investing in a Special Economic Zone

Given the huge investment that is needed for cold chain infrastructure and maintenance (For e.g. A warehouse costs around SGD 20M), and the slow rate of returns a single company may not be able to make it alone. A group of companies and the Singapore Government need to jointly invest with an Indian State Government and The Central Government in a Special Economic Zone or an Agri-Export Zone in a food processing industry. We consider the opportunities for collaboration below.

8.2 Opportunities for participation:

We have described in sections 2-7 above of the report, the Indian agribusiness scenario and also the Singapore's competencies in this sector. The following are some of the opportunities for collaborative ventures:

1. ***Real Estate and Cold chain infrastructure.*** Investments in real estate and cold chain infrastructure are capital intensive and will yield slow returns. However, 100% foreign direct investment (FDI) is allowed in this sector. The Infrastructure consists of Coolers, Warehouses, Refrigerated Trucks, Carriers, Shopping malls, etc. One needs to study of the potential risks and the ROI for this activity? The questions then are

a. Where (in which State and City in India) and for what product or products (Fruits and Vegetables, Flowers, Meat, Marine products)?

b. What is the post harvest expertise needed for design of above facilities

Power disruptions and high petrol and diesel prices make efficient operation of the facilities very expensive. This is part of the reason the current usage of the existing cold chain facilities is low. Building cold chain infrastructure and giving it for rentals may be a high risk endeavor and such an effort is recommended for own use such as for your own Retail chains.

Singapore's Housing development board (HDB) subsidiary Subana is active in India in the high rise residential building sector.

Opportunity: A good proposal might be for a group of companies and the Singapore government to jointly invest with a State Government and Indian Government in a Special Economic Zone or an Agri-Export Zone in a cold chain infrastructure for a food processing industry. The rules and regulations for such joint activity are already in place in India.

2. ***Food processing plants.*** The Government of India allows 100% FDI in this sector. There are incentives for setting up processing plants either in Agri –

Export Zones or outside of them. Sourcing of raw materials either fruits and vegetables or flowers or meat is easier with an AEZ since there are already participants with knowledge about the industry standards. It may be noted that there are several negatives about packaged food manufacturing in India. They include expensive food packaging; high import duties on processing and packaging machinery, high sales tax on packaged foods among others. There are opportunities to create in India

- a. Halal hub (Export to South-East Asia, Middle East)
- b. Vegetarian hub (20% of Indian population + overseas)
- c. Organic food hub (Europe and USA)
- d. Sea food hub

Opportunity: If Singaporean companies enter this domain, then the aim should be to manufacture for your own retailing or to have joint venture with a big multinational food manufacturer to create the hubs mentioned above. Another approach could be a joint venture with an outside investor such as World Bank or USAID for export of foods for poor countries.

3. **Wholesalers:** This is the format that Metro, the German company follows in Bangalore where 100% FDI is allowed. The infrastructure and real estate can be completely owned by foreign companies. The advantage here is that the relationships developed with the farmers and the small retailers (kirana merchants) will come in handy if the company wants to move down stream in to retailing
4. **Retail:** There is a huge opportunity in this space. However, 100% FDI is not allowed for foreign companies. The Singapore Company needs a joint venture partner. Cold storage is a joint partner with Food World. Here again there are issues that need to be considered. The first one is the products on the shelf: fresh fruits and vegetables, the pulses and oils, and also the processed foods. Since the processed food segment is small and the products are expensive, the

retail gets limited to urban elite. Secondly since the cold chain is virtually non-existent, procurement of quality supplies from the farmers and selling them quickly is important. The net result is that you are entering a market with dominant players and differentiation is important.

However, India presents a huge opportunity and is all set for a big retail revolution. India is the least saturated of global markets with a small organized retail and also the least competitive of all global markets. It presents very low barriers of entry for global players and has tremendous market size in both Urban and Rural areas. It provides excellent potential for foreign players with a Growth potential of 20-40% as in China. Also the Indian farmers and other stake holders are familiar with the International quality certification processes, shipment requirements for exports, and the documentation and other requirements at the farm level. It is a sort a prepared ground ready to take off. Thus any company entering retailing will find it easy to deal with the suppliers and the farmers.

When 100% FDI is allowed, several international retailers will enter the Indian market and the retail will go turbulent. This has happened in other controlled markets such as China, Eastern Europe, and South East Asia. In these markets, liberalization of FDI in retail and entry of foreign retailers has triggered sudden and steep rise in the number of stores and also in their sales growth. The first wave of supermarket revolution occurred extremely fast in the urban areas with a sales growth rate of 20-40%. The second wave starts with diffusion in to second-tier areas and the third wave starts when the super markets move in to rural areas. In India the rural areas are also growing very fast. There is also rapid response of competitive investment by domestic firms leading to consolidation in all the sectors of the supply chain including the farm sector.

Opportunity: There is a huge opportunity for NTUC or Cold Storage to open retail stores in the southern or Eastern India. They can move in a cluster with a food manufacturer and a cold chain operator so that the risk is spread.

5. **Logistics:** Movement of materials in the food supply chain is an important element for the success. The Singapore logistics companies such as Sembcorp logistics and APL have expertise in this area. This is an area for active consideration. This is also highly asset intensive. Temperature controlled warehouses, WMS and TMS, Refrigerated trucks, Hygiene handling of food cartons, etc are involved.

Opportunity: Third party logistics providers (3PLs) will be in demand if large international retailers move into India (This will happen when FDI is further liberalized in retail). As happened in other controlled economies, liberalization of FDI will induce joint ventures between retail chains and global logistics multinationals. Home delivery is one of the strong options for big retailers who are located in the outskirts of the city. Customers can order by telephone or Internet and collect the delivery at the nearby outlet. Assistance of logistics service providers will be needed for order fulfillment.

6. **Technology:** Safety concerns, competitive pressures and regulatory requirements are creating demand for more traceability in the foodservice industry than ever before. Also use of IT for tracking the sales and for demand forecasting is a widely accepted.

The above are some of the obvious activities for collaboration. There are several others such as training, financing, standards development etc where there could be collaborative ventures between Indian and Singaporean companies.

9. CONCLUSIONS

India is all set to become the food supplier of the world. It has the cultivable land, all the seasons for production of all varieties of fruits and vegetables, well developed agribusiness system that works in its own way. The business system is tuned to food habits (cooking at home) and convenience (kirana stores) of rural and urban folks of the previous generation. As we discussed in the report, the situation is changing fast and this provides huge opportunities for investment to processed food manufacturers, restaurants, retailers with super market and hypermarket formats, food supply chain managers and many others. Singapore with its expertise in the cold chain and food retail and the good relationship it has with the Indian people and the Government will gain substantially by using this opportunity.

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APPENDIX A

FUNDAMENTALS OF FOOD SUPPLY CHAIN DESIGN

In this Appendix, we outline the requirements of an ideal food supply chain cluster. We introduce the concept of Food cold chain hub which is a collection of companies working together towards a common destiny. It is important that these companies are interconnected logistically for movement of raw materials, semi-finished and finished goods. They should also be connected via a secure extranet for transfer of business information. The flow of funds also needs to be smooth across the stake holders.

The food supply chain can be subdivided into a number of sectors. Agriculture, horticulture, fisheries and aquaculture are the primary producers, the manufacturers who process the food for ready to eat or cook format together with the packaging companies are in the intermediate stage, and the retailers, wholesalers and caterers are in the last stage of the supply chain. At each stage value is added by the new ownership such as processors, distributors, packers, etc. and the cost and profits are part of the business. The food items can go to the final consumer from any of the three stages: from farmers in the form of fresh produce, to the caterers directly from the manufacturer, and finally from the retailer (small or big) to the consumer. The movement of goods from one stake holder to another is facilitated by the in house or third party logistics service provider. The information management is done by the all the stake holders and their information systems are all interconnected seamlessly. What we described above is the state of food chain in the advanced countries. In India and other developing countries, the state of food chain is more fragmented and primitive we have dealt with it in the earlier sections.

A.1 The Cold Chain

Cold chain is a logistic system that provides a series of facilities for maintaining ideal storage conditions for perishables from the point of origin to the point of consumption in the food supply chain. 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-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. The main feature of the chain is that if any of the links is missing or is weak, the whole system fails.

The Cold chain logistics infrastructure generally consists of

- Pre-cooling facilities
- Cold Storages
- Refrigerated Carriers
- Multi-Modal Transportation
- Packaging
- Information Management System
- Warehouse Management system
- Traceability
- Financial and Insurance Institutions

As can be seen, cold chain logistics is highly asset intensive and requires coordination between various agencies the farmers, processors, wholesalers, retailers and the logistics service providers. Since one is dealing with perishables where freshness rules and safety is a priority, any delays due to relationship problems between stake holders and also failure of supply or transport will result in increased wastage and loss of sales. Managing the supply chain to maintain quality and quality and shelf life fitness has cost and social implications. It is necessary that the supply chain operations are efficient and responsive to

customer demands for getting higher returns on investment. Figure A1 shows the costs and benefits associated with a cold chain.

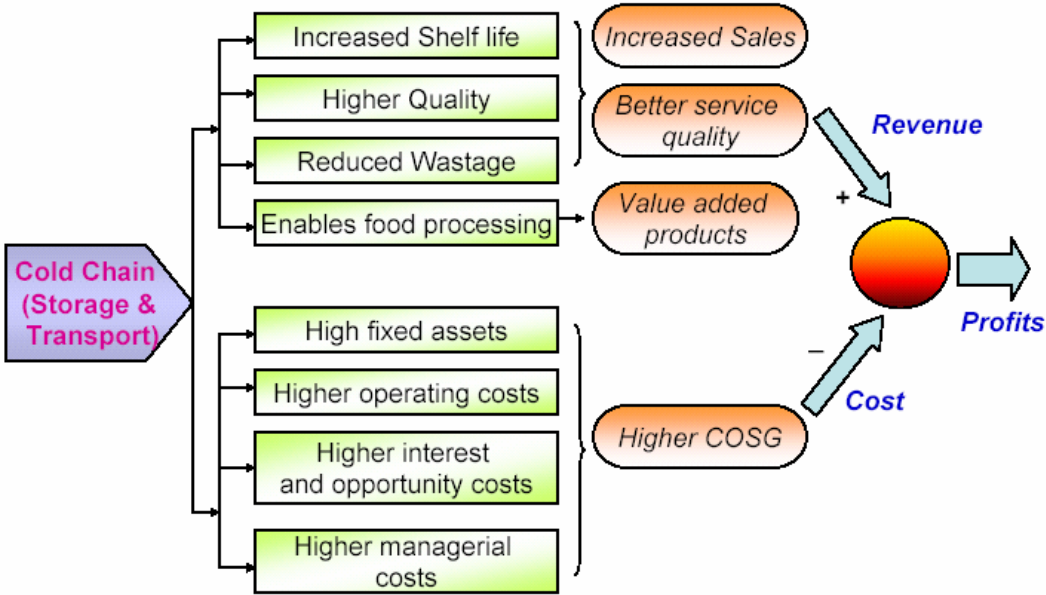


Figure A1: Cost benefit analysis of a cold chain system

The temperature controlled supply chains or cold chains are a significant proportion of the retail food market. Fast foods, ready meals and frozen products have increased market share in recent years. There are several food temperature levels to suit different types of products. Frozen, cold chill, medium chill, and exotic chill are some of the frequently nomenclatures with identified temperature ranges. The range of temperatures is dependent on the products whether it is meat or ice cream or potatoes or bananas. Failure to maintain appropriate temperature regimes through out the product life cycle may shorten the product life or adversely affect its fitness for consumption. Cold chain management involves maintaining appropriate temperature regime when the product travels from the farm in Himachal Pradesh to the consumer in London or New York City. That is why the logistics challenge is formidable in food chains, which is cost conscious industry. There are several governmental regulations in all countries and the responsibility to maintain hygiene and standards falls on the food retailer or

manufacturer. The recent developments in electronic tagging could be useful for monitoring the temperatures and also the shelf life of the product.

A.2 Food Supply Chain Clusters

Food chain clusters (See FigureA2) are formed with the participation of all stake holders such as farmers, seed growers, merchants, transporters, wholesalers, retailers, financial institutions, and insurance companies. Information sharing is essential for generating the efficiencies. The Internet and mobile communications are used to enable information and financial transfer between the stake holders. Also, recent advances in RFID technology will have tremendous impact in the management of the food chain particularly for source identification and tracking and also in providing supply chain visibility.

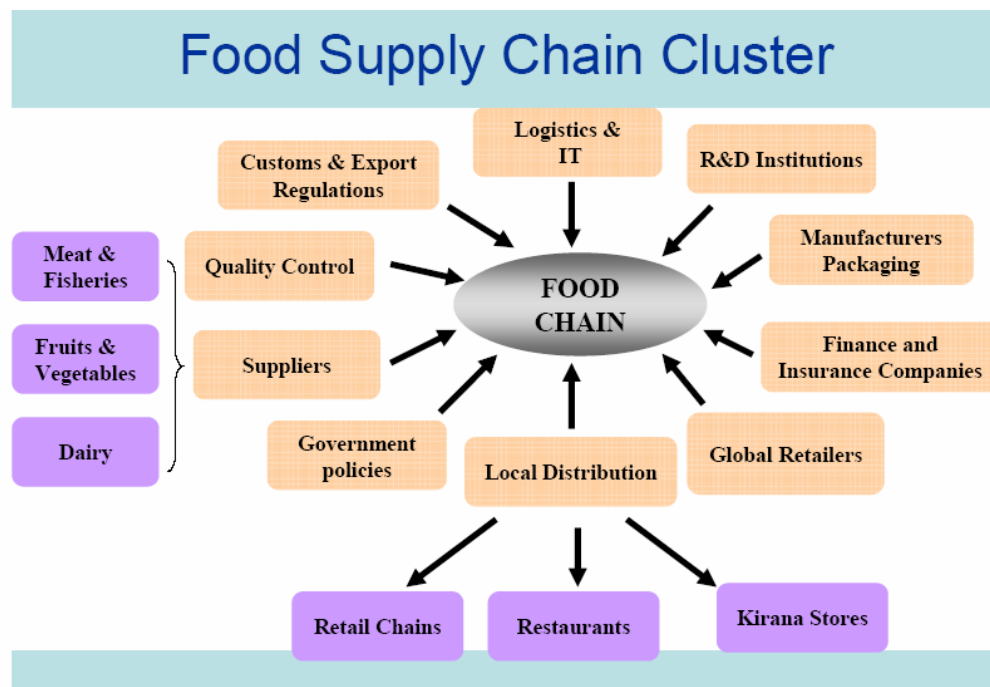


Figure A2: Supply chain cluster with all stake holders

In advanced countries, the retailers (Walmart, Tesco, etc) have become the Channel Masters of food supply chain taking over from the food manufacturers. In India, with no superstores, no economies of scale, too many intermediaries, there is a vacuum, meaning there is no real channel master managing the supply

demand situation and coordinating the supply chain and managing the logistical activities. This provides a tremendous opportunity for smart players to enter a growing market with a high potential of retail FDI. But one needs to remember that the infrastructure capital outlays are high and the returns are long term. Also there are various risks associated with owning a cold chain. Some of these include country risk, monsoon risk, crop or raw material supply failures due to pests, diseases, etc., partner risk, and numerous others

In India, there are very few large food manufacturers. Amul, Ruchi Soya, Nestle, MTR, ITC, Dabur, Britannia, HLL's food and beverages section, beverage companies such as Coke and Pepsi are some of the big names. In poultry Godrej Agrovet, Suguna, Pioneer and Venkateswara hatcheries are some of the companies integrating operations end to end from breeding to ready to eat chicken foods. High taxes on processed food, high import duties, nascent contract farming, make the profitability a big issue in India. There are several regulatory changes that need to be made all along the supply chain so that they are consistent and mutually reinforcing.

A.3 Supply chain expertise

As discussed at various points above, the food supply chain is complex with perishable goods and numerous small stakeholders. In India, the infrastructure connecting these partners is very weak. Each stakeholder: farmers, wholesalers, food manufacturers, retailers all work in silos. Also, demand forecasting is totally absent and the farmers try to push what they produce into the market. Data integration, financial flow management, supply-demand matching, collaborative forecasting, information sharing, goods movement synchronization through efficient transport scheduling, are very well practiced in high technology industries with immense benefits. These best practices should find their way into the food supply chains. Cold chain logistics supply chains should take advantage of technology improvements in data capture and processing, product tracking and tracing, synchronized freight transport transit times for time compression along

the supply chain and supply –demand matching. The media and the web should be used to bring the stake holders closer to each other and closer to the consumer. Also, the supply chain need to be designed and built as a whole in an integrated manner with the processes of new product development, procurement and order to delivery processes well designed and well supported using IT tools and software.

In particular there is a need to embrace the concept of Efficient Consumer Response (ECR) which was introduced in the United States in the 1990s and is now followed world wide in grocery supply chains. ECR refers to a set of strategies that aims to get companies across a supply chain to work closely to serve their customers better and at lower cost. Consumers benefit from improved product availability and choice, while distributors and suppliers derive better efficiency and cost savings. Also collaborative planning forecasting and replenishment is another area that has yielded substantial savings for retailers. Relationship between the stake holders in the supply chain is of paramount importance for ECR, CPFR and other relationship paradigms to work. Collaboration, total cost management rather than individual company pricings, improved information visibility, common destiny are some of the new relationship measures that are being talked about.

There are two other areas of immense interest in the food supply chain context. The first one is the Business to Business (B2B) exchanges and the Radio frequency identification technology (RFID). The B2B exchanges are essentially web based market places that bring together the buyers and sellers. They have the potential to efficiently manage the procurement of the produce from the farmers and also the replenishment of stocks in the retail shelf by the food manufacturers. These market places are the electronic versions of the farmers markets, wet markets or wholesale markets that every one is familiar with. The E-choupal is a procurement exchange which is becoming popular. The WorldWide Retail Exchange (WWRE) was set up by 17 retailers. Wal-Mart's retail link is the most influential private exchange. We consider the use of RFID in food chains below.

A.4 Data capture and Radio Frequency Identification (RFID)

Safety concerns, competitive pressures and regulatory requirements are creating demand for more traceability in the foodservice industry than ever before. Bar code and radio frequency identification (RFID) technologies can provide traceability and real-time control to meet customer and regulatory requirements while actually improving efficiency and profitability. Many companies in the foodservice supply chain will have to change their business processes to meet new safety and traceability requirements. The Food Safety Laws, require traceability of food, livestock and any substance incorporated into them through all stages of production and distribution, including records of to whom products were sold or distributed. These regulations will require businesses to produce and manage more information than ever before. Doing so in a timely and cost effective manner practically requires the use of automated data collection.

In addition, RFID can provide also provide other benefits, supply chain visibility being the important one. It can also facilitate efficient cross docking. Incoming pallets or cartons with smart labels can be automatically routed for cross docking or delivery directly to the manufacturing line because the fast-reading capabilities enable instant identification of the shipping container plus all of the individual items inside. For shipping, RFID readers can help packers quickly locate and aggregate all the items needed to complete the load. Food recalls are a near daily occurrence and distributors need to have plans and processes in place to execute them quickly and efficiently. The degree of traceability suppliers and distributors have over their products is what determines the size, scope and expense of a recall.

A.5 Food Packaging

Dairy products, edible oils, farm products, sugar, fruit juices, concentrates, preserves, hot and cold beverages, breakfast foods, biscuits and confectionery, atta, are some major foods of daily necessities where packaging will have excellent potential and growth areas. Package has become the competitive tool to

reach the consumer and the task assumes increasing responsibility with more and more of competitive and substitute products being introduced. This has opened the sector for introduction of modern technology for processing and packaging and entry of host of new organizations from all sectors of the economy both domestic and overseas. Cost of packaging ranges anywhere from 10 to 64% of production costs and efforts should be made to reduce these costs through use of manufacturing automation and economies of scale.

A.6 Financing & risk mitigation

The food processing sector primarily has small and medium sized companies and most of them have stand alone operations. They do not have control on the products, their composition or quality or on their marketing strategies. The banks and financial institutions adopt the same risk models as for manufacturing. There are a variety of risks faced by these companies including business risk, price risk, and market risk. Food processing companies need to invest significantly to build a brand. There could be also be very heavy investments if the cold chain is to be professionally maintained.

A.7 Standards

Standardization is a powerful tool for improving supply chain efficiency. There are two kinds of standards in the food supply chain. The first one is the food standard that concerns itself about the content and the manufacturing process and the packaging etc. There are several such standards for dairy, poultry etc. the second standard concerns regarding the logistics and IT systems like standardization of cartons, pallets and IT software so that seamless transfer of goods and information is possible. Standards enable partners across the supply chain to enjoy increased productivity and economies of scale due to better compatibility and interoperability of their systems and processes.

A.8 Food Safety and hygiene

Food safety is a growing concern across the world. There is increasing need to provide greater assurance about the safety and quality of food to consumers. The

increase in world food trade and the advent of the Sanitary and Phytosanitary (SPS) Agreement under the World Trade Organization (WTO) have led to increasing recognition and adoption of food safety measures. The capacity of India to penetrate world markets depends on its ability to meet increasingly stringent food safety standards imposed in developed countries. Food standards are expected to acquire greater importance given increasing concerns on food safety on the back of breakout of diseases such as BSE, Avian Influenza, Bird Flu etc on the one hand, and growing consumer demand for products which are healthy on the other. Compliance with international food standards is a prerequisite to gain a higher share of world trade.

A.9 Infrastructure and Asset Maintenance

The Cold chain infrastructure primarily consists of Cold Storages and Refrigerated Carriers. This is capital intensive activity with slow returns. Also, the warehouses, trucks, the refrigeration equipment need professional periodic and breakdown maintenance. In India, the cold chain concept is being employed at present for only high value crops like grapes, pomegranates and flowers. Even this infrastructure was acquired long time ago and is perceived to be dated. It is probably prudent for Government to attract some food manufacturing and cold chain equipment manufacturers to set up shop in India.

A.10 Training

The food supply chain is going through a period of great change and needs to be supported through new organizational forms manned by specialists. Training, coaching, counseling and mentoring have to be extended to all the parties in the supply chain. For example, it is important to conduct courses and training sessions on cold chain management to raise the knowledge and awareness on the importance of implementing the cold chain management to ensure that there is no breakdown in maintaining the required temperature throughout the supply chain. In this way a pool of skilled workforce with good knowledge of cold chain management to meet the needs of the industry to be a cold chain will be

generated. The same applies to other areas in the food supply chain such as procurement, retailing etc.

A.11 Business model: retail, e-retail, local use, export

The food processing industry supply chain starts at the farm and ends with the consumer. The local consumer could be served through home delivery or through a retailer or a neighborhood kirana store. An international consumer could be served through food malls. Thus the products need to be manufactured for local as well for export. It is important to forecast the demand for each of the channels and serve the customer within the expected lead time. The service levels and the pricing will determine if the customer returns for his or her next purchase.

A.12 Government Policies

Food and Agriculture are important national activities and affect the well being of its population of every country. In formulating the policies of farming, production, processing, distribution and retailing and also in financing these activities the Governments play leading role. This becomes all the more important in view of the globalization of the food industry. Allowing foreign operators for food production, distribution and retailing is a decision of national importance. The decisions need to be consistent all along the supply chain and mutually reinforcing and not contradictory. There are several regulatory measures handled by multitude of departments divided between State and Central governments. While some of this is inevitable but streamlining by looking at the supply chain would be extremely productive. Further, research should be initiated to develop indigenous packaging materials, machines, laboratories for developing new food products and more importantly protocols for storage and processing food raw materials.