Journal of Rural Development, Vol. 32, No. (4) pp. 451-478
NIRD, Hyderabad.

FOOD PROCESSING INDUSTRY IN INDIA : S&T CAPABILITY, SKILLS AND EMPLOYMENT OPPORTUNITIES

Mohammad Rais,
Shatroopa Acharya and*
*Neeraj Sharma***

ABSTRACT

This paper provides a detailed analysis of food processing industry in India, its S&T capability, skills and employment opportunities. Food processing industry is slowly and steadily becoming one of the major industries of our economy. Its share in GDP is on continuous rise, with a CAGR of 8.40 per cent, from 2005-06 to 2009-10. Ther0e has been a continuous increase in the total plan outlay amount from INR 650 crore in 10th Plan; to INR 15077 crore in proposed outlay for 12th Plan. The sector is growing, but it is yet to compete in the world market. India's share in world export is meagre with 1.17 per cent. There is a wide gap between productivity and processing of items. The factors which have been used to study food processing industry are S&T capability of sector, its employment generation capacity and skills needed in the sector. The S&T capability segment venture into the changing trend of technology, difference between conventional and modern technology, the areas in which India is lagging behind. The employment generation capacity highlights growth and size of the industry and skills about the kind of human resources involved in the industry, the level of technology used in the sector. The employment generation capacity of the sector is huge, but the industry is not working at its potential. The labour force is highly unskilled, with 80 per cent of them having educational level below 10th standard. The impact of a variety of policies and programmes undertaken by government to develop food processing sector has not been very encouraging. The state needs to strengthen its efforts in S&T capability, infrastructure support and skill set in order to develop food processing industry.

Introduction

Food processing is the transformation of raw ingredients into food, or of food into other forms. Food processing typically takes clean, harvested crops or butchered animal products and uses these to produce attractive, marketable and often long shelf-life food products.

The processed food industry is divided into the following broad segments:

- Primary processed food – which includes products such as fruits and vegetables, packed milk, unbranded edible oil, milled rice, flour, tea, coffee, pulses, spices, and salt, sold in packed or non-packed forms.

* Senior Principal Scientist and Project Fellow, Respectively, CSIR-National Institute of Science, Technology & Development Studies (NISTADS), Pusa Gate, K.S. Krishnan Marg, New Delhi-110 012.

** Agriculture economist, Dwarka, New Delhi-110 077.

- ☞ Value-added processed food – which includes products such as processed fruits and vegetables, juices, jams, pickles, squashes, processed dairy products (ghee, paneer, cheese, and butter), processed poultry, and processed marine products, confectionary, chocolates, and alcoholic beverages.

Across the world, food-processing is considered to be a sunrise sector because of its large potential for growth and socio-economic impact. It not only leads to income generation but also helps in reduction of wastage, value addition, and foreign exchange earnings and enhancing manufacturing competitiveness. In today's global market, quality and food safety have become competitive edge for the enterprises producing foods and providing services. "With proper investment in food processing, technical innovation and infrastructure for agriculture sector, India could well become the food basket of the world" (Punjabi Meeta, 2007). The existing level of processing and the extent of value addition are very low as compared to other developing countries. In India, the food processing industry is ranked fifth in terms of production, consumption, export and expected growth (MOFPI, 2007). A strong and dynamic food processing sector plays a significant role in diversification of agricultural activities, improving value addition opportunities and creating surplus for export of agro-food products (Merchant, 2008). Food processing accounts for about 14 per cent of manufacturing GDP, i.e. ₹ 2,80,000 crore, and employs about 13 million people directly and 35 million people indirectly. Its employment intensity can be seen by the fact that for every ₹ 1 million invested, 18 direct jobs and 64 indirect jobs are created in organised food processing industry only (MOFPI, 2010).

It is widely accepted that the food processing sector is the most appropriate sector for creating jobs for rural poor, and thus reduce the burden on agricultural sector for creation of their livelihood. This is due to their familiarity with the agricultural sector which would make it easier to train and place them in food processing enterprises. The multiplier effect of investment in food processing industry on employment generation is also higher than any other sector. Therefore, for the overall progress of economy it is important that the farmers and backward communities working in rural food-processing units are treated at the top of the growth process. Rapid and sustained poverty reduction requires economic growth which is inclusive and the one that allows people to contribute to and benefit from it.

In India, the food processing industry is highly fragmented and is dominated by the unorganised sector. A number of players in this industry are small. About 42 per cent of the output comes from the unorganised sector, 25 per cent from the organised sector and the rest from small players. Though the unorganised segment varies across categories, approximately 75 per cent of the market is still in this segment. The organised sector is relatively bigger in the secondary processing segment than the primary processing segment. Increasing urbanisation, consciousness on health and nutrition and changing lifestyle are changing the consumption habits of India. The number of working women, single students/professionals and nuclear families are creating demand for processed ready-to-eat foods. Growth of organised retail, which makes the processed food readily available, is also driving growth of food processing.

The paper endeavours to analyse the food processing industry in its current form in India. It will primarily focus on S&T issues related to food processing industry. The paper looks into the various challenges faced by the industry, and the future prospects of sector, the employment generation capability of industry, and the skills possessed by the workforce; it also deals with

various public sector initiatives implemented through various policies, programmes and schemes of government.

Methodology

We reviewed the relevant literature and analysed secondary data available on food processing sector. The data sources are from National Sample Survey Organisation (NSSO), National Skill Development Corporation (NSDC) report on Human Resource and Skill Requirements in the Food Processing Sector, Study on mapping of human resource skill gaps in India till 2022, National Bank for Agricultural and Rural Development (NABARD) occasional paper on Status and Potentials of Village Agro-Processing Units/Industries, 2005, Annual Survey of Industries (ASI) reports of the year 2010-11, Ministry of Food Processing Industry (MoFPI) strategic plan and others. The NSSO data belong to 56th and 62nd rounds. The other reports which were consulted are Planning Commission Working Group report on 12th Five Year Plan. Food Processing and Agribusiness (ASSOCHAM, 2009), Processed Food and Agribusiness: Opportunities for investment in India (FICCI, 2007), FICCI survey on challenges in Food Processing Sector, 2010.

***Limitations**:* Access and availability of same set of data on food processing industry across different years was a big constraint. There was no separate code for food processing industries till 2008 in Annual Survey of Industries and National Sample Survey Organisation reports. The Food and Processing industries are included in Food and Beverages industry according to National Industrial Classification (NIC), 2004 and in Food Industry according to NIC, 2008. The last survey done on industries by NSSO was in 62nd round (July 2005-June 2006). Before that manufacturing industries were surveyed in rounds 3rd, 10th, 14th, 23rd, 29th and after the launching of Economic Census (EC) in 1977, the industries were again surveyed in rounds 33rd, 40th, 45th, 51st, 56th and 62nd of NSSO. In ASI data are available up to 2010-11, but there is no distinction between food products industry and food processing industry. There are no data available after 2010 on food processing industry from NSSO and ASI.

Overview of Indian Food Processing Industry

In the post-Independence period, India witnessed rapid growth in food- processing sector specifically during 1980s. It followed the first phase of the Green Revolution that had resulted in increased agricultural production and the need for its post-harvest management. The importance of the sector was realised by the business community leading to diversification from grain trading to processing (Kachru, 2006). Initially it was rice processing which was followed closely by wheat milling, paper and pulp industry, milk processing sector, jute industry, sugarcane processing and oils extraction through solvent plants. In some areas like the solvent extraction industry, the growth in installed processing capacity has been far higher than the supply of the raw materials. However, in other areas like fruits and vegetable processing, the growth has not been encouraging due to poor demand for processed products by the consumers. In such cases, the industry has also not been able to develop the demand adequately. The low levels of processing are driven primarily by the food habits of the population. Fresh fruits and vegetables are preferred compared to processed fruits and vegetables (Deloitte, 2009).

Even after a strong agricultural production base, India's food processing industry is still under-developed. The highest share of the processed food is in the dairy sector, where 35 per cent of total produce is processed, of which only 15 per cent is processed by the organised sector. The processing level is around 2.2 per cent in fruits and vegetables, 21 per cent in meat and poultry products. Of the 2.2 per cent processing in fruits and vegetables only 48 per

cent is in organised sector remaining in unorganised sector (Merchant, 2008). Food and food products are the biggest consumption category in India, with spending on food accounting for nearly 21 per cent of India's GDP and with a market size of ₹ 9,050 billion. The share of food processing industry in GDP has gone up to ₹ Rs.44,93,743 crore in 2009-10 from ₹ 32,54,216 crore in 2005-06, with Compound Annual Growth Rate (CAGR) of 8.40 per cent. CAGR for total manufacturing sector during the same period has been 9.35 per cent (Table 1).

Table 1: Contribution in GDP from 2004-2010

	Contribution to GDP (₹ in crore) at 2004-2005 prices						CAGR
	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2005-06 To 2009-2010
Manufacturing	453225	499011	570436	629052	655775	713428	9.35
Food processing industry	44355	47690	52164	57320	67122	66078	8.49
Registered food processing industry	22148	26780	30710	34752	43893	43910	13.16
Non-registered food processing industry	22207	20910	21454	22568	23229	22168	1.47
Total GDP	2971464	3254216	3566011	3898958	4162509	4493473	8.40

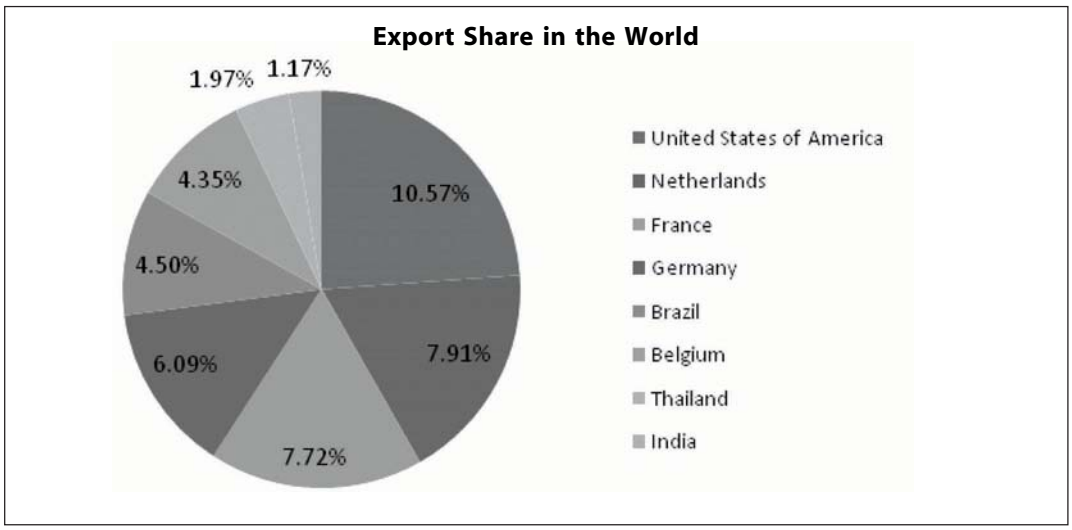
Data Source: NAS, 2011.

A study by McKinsey reiterates the importance of the food sector in India. It indicates that food in India has an economic multiplier of 2-2.5.That is to say that for every rupee of revenue from food, the economy at large gets ₹ 2-2.50. This phenomena was highlighted in a study done in Uttar Pradesh for knowing the contribution of agro-industries in generation of income and employment generation for farmers, it was found out that the farmers involved in food processing industry as suppliers are able to increase their income to the extent of 69 per cent for large farmers, followed by 13 per cent for farmers who own 10 to 20 acres of land while it increased lowest at 0.69 per cent for farmers owning land below 5 acres of land sizes. Presence of food processing industry also increases the hired workforce in farms. It is over 75 per cent for farms associated with industry in comparison to average of 72 per cent of total hired workforce in agriculture (Mehta, 2012). Even after all these benefits, farmers and the private sector are yet to exploit the full potential of food industries in India.There is a big market for products like sugar, coffee, tea and processed foods such as sauce, jelly and honey.The market for processed meat, spices and fruits is equally large.Tripling of the size of industry by 2015 is expected to generate direct employment of 28 lakh persondays and an indirect employment of 74 lakh persondays (MOFPI, 2007).

India is the largest producer of milk, fruits, pulses, cashewnuts, coconuts and tea in world and accounts for 10 per cent of the world fruit production. Confederation of Indian Industry estimated that the food processing sector has potential of attracting US$ 33 billion (₹ 1, 50,000 crore) of investment in next ten years.The Indian domestic food market is expected to grow by nearly 40 per cent of the current market size to ₹ 12,900 billion by 2015 and ₹ 17,200 billion by 2025 (World of Food India, 2011; Merchant, 2008). The state wants to fully utilise the untapped potential of the sector, and generate more revenue from the sector. If the policies of government towards food processing industry are analysed, there also it comes out that according to the vision 2015, the food processing industry is moving towards higher avenues, for example, increase in the level of processing of perishables from 6 to 20 per cent, value addition from 20 to 35 per cent, increase in share of global food trade from 1.5 to 3 per cent. These targets can be achieved if policies are implemented properly and international standards match, then food processing industry can become the leading industry of India's economy, generating huge employment opportunities and increase in income.

Still, there are significant constraints which, if not addressed sooner, can impede the growth prospects of food processing industry in India. At present, our share in exports of processed food in world trade remained at about 1.5 per cent or ₹ 16 billion (Bhuyan, 2010). Competitiveness of Indian export items are coming down, eg. India slipped from first to third rank in tea export. It is no longer competitive even with Vietnam in marine products and spices. Indian exporters are largely small scale, often undercut each other, export low value-added products to small traders/agents overseas or bulk packaged commodities for re-processing and re-packaging overseas where real value addition takes place. According to Annual Report of MOFPI, 2008-09, India produces 105 million tonnes of milk, 150 million tonnes of fruits and vegetables, 485 million livestock, 230 million tonnes of foodgrain, 7 million tonnes of fish, 489 million poultry and 45, 200 million eggs, and still our presence at world stage is even less than 1.5 per cent.

Figure 1: Export Share of Various Countries in World Processed Food Market



Source: NMCC, 2009.

Having analysed the general scenario of food processing industry, its contribution in national income, and in international trade, we will be analysing the major segments within food processing industry, the growth of food processing across various states, and its role in generating employment and skill development in the sector.

The major segments in the Food Processing sector comprise fruits and vegetables, dairy, edible oils, meat and poultry, non-alcoholic beverages, grain-based products, marine products, sugar and sugar-based products, alcoholic beverages, pulses, aerated beverages, malted beverages, spices, and salt. Out of these segments, dairy (16 per cent), grain-based products (34 per cent), bakery-based products (20 per cent), and fish and meat products (14 per cent) contribute to a major portion of industry revenues, apart from the manufacture of beverages.

Fruits and Vegetables : F&V processing is dominated by unorganised players, who occupy a share of 70 per cent in the total market size. Over the last few years, the industry has witnessed rapid growth of Ready to Eat foods, frozen vegetables, processed mushroom etc. The major challenge with this sector is non-availability of infrastructure facility to store produce. The cultural preference for fresh fruits and vegetables dominates over processed items.

Dairy: According to Dairy India 2007 estimates, the current size of the Indian dairy sector is ₹ 3133.50 billion and has been growing at a rate of 5 per cent a year. The dairy sector is mainly unorganised due to which the products do not match international standards. In 2011, the value of milk output from livestock is around ₹ 240000 crore and the value of dairy products market is around ₹ 400000 crore (Source : NDRI, 2011).

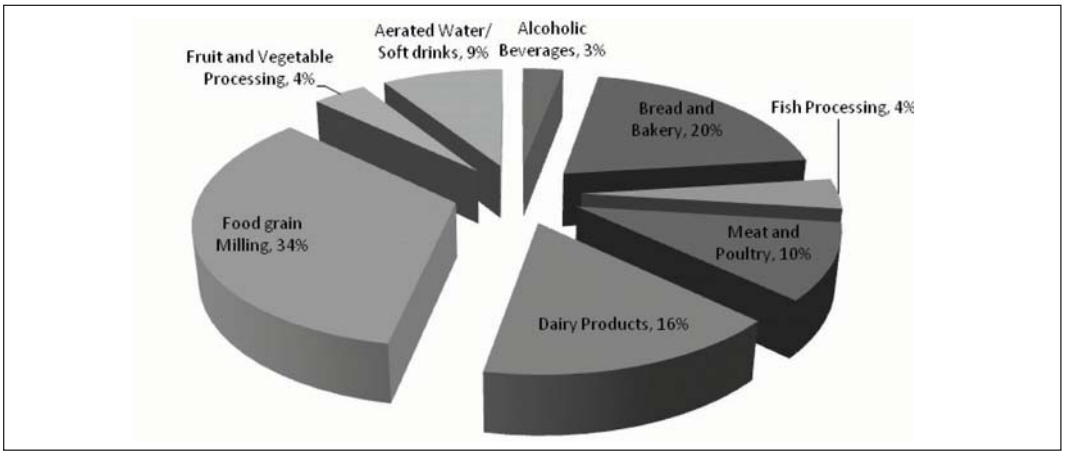
Meat & Poultry: Entry of many organised players like Godrej, Venkateshwara Hatcheries, Suguna poultry etc., in meat processing and packaging has accelerated growth of this industry segment. Meat production is estimated at 6.5 MT during 2007-08, which is around 2 per cent of world meat production. The contribution by bovine, ovine, pig and poultry is 43, 12, 8 and 37 per cent, respectively (Source: NPC, 2009).

Fish & Marine Products : The dietary habits of the people all over the globe are changing fast and India is gearing up to produce and supply value added products in tinned packs by adopting the latest technologies and by tapping the unexploited and under-exploited fishery resources. Value addition has been considered as the thrust area. Indian seafood processing units are being encouraged to go in for value addition and export through setting up new units, expanding their capacity and diversifying their current activities etc., for value addition. The export of marine products has steadily grown over the years-from a mere ₹ 3.92 crore in 1961-62 to ₹ 8607.94 crore in 2008-09. Marine products account for approximately 1.1 per cent of the total exports from India (Source: NPC, 2009).

Snacks : The Indian snacks market is estimated to be worth ₹ 150 billion with the organised segment accounting for half of the market share and is growing at a rate of 15-20 per cent. The unorganised share is roughly ₹ 75 billion and is currently growing at a rate of 7-8 per cent. Potato chips and potato based products occupy almost 85 per cent share of the Indian snack market (Source: PC, 2009).

Beverages : The market for carbonated drinks in India is worth US$ 1.5 billion while the juice and juice-based drinks market accounts for US$ 0.25 billion. Growing at a rate of 25 per cent, the fruit-drinks category is one of the fastest growing segments in the beverages market (Source: NPC, 2009).

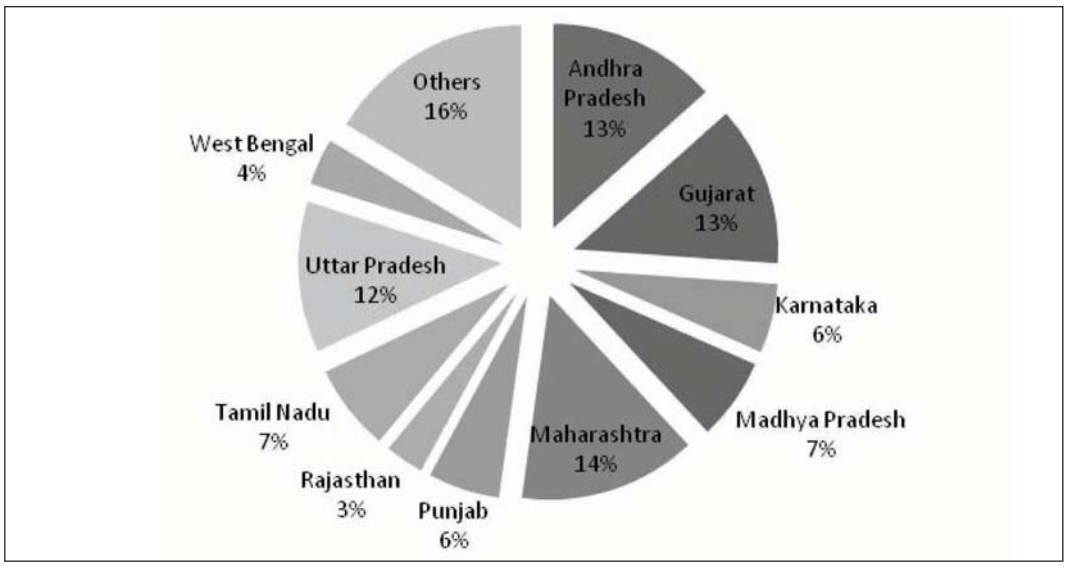
Figure 2: Share of Major Segments of Food Processing Industry in Revenue Generation in 2010



Source: ASI, MOFPI, 2010.

Major food processing States in India are Andhra Pradesh (13.4 per cent of India's food processing industry, and a centre for fruits, vegetables, grains and livestock products viz. poultry, dairy, fisheries, meat, etc.), Gujarat (12.7 per cent, and a centre for edible oils and dairy), Maharashtra (14 per cent, and a centre for fruits, vegetables, grains and beverages), and Uttar Pradesh (12 per cent, across almost all product categories).

Figure 3: Major Food Processing States in India



Source: ASI, 2010.

Figure 3 demonstrates that there is uneven development of food processing industries in India, most of the States have not fully capitalised their resources, and most of the produce is getting waste. This figure also demonstrates the fact that there is huge gap between numbers of food processing industries present in different States.

The food processing industry has strong backward linkages with rural economy, as all the raw material is produced by rural people. Hence, any growth in food processing industry, positive or negative, will have a direct impact on economy of rural India. According to NABARD (2005-06), the share of agro-industry in village level rural industry in terms of number of enterprises, total employment and gross value added were 83, 78 and 72 per cent, respectively. Out of the agro-processing sector in rural areas, the food processing industry is the second most important industry, in terms of revenue generation. But there is a huge productivity gap because of the use of traditional technology in production.

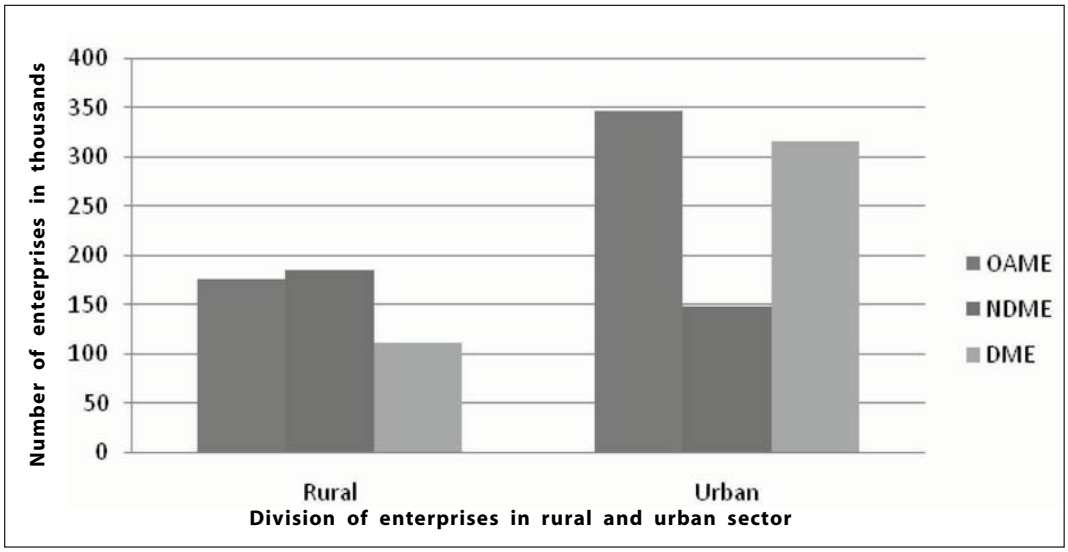
In rural areas, the food processing industry is mainly unorganised. According to NSSO classification, there are two types of setup in unorganised sector, one is own-account enterprise and another is establishment. An own-account enterprise is an enterprise which is run without any hired worker employed on a fairly regular basis, and an establishment is the one which employs at least one hired worker on a fairly regular basis.

In the unorganised sector, the OAME have the highest number of enterprises in both rural and urban areas. The OAME consist of fragmented primary processing units which are mostly home-based (Graph 1). The higher share of OAME leads to non-adherence to quality standards, low income generation, and less skill development. In OAME, it's the same work which continues for generation, thus leading to stagnation of creativity and development of technology.

The study by Sarkar (1995) indicated that the Own Account Enterprises (OAE), the smallest size group in the unorganised sector, is disadvantageously positioned in terms of backward linkage, raw material concentration index and size of market factors. Their ever diminishing advantages lie in dispersed raw material availability and sectors where processes are difficult to standardise. Further, raw material concentration index and direct backward linkage are positively and significantly correlated. It signifies that food-industries using larger proportion of material inputs also have added advantage in geographically concentrated availability of raw materials used in production. Whereas the advantages of factory sector lie in terms of larger market, higher linkages and concentrated availability in raw material. Specialisation of agricultural production in different regions, higher income level by expanding size of market and better transportation facilities are likely to eat into the location advantages that the OAME still possess.

With the increase in preference for processed food in India, there is a significant

Graph 1: Total Number of Unorganised Food Processing Industries in India in 2006-07



Source: NSSO 62nd round, February 2008.

increase in the number of industries in organised sector. The sector has grown at 31 per cent in the last three years (Table 2). This development gives a very encouraging view of food processing industry.

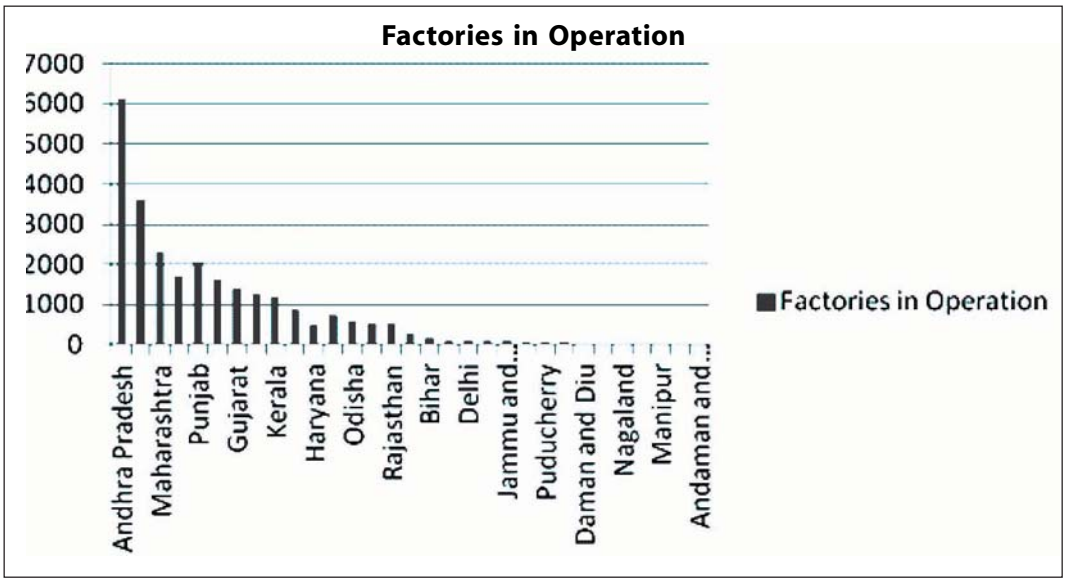
Table 2: Total No. of Factories in Organised Food Processing Sector from 2008 to 2011

Year	No. of factories
2008-09	25854
2009-10	26164
2010-11	34023

Source: ASI, December 2011.

India's strong agricultural base, variety of climatic zones and accelerating economic growth hold significant potential for food processing industry, and provide a strong attraction to foreign investment. The foreign players are able to sense enormous unexploited potential, and are continuously increasing their investment in food processing sector. The sector has been able to attract around INR 45.19 billion Foreign Direct Investment (FDI) during 1991-2005 which is 3.3 per cent of total FDI inflow in India, and has been ranked as 7th sector attracting largest FDI in India. There is quite a significant presence of food processing Multi National Corporations (MNC's) in different States in India. The highest number of MNC's are present in Andhra Pradesh (6127), followed by Tamil Nadu (3589) and Maharashtra (2316). These numbers show that those States which have provided some incentives through policy initiatives in the food processing industry are able to attract foreign investment. They provide significant investment subsidy, sales tax exemption on a fixed capital and rebate on power bill, thus making themselves a perfect choice for investment.

Graph 2: State-wise Number of MNC Food Processing Factories in Operation



Source: ASI, MOFPI, 2010.

The presence of FDI is beneficial to the retail segment also. The presence of FDI cutout the middlemen, thus giving a platform to the farmers to sell their produce to industry at a profitable price. There has been some hesitation regarding government decision to allow FDI in food retail sector, but some of the farmers' associations like All India Vegetable Growers Association (AIVGA), Bharat Krishak Samaj, Consortium of Indian Farmers Associations (CIFA), People for Environment Horticulture & Livelihood of Himachal Pradesh have come out in the support of FDI, as they expect that FDI will roll out produce storage centres, increase market access, reduce the number of middlemen and enhance returns to farmers. Then there are various examples where presence of Multi-national Corporation has changed the fortune of farmers of that area. Here, study of two cases is given which strengthen the fact that FDI will bring a good change for the farmers.

Case study1: PepsiCo India

PepsiCo India's potato farming programme reaches out to more than 12,000 farmer families across six States. They provide farmers with superior seeds, timely agricultural inputs and supply of agricultural implements free of charge. The company has an assured buy-back mechanism at a prefixed rate with farmers. This insulates them from market price fluctuations. Through their tie-up with State Bank of India, they help farmers get credit at a lower rate of interest. The company arranges weather insurance for farmers through tie-up with ICICI Lombard. They have a retention ratio of over 90 per cent, which reveals the depth and success of their partnership with farmers. In 2010, contract farmers in West Bengal registered a phenomenal 100 per cent growth in crop output, creating a huge increase in farm income. The remarkable growth has resulted in farmers receiving a profit between ₹ 20, 000– 40,000 per acre, as compared to ₹ 10000–20,000 per acre in 2009.

Case study 2: Bharti Walmart Initiative

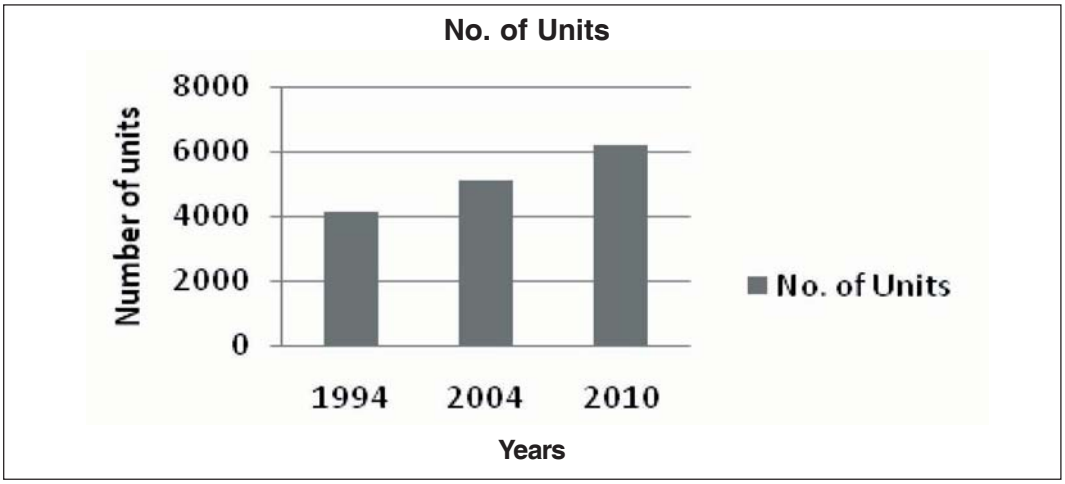
Corporate Social Responsibility (CSR) initiatives in Bharti Walmart are aimed at empowerment of the community thereby

fostering inclusive growth. Through their philanthropic programmes and partnerships, they support initiatives focused on enhancing opportunities in the areas of education, skills training and generating local employment, women empowerment and community development. In conjunction with the farmers' development programme in Punjab, community-building activities have been implemented in village, Haider Nagar. Due to lack of sanitation facilities, households tend to use the farm fields, thereby affecting yields and impacting the produce that is being supplied to stores. In order to improve the yields and the community's way of life, the company is working on the issues of Sanitation and Biogas, Education, Awareness Building and Health and Hygiene.

The presence of FDI will definitely act as a boon for the investors, farmers and everyone associated with food processing sector, but there is a strong need to regulate the modern retail, the laws should be properly implemented such that small retailers are safeguarded, the traditional retailers should be upgraded and wholesale markets should be upgraded to serve retailers and farmers better. The policy should work on the line of "Competitiveness with inclusiveness".

One of the sectors which is attracting a huge attention from global market players as well as from domestic players is fruit and vegetable processing sector. There is a sudden surge in demand for these products and market is trying to cope up with the demand. India is the second major producer of fruits and vegetables after China, but our fruit and vegetable processing industry is making a very slow progress. In last 16 years, only 2068 new licenses have been issued for the fruit and vegetable processing industries, marking only 50 per cent rise in the number of industries. These facts again prove that there is higher preference for fresh fruits and vegetables.

Graph 3: Fruit and Vegetable Processing Licensed Industries (1994, 2004 and 2010)



Source: Indiastat.com, 2010.

Till now we have studied that the food processing industry is growing at a significant rate. There is a continuous increase in the number of industries. There is a decent presence of foreign capital in the sector. The industry is growing in some States at a very fast pace (Andhra Pradesh, Maharashtra, Tamil Nadu), but some places are yet to mark their place especially north-east. But, overall the industry is growing, which is a positive sign.

With the kind of growth the industry is registering, it is important to know about its technology, its income and employment generation capability and skills needed in the sector.

Technological Capability of Food Processing Industry

The incoming of FDI and increase in the number of food processing industries, highlights the importance of science and technology capability of our food processing industries. A well developed technology infrastructure will add on to other incentives which India enjoys in food processing industry. In India, food processing dates back to the pre-historic age when crude processing including various types of cooking, such as over fire, smoking, steaming, fermenting, sun drying and preserving with salt were in practice. Foods preserved this way were a common part of warriors' and sailors' diets. These crude processing techniques remained essentially the same until the advent of the Industrial Revolution. Modern food processing technologies, in the 19th century were also largely developed to serve military needs. In the early 20th century, the space race, change in food habits and the quality consciousness of the consumers in the developed world furthered the development of food processing with advancements such as spray drying, juice concentrates, freeze drying and the introduction of artificial sweeteners, colourants, and preservatives. In the late 20th century, products including dried instant soups, reconstituted fruit juices, and self-cooking meals such as ready-to-eat food rations etc., were developed. But, in technological advancement and use, India is far behind other countries. Most of the work is done manually, and international standards are compromised.

India produces about 450 million tonnes of raw food materials of plant and animal origin which are refined, stored and transformed into various usable products using conventional and modern post-harvest and food processing technology. It involves operations like cleaning, grading, drying, storage, milling, packaging, transport, marketing and utilisation. At the end of each operation, value is added to the product. The lowest and the highest monetary values of a food commodity are, respectively, when it is in raw and fresh form and when it is in processed and ready to consume/eat form. Post-harvest and food processing technology are commodity and location-specific. It enhances and augments per capita food availability from a unit arable land and other resources by preventing avoidable post-harvest losses and adding value to the fresh agro-produces. It also creates opportunities for employment and income generation. Integration of production agriculture with on-farm primary processing is needed to have higher and sustainable production, productivity and better quality end products for domestic and export markets. It, therefore, demands establishment of Agro-Processing Centres in the production catchments itself to facilitate backward linkage with farmers, have fresh and best quality raw food materials for processing and value addition, minimise material movements, check migration of rural people to urban areas for jobs and thereby reducing pressure on public utilities in urban areas. Such centre would be a very strong tool for rural reconstruction and its upliftment. It would help in reducing rural- urban disparity and ensuring household food and nutritional security for all at an affordable cost. The technology is available but political will and commitment is required to implement the programme to shape a new India in the new millennium where everyone would be healthy and happy. It is in the interest of the nation and its people.

In India, the post-harvest losses are to the tune of ₹ 76,000 crore per annum, giving out a gruesome picture of industry. A substantial amount of these losses could be prevented if appropriate agro-processing centres having backward linkage with farmers to ensure

constant supply of quality raw food materials are established and operated. The two major goals of post-harvest technology are loss prevention and value addition to the raw food commodities through preservation and processing. Raw food materials are cleaned, graded and then they are either stored or processed. Processing is done to make raw commodities edible through primary and secondary processing and ready to eat through tertiary processing. Estimated value additions to the raw food materials through primary and secondary/tertiary processing in India are 75 and 25 per cent, respectively.

Now, we will explore some of the conventional and improved agro-processing technologies which are used in food processing industry. Indian food processing industry is growing at a healthy rate, and two sectors which are driving the growth are dairy sector and horticulture sector.

Table 3: Conventional and Improved Agro-processing Operations Used in Food Processing Industry

Operation/activity	Conventional technology	Post-harvest technology
Threshing	Manual beating and animal/tractor treading	Mechanical threshing with improved design of threshers
Winnowing	Manually with ordinary baskets	Mechanical winnowing with manual mechanical power.
Cleaning	Manually operated SUPA, a simple device but of low capacity	Manual/power operated cleaner cum-graders.
Drying	Open yard sun drying	Solar dryers or heated air dryers using mechanical power.
Storage	Earthen pitchers, mud bins or bag storage	Metal bins, brick structures and concrete silos of improved designs.
Milling	Hand and foot pounding, rice hullers, stone grinders, oil ghanis, etc.	Modern rice, dal and flourmills of different capacities, oil expellers, solvent extraction plants.
By-product utilisation	Direct feed and fuel uses	Solvent extraction of rice bran and oil cakes, pelleted animal feed, etc.
Marketing	Selling raw materials to middlemen of trade at low prices	Selling of cleaned and graded produces, value added products directly to super/cooperative markets for better profitability.
Preparation and utilisation	Open vessel cooking and traditional food preparations	Pressure and microwave cooking. Nutritionally balanced diet/recipes. Use of refrigerators, grinders/ mixtures.

Source: Ali, 1999.

Dairy Sector

India is currently the largest producer of milk in the world, a status it has maintained since the late nineties. Further, India is also self-sufficient in milk. This has been largely achieved through a combination of favourable policies and an institutional network that has helped support millions of rural households in pursuing their livelihoods through small-scale dairy farming. About one-fifth of the milk produced is collected and processed by the organised dairy sector. Cooperatives now link more than twelve million small-scale dairy producers to urban markets and provide them a stable source of income. India is witnessing winds of change because of improved milk availability, a change-over to market economy, globalisation, and the entry of the private sector in the dairy industry. The value addition and variety in the availability of milk products are on everybody's agenda. There is an increasing demand for new products and processes. The main reasons are - an increase in disposable incomes; changes in consumer concerns and perceptions on nutritional quality and safety; arrival of foreign brands; increasing popularity of satellite/cable media; and availability of new technologies and functional ingredients.

In India, milk and milk products are inseparable part of socio-cultural life. The traditional milk product marks an auspicious and happy occasion in India. Traditional products account for more than half of the total revenue generated from dairy industry. But, then also these products have not been able to create an international demand for them, due to their limited shelf-life period. With advent of new processing technology in dairy sector, the sector is gearing up to take on the world with its traditional products.

Traditional Sweets : With the successful innovation of Scraped Surface Heat Exchangers, traditional sweet products can be easily manufactured by the Indian dairy industry. About 15 plants in India have initiated industrial production of khoa with daily output of 1 to 4 tonnes using continuous khoa making machine. The entire traditional technology can be improved and modernised by employing mechanical systems such as casein parocess for chhana and paneer making. Shelf-life of pasteurised milk could be extended by adoption of higher pasteurisation conditions, Lactoperoxidase (LP) - system, bactofugation technique, micro-filtration technique, electrical process, thermisation process or use of bio-preservatives. These sweets are also gaining wide acceptance in South Asian and African countries, UK, Canada and the USA.

New Whey Products : In India, whey is obtained during the manufacture of paneer, chhana, casein and shrikhand. It has been estimated that about one million tonnes of whey is annually derived as a by-product which possesses about 70,000 tonnes of nutritious solids. Whey obtained in our country as by-product is mostly thrown away as waste. No proper attempts have so far been made particularly on a small scale to exploit this by-product. Considerable economic benefit can also be secured from prompt utilisation of the whey. Whey can be converted into a range of products viz. whey powder, lactose, high protein whey powders, whey protein concentrate, granulated high protein whey powders, These products can be used in infant foods, weaning foods, bakery products, confectionery products, dairy products etc. Beverages and soups are generally consumed by a large number of people for the reasons of their being refreshing, tasty and nutritious.

Ultra High Temperature (UHT) Processing and Aseptic Packaging: Considered as the single most important innovation for dairy products in the last half-century, it involves producing shelf-stable products by sterilising the product and the packaging material or container separately and filling in a sterile environment. It was popularised in India with the success of fruit juices, drinks and milk such as Amul Taaza.

Super Heated Water Spray Steriliser : Early methods for sterilising milk involved filling milk into heat resistant glass bottles, then sealing them with air tight, pressure resistant caps and heating in a commercial pressure cooker (or retort) to temperatures between 1150 C and 122.70 C for between 12 and 20 minutes. The retort process can include an agitation step which helps reduce heat transfer time and combats settling and separation. A new method of sterilisation has been developed called "Super Heated Water Spray Steriliser" for heat sensate products. This is suitable for delicate containers like plastic bottles. This system is suitable for rapid heating and rapid cooling for heat liable products.

Membrane Processing *:* Recently, membrane processing has gained importance over conventional processes in dairy industry for its advantages that are well known and established. Membrane processing has presented new possibilities for the production of newer intermediate dairy products that can be used in different foods based on their functional properties.

Horticulture

Another very important component of food processing industry is Horticulture. Horticulture sector includes fruits, vegetables, root and tuber crops, spices, mushrooms, honey, floriculture, medicinal and aromatic plants and nuts. These crops though account for only 6-7 per cent of the total area under cultivation, provide more than 25 per cent of total agricultural GDP and the total agricultural expertise. It is estimated that post-harvest losses of horticultural produce range between 8-37 per cent. Even if 10 per cent of these losses could be saved by converting the surplus into processed products, there will be considerable saving to the horticultural wealth in the country.

The horticulture sector of India has got its share of limelight in last decade only, with the advent of globalisation. Before that, most of the fruits and vegetables were stored in the form of pickles, murabba and other homemade chutneys. Mostly the produce was heated, boiled or sun dried. There was no big business in the form of fruit and vegetable processing.

But in the last two decades things have changed, with the coming of multi-national corporations and new technologies, fruit and vegetable processing is also seen as a business opportunity. Some of the new technologies which are used in horticulture sector are:

Thermal Processing Methods: In this method the severity of the heat treatment and the resulting extension of the shelf life are determined mostly by the pH of the food. In low acid foods its mainly high temperature processing, and in acidic and highly acidic food its boiling water processing. Some of the thermal processing methods are, Blanching, Pasteurisation, Sterilisation and Commercial Sterilisation.

Drying/ Dehydration: Preservation of foods by drying is perhaps the oldest method known. Drying of foods and biological products is a widely applied process for different purposes such as increasing shelf life, reducing packaging costs, lower shipping wastes, encapsulating flavours, making food available during off-season, adding value by changing the phase structure of the native material and maintaining nutritional value. In earlier times drying was only done by solar, i.e. sun drying. With the invention of new technologies many more have come, they are Mechanical (Cabinet) dehydration, Osmotic dehydration, Freeze drying, Ionising radiations.

Chemical Preservation: In this technique, chemical additives such as sugars, salt, acids, spices etc., are used to preserve food. Some of the common ways are high sugar preservation, use of salt/acid/spices, and use of chemical additives.

The use of chemical additives is highly sensitive issue; there are basic rules which

govern chemical preservation. Chemical food preservatives have to be used only at dosage level that is needed for a normal preservation and not more than that prescribed by Fruit Product Order, 1955. Reconditioning of chemical preserved food is not recommended. The use of chemical preservatives must be strictly limited to those substances which are recognised as being without harmful effects on human beings' health and are accepted by national and international standards.

Another very common method of preservation is **Hurdle technology**; it's a combined method of preservation. The trend of using a wide range of mild preservation techniques has emerged to be known as combined preservation or barrier (Hurdle) technology. It advocates the deliberate combination of existing and novel preservation techniques in order to establish a series of preservative factors (hurdles) that any microorganisms present should not be able to overcome.

These were some of the technologies used in horticulture for the preservation of products. The Indian entrepreneurs are making use of new technologies to increase their production, match the quality standards of international trade, and to generate maximum profit for themselves. But Indian food processing industry is highly unorganised, and most of the employers in this sector ignore the new technologies and prefer manual labour, compromising on Good Manufacturing Practices. For example, our meat and poultry industry, which has a huge market outside India, has only 9 modern abattoirs out of the 3,600 slaughter houses. Therefore, it's the time when Indian government should come out with various policies to promote technological development of food processing industry.

Now, we will analyse the employment generation capacity and skill requirements of the sector. The food processing industry is employment intensive. The sector employs people of different backgrounds and of different education level. The sector actually needs highly skilled people, who can contribute to the growth of sector. The need of skills is different in different segments of the sector. For example: a person, who is working in dairy segment, might be highly skilled for that segment, but he will not be suitable in fish processing segment. In this part we will first analyse the employment generation capacity of food processing sector.

Employment Generation Capacity

As stated earlier, food processing industry employs 13 million people directly and 35 million people indirectly (MOFPI, 2011), and the kind of growth industry has it is expected that it will create job opportunities for large part of workforce. The food processing sector is highly unorganised, 82 per cent of the workforce employed in food processing industry is in unorganised sector, and i.e. out of every 10 persons around 8 are employed by unorganised sector (Table 4).

Table 4: Employment Scenario in Food Processing Industry in India in 2010-11

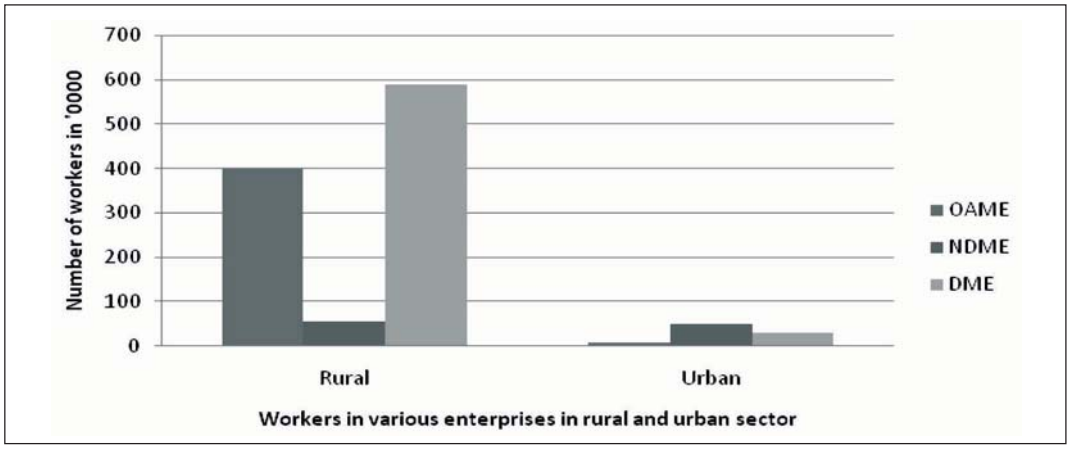
Sector	No. of Persons (million)	Share (%)
Organised	1.53	18%
Unorganised	7.00	82%
Total	8.53	100

Source: ASI, NSSO, 2010-11.

As for unorganised sector, the maximum working population is in DME (Directory Establishment). The higher proportion in DME can be attributed to the fact that they are large

industries and hire more people. Another striking feature which comes out of Graph 6 is that in rural areas OAME (Own account manufacturing enterprises) sector is much bigger than the NDME (Non-directory manufacturing establishment) sector in employment generation, i.e. more people go for their own enterprises in rural areas, and in urban areas the OAME sector is almost negligible.

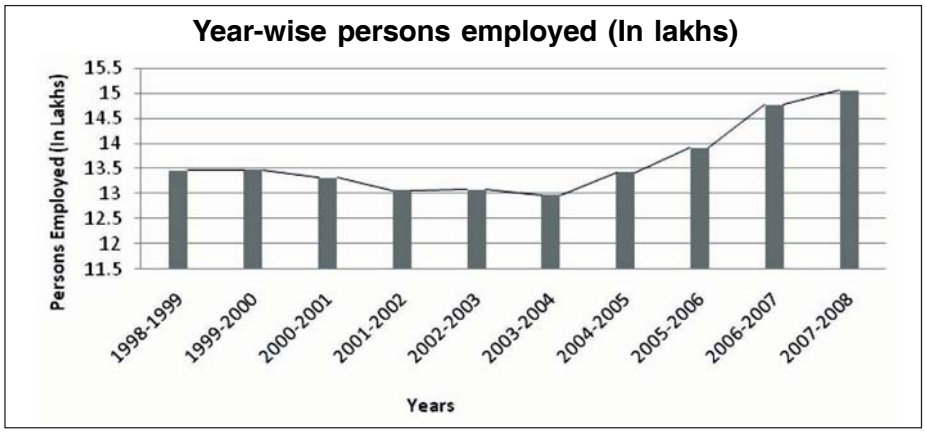
Graph 4: Number of Workers Engaged in Unorganised Food Processing Industry by Enterprise Type, 2005-06



Source : NSSO, December 2007.

Persons employed under the registered food processing industries have been increasing from 2004-05 to 2007-08. There has been a fall in the growth rate of employment in registered food processing industry units in 2007-08, probably because the growth had been very high in the preceding years and also because 2007-08 was a year when there was a global slowdown in economic activity.

Graph 5: Persons Employed Under Registered Food Processing Industries



Source : ASI, 2007-08.

In division of employment state-wise it came out that Andhra Pradesh has the biggest share of persons employed in food processing industry, as Andhra Pradesh is the biggest centre of food processing sector in India (Table 5).

Table 5: Share of Various States in Employment in Food Processing Industry in 2010

S. No.	Name of the State	Share of employment in %
1	Andhra Pradesh	14.1%
2	Assam	4.7%
3	Gujarat	5.9%
4	Haryana	3.3%
5	Karnataka	6.0%
6	Kerala	11.9%
7	Madhya Pradesh	2.3%
8	Maharashtra	7.8%
9	Punjab	7.7%
10	Tamil Nadu	11.2%
11	Uttar Pradesh	12.0%
12	West Bengal	4.8%
13	Others	8.3%

Source: NSDC, 2010.

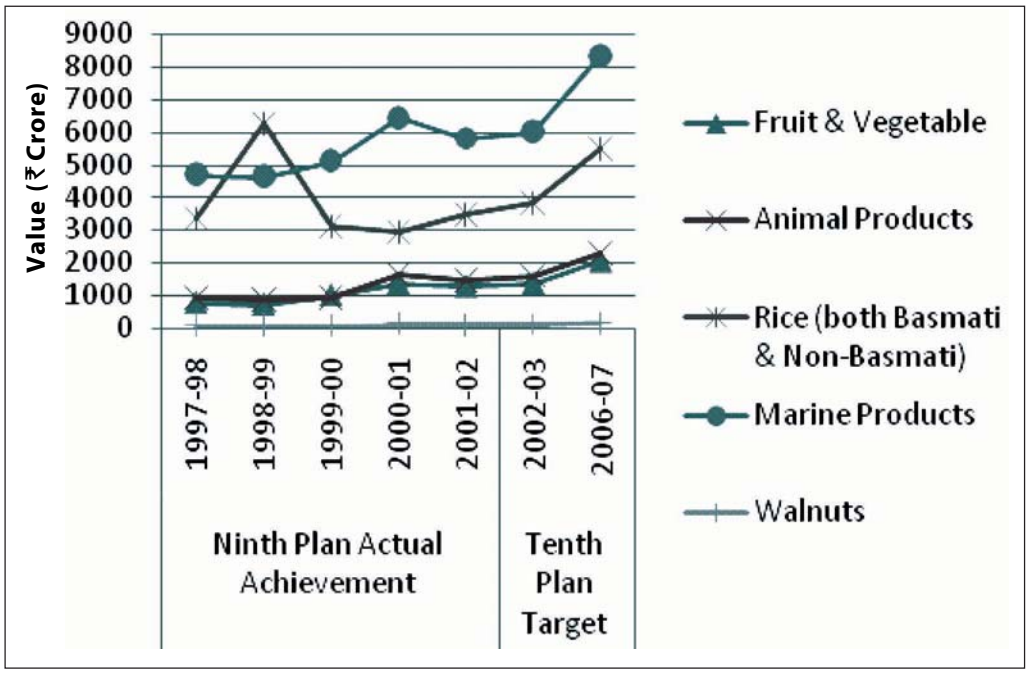
While analysing the employment generation of food processing industry, it is important to understand the skill set which is required in food processing Industry. To understand the skill set required it is important to know value chain in food processing industry.

Value Chain in Food Processing Industry

The value chain in food processing industry starts from farm inputs and ends at food retail and food service. The first stage of value chain includes delivery of agro-inputs, i.e. seeds, agro-chemicals, fertilisers etc. This also includes production of crop, and insurance of crop against any sort of natural or man-made calamity. The stage also involves procurement of agro-produce for value addition. The second stage of trade and distribution, which involves storage and trading of produce and here, comes the importance of cold chain facilities. The absence of proper cold storage facilities leads to wastage of produce, which amounts as high as 35 per cent. This problem has been marked as number 1 challenge in food processing industry, by the entrepreneurs in a survey conducted by FICCI (FICCI, 2010). The trade and distribution facilities also include transportation for export, and shifting of produce from one place to another and trading of sourced agro-produce. Then comes the processing part which involves grading, sorting and waxing in case of fruit and vegetable segment, milling, grading in case of grains (for example, paddy-rice, wheat-flour). Then value addition of wheat into noodles, wheat into bakery items, processed fruit and vegetables, extruded snacks etc. In the next stage there is wholesale trading of value-added produce, export of produce and branding of products. The entry of big brands in food industry has created a tiff competition for small players. The presence of MNC's in the market, do not allow local players to grow, as they lack that extensive branding and publicity. The final stage of food retail and food services, implies retailing of value-added foods by means of hotels, restaurants, eat-outs and retail stores (for packed items, grains, Ready to Eat foods etc.). There is increase in value addition in every segment of food processing industry

with increase in demand for processed food. Graph 6 clearly shows that there is increase in target for Tenth Plan in every segment with respect to Ninth Plan.

Graph 6: Value Addition in Different Segments in Ninth Plan and Target for Tenth Plan



Source: Indiastat.com.2005.

The value addition in different stages in food processing industry requires different skill sets; the basic functional distribution of human resource across segments in food processing industry is given in Table 5. Around 55 per cent of the human resource in food processing industry is involved in production work, or in processing stage. Table 6 gives out a basic distribution of human resources across different segments in food processing industry.

Table 6 : Basic Functional Distribution of Human Resources Across Segments in Food Processing Industry in 2010

Function	% of employees
Procurement	10%
Testing and Quality	20%
Production	55%
R&D	1-2%
Storage	2-3%
Other(Sales and other support functions)	10%

Source: NSDC, 2010.

Having provided the functional distribution of human resources across segments in food processing industry, now we will reflect upon the educational profile of the employees involved in food processing industry.

Analysis of Table 7 shows that maximum percentage of workers in food processing industry have low level of education, and therefore, their skill level is also low. Low level of skills highlights a very dark picture of Indian food processing industry; here workers can not contribute from their side in the development of the industry, thus leading to stagnation of the industry.

Table 7: Distribution of Human Resources by Education Level in Food Processing Industry

Education level	% of employees
Employees with management education	1-2%
Proportion of food technologists	20%
Post-Graduates	0.5-1%
Graduates	10%
Diploma holders	2-5%
Certificate holders	2-5%
10th Standard or below	80%

Source: NSDC, 2010.

While the overall requirement for skilled human resource in the food processing sector is much larger, we have considered the organised sector to illustrate the demand-supply gap. Table 8 presents the demand for skilled human resource across different educational qualification for the organised sector alone.

Table 8 : Annual Demand for Skilled Human Resource in Organised Sector in Food Processing Industry

Category	Required annual demand
Food technologists (Post Graduate)	2,384
Food technologists	5,363
Diploma	4,768
ITI/ITC	4,768
Short term-course trained personnel with education below 10th /12th std.	95,351
Total	112,633

Source: NSDC, 2010.

While there are gaps in terms of excess of demand over supply in the organised sector at all levels, the gap is maximum when considering the demand for 'those trained by short-term courses' with low educational qualification (below 10th/12th standard) where there is a required demand for about 1 lakh trained persons annually against a supply of over 10,000 persons. This requirement will increase to over 5.3 lakh if the unorganised sector is also taken into account.

Skill Gaps in Food Processing Industry

Analysis of Table 9 shows that there is a wide gap between skills needed and skill available. If India is to make its presence in the

world market, then there is a need to bridge this gap as soon as possible. There is a huge gap in demand and supply market. According to a survey done by NSDC, there is a huge demand for skilled workers at all the stages in food processing industry, especially for persons with short-term course training, having education level below 10^{th}/ 12^{th} standard.

Table 9 : Skill Gaps Present in Various Segments of Food Processing Industry

S. No.	Type of Gaps	Dairy	Foodgrain milling	Fruit & Vegetable	Meat & Poultry	Fish and marine products
1	Production	Inadequate knowledge of ways of maintaining the quality of produce. Inadequate knowledge of breeds, feeding, disease control, and poor knowledge of hygiene maintenance and management practices.	Inadequate knowledge of latest / best farming practices because of lack of training /access to other information sources. Inadequate knowledge of percentage increase in value with minimal value addition to Produce. Lack of knowledge of grading and standardisation of foodgrains. Inadequate understanding of ways to minimise breakage of grains.	Inadequate / restrictive motivational skills Inadequate documentation skills / not conversant with e-reporting / working on computers. Inadequate knowledge of operations resulting in wastage	Inadequate consistency in Operations due to inadequate understanding of immediate or long term impacts. Tendency to change jobs frequently, leading to a high attrition rate and consequently lower quality of work and lower productivity.	Inadequate knowledge of fish breeding and rearing processes. Inadequate sensitivity to environmental issues, thus leading to poor hygienic conditions
2	Testing	Inadequate ability to practically conduct tests and record results, no knowledge of correct sampling methods.	Inadequate practical expertise in conducting tests. The field needs Visual examination skills for faster segregation and checking of input/ output and ability to record the results as they are observed and reporting non-adherence to standards.	Inadequate ability to apply technical expertise and procedural knowledge in actual work situations, especially at the entry level.	Inadequate ability to conduct tests and record results. Inadequate technical knowledge for primary medication in case of disease/ medication.	Inadequate technical knowledge about the new machines and the associated aspects of maintenance.
3	Procurement	Inadequate ability to forecast demand. Inadequate communication skills, especially in local language because of diverse dialects. Poor knowledge of making milk by-products, and inability to increase their shelf life.	Inadequate ability to forecast the demand accurately. Inadequate training skills for encouraging the producers for better productivity and quality. Inadequate ability to follow rules of marking gunny bags.	Inadequate knowledge and ability to educate farmers on demand, advice on farming and wastage reduction. Inadequate communication skills to be able to motivate farmers for better quality and higher productivity.	Inadequate awareness of prevention care techniques.	

Data Source: NSDC, 2010.

The demand for skilled human resource is continuously increasing, but there is greater demand in unorganised sector rather than organised sector (Table 10). This is because of the fact that organised sector is very small in respect to unorganised sector.

Table 10: Incremental Human Resource Requirement for Persons Trained Through Short-term/Modular Training Initiatives in Food Processing Industry-Annual Requirements (in'000s)

Sector	Total demand of trained human resources	Demand of trained human resources in organised sector
Fruit and Vegetable Processing	12	2
Foodgrain Milling	42	8
Dairy Products	68	12
Meat and Poultry Processing	104	19
Fish Processing	1	0
Bread and bakery	258	46
Alcoholic beverages	42	8
Aerated water/soft drinks	2	0
Total	530	95

Source: NSDC, 2010.

We have studied the various skill gaps present in food processing industry. Now, we will look at various science and technology policy initiatives of Government of India in development of food processing industry.

Table 11: Various Institutions Providing Vocational Education and Training Programmes in Food Processing Sector

S.No.	Ministry/ Department	Schemes/Programmes/ Institutions having provision for vocational education and training programme	Target Group	Duration of training (short-term/long-term)
1	Ministry of Food	Grants were provided to NGO for setting up 326 food processing and training centres (FPTCs) during 1992-93 to 2000-01.	Persons living in rural areas with preference being given to women, SC, ST and other weaker sections of society.	
		Institutions like Central Food Technology Research Institute, Paddy Processing Research Centre, PHTC, Council of Entrepreneurial Development Programme (EDP) are also training courses.	Mainly persons in food Processing Industries	Short-term
		Person power development in rural areas (FPTC Scheme)	Open	Short-term
		Entrepreneurship Development Programme	Open	Short- term
		Programmes for development of human resources in food processing, testing, training, quality management etc.	Candidates aspiring to managers, technicians/ technologists, and entrepreneurs.	AICTE approved diploma/degree courses durations as usual (Long-term)
2	Ministry of Micro, Small and Medium Enterprises	Entrepreneurship Development programme, Skill Development	▪ Workers	Both short-term and long-term
	[Small Industries Development Organisation (SIDO)]	Programme (SDP), Management Development Programme.	▪ Educated unemployed youth ▪ Entrepreneurs	

Source: MOFPI, MMSME, 2012.

Table 12: Programmes and Policies of GoI for Food Processing and Gaps Present

Policy/ Programme	Year	Feature	Gap/ Constraints
Scheme for Implementation of HACCP/ISO 22000, ISO 14000/GHP/GMP, Quality/ Safety Management (Source: Food Safety and Standards Bill, 2005)	2005	Match the quality standards of the world.	The numbers of food processing centres are highly uneven in respect to number of industries.
Scheme of Technology up-gradation, Establishment and Modernisation of Food Processing Industries (Source : MOFPI , 2006-07)	2007	Financial intervention for enhancing processing levels of industries, and assistance in setting up new industry	No knowledge on how unorganised sector will come in its purview. There has been a persistent demand for increasing the limit of capital grant, but this does not seem to be feasible in view of the limited resources for and galloping demand on the scheme.
Entrepreneurship Development Programme (Source: Eleventh planning commission report, 2007)	2007	Financial assistance to various organisations to promote establishment of food processing industries.	No incubation policy in case of failure of the business.
Scheme for creating Primary Processing Centres/Collection Centres in rural areas. (Source: Draft report for WG 12TH FYP,2011)	2011	Development of rural entrepreneurship and transfer of technology for food processing by utilising locally grown raw materials.	The entrepreneurs do not pay adequate attention to all these facilities, therefore all the responsibility falls on farmer groups.
Training at recognised national/state level institutes sponsored by MOFPI/other training programmes (Source: HRD Ministry, annual report 2011-12)	2011	Financial assistance to farmers or upcoming entrepreneurs for training	The training centre location, and till time even after grant of budget no training institute has come up.
Creation of Infrastructure Facilities for running Degree/Diploma Course in Food Processing Technology (Source: HRD Ministry, annual report 2011-12)	2011	Financial assistance to educational institutions for starting course in food technology.	The problem lies whether the courses introduced are in line with the market demand. Various short duration certificate courses have been introduced, but there are no statistics on whether they suffice the market demand.

Most of the policies developed by Central government are generic in nature. In order to benefit from these policies, respective States have to evolve their own policies, which are in tune with their socio-economic and agri-livestock resource base. The policy from the Centre and State should incentivise and encourage Public Private Partnership (PPP) in overcoming various constraints namely, non-availability of adequate infrastructure facilities, cold chain, packaging and grading centres, lack of adequate quality control and testing infrastructure, inefficient supply chain, shortage of processable varieties of farm produce, seasonability of raw material, high inventory carrying cost, high taxation, high packaging cost, affordability and cultural preference for fresh food. Table 13 lists various challenges faced by food processing industry, and their weightage.

Table 13: Top Five Challenges of Food Processing Industry and Their Weighted Response

Top Five Challenges Identified	Weightage of Challenges
Inadequate Infrastructural Facilities	44.25
Comprehensive national policy on food processing sector	34.46
Food safety laws	28.51
Inconsistency in Central and State policies	28.08
Availability of trained manpower	25.53

Source: FICCI survey, 2010.

The food processing sector is governed by multiple acts rather than a single comprehensive policy on food processing. The food laws governing food processing industry span nine ministries, comprising 13 central orders alone; in addition, States have their own control orders. The policy to be effective will have to be comprehensive and adopt a number of legislative, administrative and promotional measures. According to NABARD, village level agro-industry does not come within the purview of any single Ministry. Because of this problem, only a fraction of the village level agro-industries are registered. It says further that an overwhelming proportion of the registered enterprises are registered with the village panchayats. To infuse technology and credit in agro-industry, it is required to bring them under single registration authority and start a massive campaign to register village level agro-industries. It goes on to state that in spite of the government programmes, lack of infrastructural facilities hinders the growth of agro-industries. These include electricity connection, power cut, transportation facilities, etc. Infrastructural facilities need to be upgraded substantially for economic viability of these enterprises through widespread development of rural infrastructure (NABARD, 2005).

If infrastructural facilities present at village level or all over India are considered, then the most important part of infrastructure facility in food processing industry is cold storage facilities, which are crucial for the value addition. In India, there are 5,381 cold stores with a storage capacity of 24.45 MT. Uttar Pradesh and West Bengal account for more than 60 per cent of the cold storage capacity followed by Punjab, Bihar, Gujarat, Andhra Pradesh and Madhya Pradesh. Over ninety five per cent of the cold storages are in the private sector. According to the Report of the Task Force on Development of Cold Chain in India constituted by Ministry of Agriculture in May, 2007, more than 80 per cent of the capacities are utilised only for potatoes and about 17 per cent fall under multi-commodity category. Most of the multi-purpose cold stores are also used for potato storage besides providing storages for chillies, dry fruits, spices, vegetables etc. Cold storages for meat, fish, milk and milk

products and for other commodities such as chillies and other spices account for about one per cent of the total cold storage capacity. These cold storages are usually smaller in capacity. This difference in storage of potatoes and other products is mainly attributed to the high and annual intake of potatoes, and its longer shelf life. The various existing challenges present in cold storages in India are discussed in Box 1.

Box 1 : Technological challenges in cold storage facility in India

- Designed to store single commodity, not suitable for multipurpose.
- Not suitable for providing storage conditions of uniform temperature, humidity, air circulation and fresh air requirements.
- Pre-cooling technologies such as forced air evaporative cooling, package icing, and vacuum cooling are non-existent in India.
- Controlled atmosphere cold storages still in nascent stage.
- Over 90 per cent of cold stores use old ammonia refrigeration compressor without any capacity control, which is inefficient and expensive.
- Managed by unskilled and untrained manpower, not aware of latest technology and techniques in handling and storing fresh perishable produce to international standards.

In context with food regulation laws, the Indian food regulations comprise various food policies that have been enacted at different points of time, and are under the ambit of various ministries of Government of India (GoI). Historically, they were introduced to complement and supplement each other in achieving total food sufficiency, safety and quality. This incremental approach has led to incoherence and inconsistency in the food sector regulatory scenario. In addition, the multiplicity of ministries and administering authorities at both the Central and State levels has resulted in a complex regulatory system that is not well integrated adding an additional burden on the food industry.

Lack of skilled and trained manpower in food processing industry is also a big issue. Many positive developments in the food processing sector have also resulted in the apprehension about the emerging skill shortages due to mismatch between the demand for specific skills and available supply. In fact, of late, shortage of skilled, semi-skilled and unskilled workers has emerged as a critical factor impacting the competitiveness of Indian food industry. Around 58 per cent of the employers are dissatisfied with technical skills and knowledge needed for the job. Also 72 per cent showed discontent with employees' ability to use appropriate and modern tools, equipment, and technologies specific to their jobs (FICCI, 2010).

The food processing industry has many challenges in front of it, ranging from infrastructure to human resources and to technological backwardness. Now, with the growing demand of processed food there is a need to address these problems and concerned issues on priority basis. Else, India will miss a golden opportunity of using its vast agri-livestock resources to strengthen its economy, revive its rural industries and create employment for thousands of people.

Opportunities

Indian food processing industry has seen significant growth and changes over the past few years, driven by changing trends in markets, consumer segments and regulations. These trends, such as changing demographics, growing population and rapid urbanisation are expected to continue in the future and, therefore, will shape the demand for value added products and thus for food processing industry in India. The Government of India's focus towards food processing industry as a priority sector is expected to ensure policies to support investment in this sector and attract more FDI. India, having access to vast pool of natural resources and growing technical knowledge base, has strong comparative advantages over other nations in this industry. The food processing sector in India is clearly an attractive sector for investment and offers significant growth potential to investors. There is a huge opportunity to develop S&T capability and R&D in the sector. There is a need to train the unskilled labour force, need for development across various human resource profiles. India can harness all the opportunities present in food processing sector only when its labour force is educated and skilled. The government needs to strengthen its skill development programme; new training institutes should open up, which are in tune with market demand. The development of infrastructure facilities like cold chain, road facilities, and power will strengthen the food processing industry. It will have a very positive sign on perishable food products industry, such as fruit and vegetable, dairy industry, meat and poultry segment. The food processing industry is all set to drive Indian economy to higher growth, only need is to pay due attention on technological development of field, and generation of skilled manpower.

References

1. Ali, Nawab, (1999), Post-harvest Technology and Agro-Processing for Important Rainfed Crops, Chapter-36 in the Book entitled Fifty Years of Dry land Agricultural Research in India Ed. by HP Singh et.al. Published by CRIDA, Hyderabad, India.
2. ASSOCHAM (2009), Food Processing and Agribusiness, New Delhi.
3. Bhuyan,A (2010), "India's Food Industry on the Path of High Growth", Indo-Asian News Service, Zurich.
4. FICCI (2006), Indo-Israel Partnership: The Agribusiness Opportunity, New Delhi.
5. FICCI (2007), A Report on Processed Food and Agribusiness: Opportunities for Investment in India, Mumbai.
6. FICCI (2010), Survey on Challenges in Food Processing Sector, Mumbai.
7. Government of India, Department of Scientific and Industrial Research (2007), Annual Report, New Delhi.
8. Government of India, Ministry of Earth Sciences (2011), Report of the Working Group on S & T for Vulnerable Sections of Society, New Delhi.
9. Government of India, Ministry of Human Resource Development (2011), Annual Report, New Delhi.
10. Government of India, Ministry of Food Processing Industries (2006-07), Annual Report, New Delhi http://mofpi.nic.in/ContentPage.aspx?CategoryId=148 Accessed on10.11.2012.
11. Government of India, Ministry of Food Processing Industries(2011-12) , Annual Report , New Delhi http://mofpi.nic.in/ContentPage.aspx?CategoryId=1109 Accessed on 10.11.2012.
12. Government of India, Ministry of Food Processing Industries, (2005), Vision, Strategy and Action Plan for Food Processing Industries in India, New Delhi.

13. Government of India, Ministry of Food Processing Industries, (2011), Strategic Plan for Food Processing Industries in India, New Delhi.

14. Government of India, Ministry of New and Renewable Sources of Energy (2011), White Paper Document for Indian Dairy Industry, Karnal, Haryana.

15. Government of India , Ministry of Statistics and Programme Implementation (2007), National Sample Survey Organisation, Operational Characteristics of Unorganised Manufacturing Enterprises in India, NSS 62nd round, July 2005-June 2006,Report No. 524(62/2.2/1),New Delhi.

16. Government of India, Ministry of Statistics and Programme Implementation (2008), National Sample Survey Organisation, Unorganised Manufacturing Sector in India: Input, Output and Value Added, NSS 62nd round, July 2005-June 2006, Report No. 526(62/2.2/3), New Delhi.

17. Government of India, Ministry of Statistics and Programme Implementation (2009), Annual Survey of Industries, Principal Characteristics by Major Industry Group for the Year 2008-09, New Delhi.

18. Government of India, Ministry of Statistics and Programme Implementation (2010), Annual Survey of Industries, Principal Characteristics by Major Industry Group for the Year 2009-10, New Delhi.

19. Government of India, Ministry of Statistics and Programme Implementation (2011), Annual Survey of Industries, Principal Characteristics by Major Industry Group for the Year 2010-11, New Delhi.

20. Government of India, National Manufacturing Competitiveness Council (2009), Enhancing Firm Level Competitiveness in Indian Food and Agro-processing Industry: Strategies and Road Map Development, New Delhi.

21. Government of India, National Productivity Council (2009), Productivity and Competitiveness of Indian Manufacturing: Food Processing Sector, New Delhi.

22. Government of India, National Dairy Research Institute (2011), International Animal Industry Vision 2020, Future of Indian Dairy Industry, 1-2 December, 2011, Karnal, Haryana, India.

23. Gupta, Rupali. (2012), "FDI in Indian Retail Sector: Analysis of Competition in Agri-food Sector", Competition Commission of India, New Delhi.

24. http://www.indiastat.com/industries/18/industrialsectors/107700/agrobasedandfoodprocessingindustries/43/stats.aspx Accessed on 18.02.2013.

25. http://www.indiastat.com/industries/18/industrialsectors/107700/agrobasedandfoodprocessingindustries/43/stats.aspx. Accessed on 21.02.2013.

26. Kachru, R.P. (2006), Agro Processing Industries in India in Status of Farm Mechanization in India. http://agricoop.nic.in/Farm%20Mech.%20PDF/05024-06.pdf Accessed on 20.11.2012

27. Mehta, G.S. (2012), "Agro-Processing Industry in Uttar Pradesh : Emerging Structure and Development Potentials", Giri Institute of Development Studies, Lucknow.

28. Merchant, A (2008), India –Food Processing Industry, OSEC Business Network, New Delhi.

29. National Skill Development Council (2010), Human Resource and Skill Requirements in the Food Processing Sector, Study on Mapping of Human Resource Skill Gaps in India till 2022, New Delhi.

30. Punjabi, Meeta. (2007), " Emerging Environment for Agribusiness and Agro-Industry Development in India", Food and Agricultural Organisation of the United Nations, New Delhi.

31. Sarkar, S. (1995), "Size Structure of Agro-industry: A Linkage Analysis," *Indian Journal of Agricultural Economics,* Vol.50, No.4, Oct-Dec, 1995.

32. Sarkar, Sandeep and Karan A.K. (2005), Status and Potentials of Village Agro-processing Units / industries, Occasional 37, National Bank for Agriculture and Rural Development, Mumbai.

33. Sethi, Shruti. (2007), "Horticulture- Post Harvest Technology, Principles of Food Processing", Indian Agriculture Research Institute, New Delhi.

Journal of Rural Development, Vol. 32, No. (4) pp. 479-480
NIRD, Hyderabad.

ANNEXURE

Definition BY NSSO :

Enterprise:

An enterprise is an undertaking engaged in the production and / or distribution of some goods and / or services meant mainly for the purpose of sale, whether fully or partly. An enterprise may be owned and operated by a single household or by several households jointly on a partnership basis, or by an institutional body.

Manufacturing Enterprise:

A manufacturing enterprise is a unit engaged in the physical or chemical transformation of materials, substances or components into new products. It covers units working for other concerns on materials supplied by them. Also included are units primarily engaged in maintenance and repair of industrial, commercial and similar machinery & equipment, which are, in general, classified in the same class of manufacturing as those specialising in manufacturing the goods.

Unorganised Manufacturing Enterprise:

The unorganised manufacturing sector for the present survey consists of following types of enterprises: (i) All manufacturing enterprises except those registered under section 2m(i) and 2m(ii) of Factories Act, 1948 and Bidi and Cigar Workers (conditions of employment) Act, 1966.

(ii) All manufacturing enterprises except those run by Government (Central Government, State Governments, Local Bodies) / Public Sector Enterprises.

Household Enterprise:

A household enterprise is one which is run by one or more members of a household or run jointly by two or more households on partnership basis irrespective of whether the enterprise is located in the premises of the household(s) or not. In other words, all proprietary and partnership enterprises are household enterprises.

Non-household Enterprise:

Non-household enterprises are those which are institutional i.e. owned and run by the public sector (Central or State Government, local self-governments, local bodies, government undertakings, etc.), corporate sector, cooperative societies, other type of societies, institutions, associations, trusts, etc. Nonhousehold enterprises covered under public sector were not included in the current survey.

Own-account Enterprise:

An enterprise, which is run without any hired worker employed on a fairly regular basis 5, is termed as an own account enterprise. If such an enterprise is engaged in manufacturing and/or repairing activities, it is termed as Own Account Manufacturing Enterprise (OAME).

Establishment:

An enterprise which is **employing at least one hired worker** on a fairly regular basis is termed as establishment. Paid or unpaid apprentices, paid household member/servant/resident worker in an enterprise are considered hired workers.

Establishments have further been categorised into two types: non-directory and directory.

Non-directory Establishment:

An establishment employing less than six workers (household and hired workers taken together) is termed non-directory establishment. If such an establishment is engaged in manufacturing activities, it is termed Non-Directory Manufacturing Establishment (NDME).

Directory Establishment:

A directory establishment is one which has employed six or more workers (household and hired workers taken together). If such an establishment is engaged in manufacturing activities, it is termed Directory Manufacturing Establishment (DME).

Definition by ASI

Factories:

Factory is one that is registered under sections 2m (i) and 2m (ii) of the Factories Act, 1948.The sections 2m (i) and 2m (ii) refer to any premises including the precincts thereof (a) whereon ten or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on with the aid of power, or is ordinarily so carried on; or (b) whereon twenty or more workers are working or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on without the aid of power, or is ordinarily so carried on.