

# 1 Can India be the Food Basket for the World?

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## 1.1 Introduction

India can become the food supplier of the world. It has the cultivable land, all the seasons for production of all varieties of fruits and vegetables, an agribusiness system that works although it needs to be vastly improved. The single most important problem facing the Indian agricultural industry is the highly inefficient supply chain. Because of lack of cold chain infrastructure and also a food processing industry about 20% of all foods produced in India (Rs. 500 b) are wasted. By building an efficient and effective supply chain using the state-of-the-art techniques it is possible to serve the population with value added food while simultaneously ensuring remunerative prices to the farmers. The surplus of cereals, fruits, vegetables, milk, fish, meat, and poultry can be processed as value added food products and marketed aggressively both locally and internationally. Investments in cold chain infrastructure, applied research in post harvest technologies, installation of food processing plants in various sectors and development of food retailing sector are mandatory for achieving gains in this sector. Strategic growth plans for achieving both national and international competitiveness of the food industry are essential.

In this paper 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. In particular, we identify opportunities for improvement in real estate and cold chain infrastructure, establishing food processing plants, wholesale, retail, third party logistics, and technology. In Section 1.2, we discuss the current state of the agricultural industry in India. In Section 1.3 we present the state of food processing industry in India. In sections 1.4 and 1.5, we present the cosmic

<sup>†</sup>This research was sponsored by Institute of South Asian Studies, Singapore

view of the food supply chain and its various constituents. We outline the current initiatives promoted by the Government and the Private sector in Sections 1.6 and 1.7. In Section 1.8, we bring to focus the areas that need attention. A sample list of research areas for OR specialists is discussed in Section 1.9. We wrap up our analysis with conclusions presented in Section 1.10.

## 1.2 Current State of Indian Agricultural Industry

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 countrys work force. As mentioned in the FICCI report of October 2004 India is the

- Second highest fruit and vegetable producer in the world (134.5 million tonnes) 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 spite of the vast natural resources and abundant agricultural produce India ranks below 10<sup>th</sup> in the export of food products. 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%. Currently, the food processing sector, though in the nascent stage, constitutes 14% of manufacturing GDP amounting to products value of Rs. 2,80,000 Crore. It employs 130 lakh persons and is supposed to increase at an annual rate of 7%.

### 1.3 The 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. 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. 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.

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 a 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, Qwikys, 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 whereas China and Philippines have several large players with sales exceeding US\$ 1 billion.

## 1.4 The Food Supply Chain

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*, and the *Sea food hub* among others.

The food supply chain is complex with perishable goods and numerous small stake holders. In India, the infrastructure connecting these partners is very weak. Each stake holder: farmers, wholesalers, food manufacturers, retailers all work in silos. Also, demand forecasting is totally absent and the farmers try to push what they produce in to 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 in to 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 supplydemand matching. 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.

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.

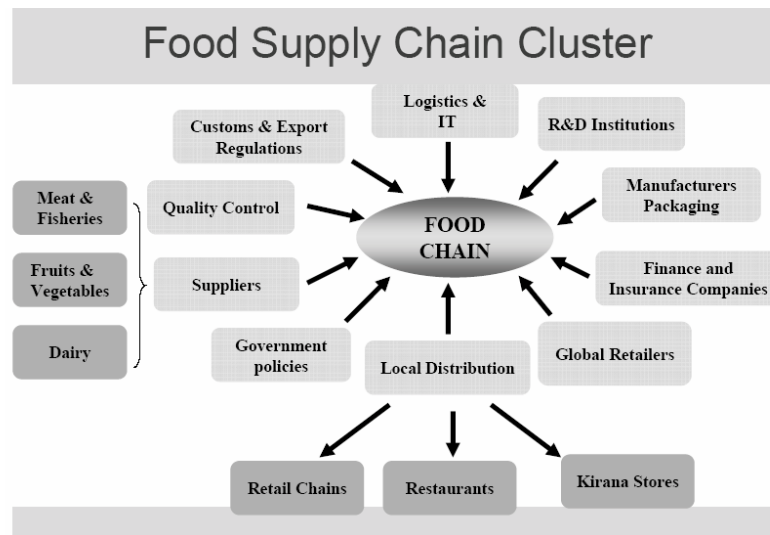


Fig. 1.1 Food supply chain cluster

## 1.5 Food Supply Chain Cluster

Food chain clusters (see Figure 1.1) 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.

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, HLLs 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

### 1.5.1 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
- Packaging
- Warehouse and Information Management systems
- Traceability
- Financial and Insurance Institutions

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.

### 1.5.2 Supply chain expertise

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.

### 1.5.3 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.

#### 1.5.4 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.

#### 1.5.5 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, avian flu, 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.

#### 1.5.6 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.



### 1.5.7 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.

### 1.5.8 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.

## 1.6 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.

#### 1.6.1 Agri Export Zones (AEZs)

The concept of the Agri Export Zone 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.

## 1.7 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.

## 1.8 Opportunities for Improving Food Supply Chain

The following are some of the opportunities:

### 1.8.1 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.

### 1.8.2 Third party logistics

The food supply chain is temperature sensitive and manual handling reduces the product quality and life. Logistics providers with air conditioned trucks, automatic handling equipment and trained manpower will provide end to end support. They can also adapt state of the art techniques such as cross docking that will reduce the transit times and inventory.

### 1.8.3 Food processing industry

The Government of India allows 100% FDI in this sector. There are incentives for setting up processing plants either in AEZs 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. There are opportunities to create in India:

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

### 1.8.4 Retail

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. Currently 100% FDI is not allowed for foreign companies. 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.

## 1.9 Opportunities for Research in Food Supply Chain

There are several significant research issues for an emerging economy like India. Although agribusiness may look low tech, there are several innovations possible with tremendous consequences. We outline a few of these here:

### 1.9.1 Strategic Level

Given the fact India has surplus fresh food stuffs that are currently wasted away and also has a very large local market, the Government can invite processed food manufacturers to set up mass production shops in the country which may be marketed through the fair price shops (these shops currently sell fresh foods). Design of the country wide production-distribution system for each of the produces taking into account the constraints on power infrastructure and water and identifying the possible MNCs that can play role will be a challenging task. The formats of small packages combined with *buy before you eat* variety will reduce the load on cold chain and will cater to the large section of people without refrigerators at home. Another important area of research is to develop predictive models for concerns such as *what happens if 100% FDI is allowed in retail?* and also *ROI models for establishing cold chain infrastructure*, etc.

### 1.9.2 Operational level

Produce to demand rather cropping as a matter of routine is an absolute necessity. This will probably lead to contract farming with ensured quality of the produce. This is a design of experiments problem of choosing the right kind of inputs, and timing for various tasks for seeding, weeding and harvesting depending on the environmental parameters. Design of E-procurement and just in time delivery systems for estaurants and hotels in big cities will save money on inventory, wastage and bulk purchase.

The above is a sample of research issues of extreme significance to the country. There are several others that can inspire young and mature minds while creating significant opportunities for growth.

## 1.10 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. Factors such as rapid growth in the economy, the technological innovations in home appliances such as refrigerators microwave ovens, rise of families with dual incomes and the changing food habits of the population all point to the increasing need for healthy processed food. The supply chain sector is very weak with no process owner and this can spell disaster. The food supply

chain needs the attention of the academics, the industry and the Government.

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