CHAPTER FIFTH

PROFILE OF INDIA’S FOOD PROCESSING BUSINESS

5.1 INTRODUCTION:
Practically every day we read about, or see an advertisement for a new kind of food item - variations of snacks and crispies, fancy soups and sauces, and any number of ready-to-cook dishes, from pastas and noodles to mutter paneer and chicken korma. This is the era of the convenience food, as with convenience everything. The fast paced life in a changing socio-environment, with less time for food preparation and larger disposable incomes, has created a growing demand for packaged and processed foods. There are also an increasing number of women going out to work, yet not wishing to short-change their households on wholesome meals. Along with that there is a greater awareness of the need for quality and safety in food and for nutrition all these factors pose an enormous challenge to the food processing industry to come up with appropriate food products to suit these varying needs.

The concept of processed foods has caught the imagination of consumers in recent years, because of their enhanced convenience, variety, nutrition and taste. The challenge therefore lies in continuously developing new variations of food items, as well as new processes that will maximise its appeal and shelf-life, and minimise the use of chemicals and preservatives.

The food processing industry covers a range of food products. These include the basic or primary foods, such as wheat and rice products, sugar, oil and pulses, and the processes for converting them into edible form; and the processed foods, such as biscuits and bakery products, confectionery, dairy products, breakfast foods, meat and fish products, fruit and vegetable products and all such items which are processed and packaged to enhance and prolong their edible life.

The growth in the industry until a few years ago was mainly in the traditional sectors like rice, flour and oil milling. However, the swelling consumerism has seen the introduction of a range of new products like ready-to-eat snack foods, breakfast cereals, texturised vegetable protein foods and so on. Along with the new and improved food products, the modernisation of food processing plants, greater automation, advertising, research and development has provided a major impetus to this industry, which already attracts an investment of over Rs10,000 crores.

The food sector contributes 26% to India’s GDP. However, most food products are sold to the end consumer in a basic, non value-added form. Value addition is currently restricted mainly to household kitchens. The growth of the food processing industry has been restricted in the past by demand as well as supply related constraints. But changes accompany in by
liberalisation as well as growing personal income foretell well for the future of this relatively untapped industry.

Increased urbanization, improved standards of living, and the convenience needs of dual income families point to major market potentialities in the food processing and marketing sectors. This is also evident from the presence of several global foods giants and leading Indian industrial enterprises in the country's food processing sector, such as: Nestle India Ltd, Cadbury's India Ltd, Kelloggs India, Hindustan Lever Ltd, ITC-Agro, Godrej Foods and MTR Foods Ltd. Besides, in the current globalized milieu, our surplus food production, as well as the increasing preference for Indian foods (in several regions of the world) need to be leveraged to achieve economic, and strategic objectives through exports. The Food and Agriculture Integrated Development Action (FAIDA) report (1997) prepared by McKinsey has estimated that, driven by changing consumer preferences, the annual consumption of 'value-added' foods alone would grow to Rs.225,000 crores by 2007?larger than the entire manufacturing sector! A more recent report has stated an absolute revenue increase of Rs. 900 billion in food manufacturing between 1993 and 2000. This is in contrast with Rs. 150 billion and Rs. 300 billion in the pharmaceutical and IT industries, respectively. Overall, the value of the Indian food industry has increased from Rs. 3.09 trillion in 1993-94 to Rs. 3.99 trillion in 2000-01. The segments with the largest growth potential have been identified as dairy, wheat, fruits and vegetables, and poultry.

5.2 MARKET CHARACTERISTICS:
Historically, consumers in underdeveloped economies spend a large proportion of their income on food and related products. As development indicators improve, the percentage of income spent on food reduces, with a proportional increase in the expenditure on clothing, medical care, and luxuries. This trend has been noticeable in India as well, with the relative share of food, beverages and tobacco in private final consumption expenditure declining substantially over the last three decades. The size of the Indian food market is estimated at a mind-boggling Rs. 250,000 crore. Value added foods account for around. Rs. 80,000 crore, or 32% of the food industry (Source: McKinsey Report). The CAGR for the industry is estimated at 9-12%. The low capital requirements, as well as government
reservation policies in the past have helped the unorganised sector to flourish. Consequently, the industry is extremely fragmented, with few established players at the national level. The existing low base, income growth and "supply led demand" post regulatory changes will continue to support healthy growth rates in the food processing sector. On the other hand, infrastructural bottlenecks, and well-entrenched consumer preferences, will prevent dramatic growth rates. Regional players and the unorganised sector would continue to play an important role, even as a few giant players, including multinationals, drive the growth of branded semi-processed and ready to eat foods.

5.3 MARKET CHARACTERISTICS: DEMAND SUPPLY, COMPETITION AND PRICES

5.3.1 DEMAND-SUPPLY:
According to a McKinsey-CII report on the sector, the size of the Indian foods market is Rs. 250,000 crore. No other category of expenditure even comes close to what the average Indian spends on food. While this percentage should decline in line with overall economic development, a sea change in consumer spending patterns is not foreseeable, given our relatively backward economic status. Despite the fact that food accounts for a major share of the average Indian's wallet, the processed food industry in India has faced constraints on the demand as well as supply side. Consequently, value added foods are estimated to account for only 32% of the food industry. Some of the major factors limiting the demand growth in processed foods are:
* A vast majority of the population cannot afford processed/branded foods.
* The flourishing of the processed foods industry is correlated to the proportion of working women in the economy. This proportion remains low in India.
* There is a traditional preference for homemade and freshly cooked foods, thereby constraining the growth prospects of packaged foods.
* India being a labour surplus economy, middle and higher income consumers can comfortably afford servants/cooks to prepare food. There is no particular incentive to buy convenience foods.
* Given that unorganised players have traditionally dominated the foods sector, there is a perception that purchased foods may be detrimental to health, as several of these players are not seen to invest adequately in maintaining quality/hygiene standards.

On the supply side, the market is characterised by small, regional players, most of who belong to the unorganised sector, in addition to a few national level entities. The unorganised sector accounts for 70% of the industry (Source: Economic Times, Dec 11, 1997). Popular, traditional foods such as namkeens, sakharpara, fried dal, samosa, cutlet, vada, kachori, bhaji, tomato chips, banana chips, extruded snacks, cereals, flour, starch, etc are made by small local players and retailed through grocery/ small food shops.
The urban fast food market is estimated to at Rs. 5000 crore and is growing at 20-25% (Source: Probity research). This market, again, is dominated by the unorganised sector, peddling their products on roadside stalls in the cities, and on highways. The market share of MNCs such as Kentucky Fried Chicken and McDonald's remains negligible, despite the considerable hype created around their emergence.

Some of the supply side constraints restricting the growth of the food processing industry have been as follows:

- Poor infrastructure, cold storage, and transport facilities do not allow for efficient handling of perishable food items.
- Small scale players lack the necessary capital to invest in marketing and distribution, thereby constraining their geographical expansion.
- Small shops which again lack the wherewithal to invest in adequate storage facilities for processed foods dominate the retail industry in India.

India has the potential to emerge as a major player in the exports market for foods. While rice and marine products accounted for 70% of the processed food exports (Source: Ministry of Agriculture), there is ample scope to boost exports in processed fruits and vegetables.

Market research agencies have pegged the annual growth rate of the industry at 9-12% per annum. According to McKinsey, packaged atta will expand into a $4 billion industry, packaged milk ($10 billion), bakery products ($3 billion), and poultry an $8.3 billion business by 2007. Increasing urbanisation, personal income growth, and emergence of retailing as an industry should comfortably support these growth rates in future as well. However, at least on paper, there is enough to suggest that the Indian market is capable of registering significantly higher growth. For example, India is the world's second largest producer of fruits and vegetables. But only 2% of these fruits and vegetables are processed, as against 40-80% in other developing countries such as Thailand and Malaysia (source: Economic Times, Sept 15, 1998). In a nutshell, while the potential is immense, infrastructural constraints and socio economic patterns would remain hurdles to exponential growth.

5.3.2 COMPETITION:
The foods processing sector is multi-segmented, with each segment being highly fragmented. Some multinational companies, and a few local players such as MTR, Vadilal, etc, enjoy nationwide recognition in specific product segments.

The industry may be segmented as follows:

- Foodgrain/ pulse milling
- Fruit & vegetable processing
- Milk and milk products
- Beverages
- Fish, poultry products (eggs)
- Meat and meat products
- Aerated water/ soft drinks
- Beer/ alcoholic beverages
- Breakfast cereals; bread, biscuits, confectioneries, malt protein, weaning, extruded food products
Edible oil/ fats.

The unorganised sector dominates each of the above segments, although market leadership may be vested with large organised manufacturers. For example, Nestle and Cadbury are major players in the milk products and beverages segments, while Britannia and Parle lead the organised sector in the bakery segment.

The high level of fragmentation in the industry is reflected in the large number of food processing units in the organised sector alone (Source: Probity Research)

<table>
<thead>
<tr>
<th>Food processing units in the organised sector</th>
<th>Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flour mills</td>
<td>800</td>
</tr>
<tr>
<td>Fish processing units</td>
<td>412</td>
</tr>
<tr>
<td>Fruit &amp; vegetable processing units</td>
<td>4920</td>
</tr>
<tr>
<td>Meat processing units</td>
<td>114</td>
</tr>
<tr>
<td>Sweetened &amp; aerated water units</td>
<td>656</td>
</tr>
<tr>
<td>Milk product units</td>
<td>90</td>
</tr>
<tr>
<td>Sugar mills</td>
<td>429</td>
</tr>
<tr>
<td>Solvent extraction units</td>
<td>725</td>
</tr>
</tbody>
</table>

The sector is characterised by small, regional players, some of whom have successfully carved out niches in their respective segments. Margins are low, with profitability being volume driven. Market leaders have been able to distinguish themselves primarily through brand promotion and distribution strengths. The large size of the Indian market, along with gradual liberalisation of the sector has prompted investments of around Rs. 60000 crore (source: Probity Research) by multinationals such as Kelloggs and Heinz over the last five years. However, given the deeply entrenched food habits and tight purse strings of the Indian consumer, such forays are likely to be largely restricted to the top end of the market.

The serious volumes in the foods business are to be found at the lower end, and in traditional foods. This has prompted companies such as Britannia and Hindustan Lever to look with renewed interest at niches such as glucose biscuits and packaged wheat flour respectively.

5.3.3 PRICES:

Prices are determined by the market’s capacity to absorb. Competition precludes any ambitious price hikes, which usually reflect changes in the cost of raw materials such as cereals, sugar, oils and milk. Since the raw materials are basic commodities, prices are set so as to maintain some margin to allow for cost fluctuation. Margins are wafer-thin, and the most profitable companies are those with the highest working capital turnover. For example, even for a market leader such as Britannia, gross margins are as low as 5-6%. However, the high volumes achieved, with low capital spending, enable a very healthy overall return on investment.

5.4 KEY INPUTS AND TECHNOLOGY:
Technology has played a rather limited role in the food processing Business. Processes are simple and easily replicated, as reflected in the predominant position of the SSI sector. Manufacturing processes are not as important a consideration as marketing and distribution. Cereals, fruits, vegetables, oils, milk, sugar, and other such primary products form the basic raw materials. Agricultural products, their derivatives, and animal products form the key inputs in this raw material industry. In the bakery segment, for example, raw material costs account for 60-65% of sales. Companies typically source their raw material requirements from the wholesale trade. Given that the highly fragmented trading community consists largely of the unorganised sector, operating on very thin margins, its bargaining power with players in the food processing sector is minimal. As a result, the larger manufacturers are generally able to negotiate very attractive credit terms with their raw material suppliers. Inputs, being of a commodity nature, are subject to price volatility. However, the relative price inelasticity of demand for foods and the lack of substitutes enable food processors to pass on increase in raw material prices.

Packaging material is yet another important raw material cost component. Packaging activity is often a bottleneck on the shop floor, and much of the capital investment made by industry leaders is towards acquiring mechanised packaging equipment leading to productivity improvements. Attractive packaging is a key aspect of brand promotion. Considering that distribution and brand building take precedence over manufacturing aspects in most segments, it is likely that the industry will pay greater attention to packaging aspects in future.

Technology plays a limited role in the contemporary food processing industry. The manufacturing processes involved are essentially simple operations such as cutting, sieving, crushing, baking, drying, pickling, and mixing. Therefore, the emphasis has been on making investments in distribution infrastructure and promotions, rather than manufacturing technology. The modest technological needs of the sector have also enabled large manufacturers to outsource the manufacturing of reserved product categories to SSIs, as mandated by the Government. The marketing companies undertake contracts with SSI units, wherein they supply the raw material to the latter, who are paid a conversion charge for their services.

Enhancement of the shelf life of the more perishable food items is an important technological consideration. For example, considerable investments have reportedly been made by Dynamix Industries (suppliers to Britannia, among others) towards improving the shelf life of cheese. The company claims to have used the same manufacturing technology as used by the suppliers to McDonald’s, the global food chain. Modernisation of distribution infrastructure is yet another important aspect, particularly in perishable items such as milk products. The lack of adequate cold storage facilities across the country has contributed to the low penetration of cheese products. Market leaders in milk products and chocolates are now placing considerable emphasis on developing a nationwide “cold chain” to support their distribution network.

The future is likely to witness an increased importance to technology in the food processing industry. India, with its large area of arable land and substantial animal resources, has the potential to emerge as a significant player in the global market. The quantum jump in our low productivity levels that
is required to achieve this goal is possible only through appropriate food policies, complemented by technological advancement in irrigation, water management, research, etc. Further, considerations such as quality and hygiene etc. play a very important role in the exports market. These require a higher amount of process mechanisation than is prevalent today.

5.5 GOVERNMENT POLICY
The prevailing regulatory environment has significantly influenced the evolution of the industry, whether in the form of food subsidies, or reservation schemes for SSIs. The latter, particularly, has constrained the growth of dominant players in segments such as bakery. The changes in government policy introduced over the last couple of years are likely to impact the growth prospects of the sector, and its internal competitive scenario. Food subsidies and reservation of certain segments for SSI units are two key aspects of regulation affecting the industry. Food subsidy is an extremely politically sensitive issue in India. Basic food grain in India is highly subsidized. The Government grants direct subsidies to food grain, sugar, etc. through the Public Distribution System. The agricultural sector also receives substantial indirect subsidies on electricity, irrigation, interest, etc. Despite the obvious demands of fiscal prudence, successful Governments have been unable to tackle the growing burden of food subsidies, owing to political compulsions. India’s annual food subsidy bill is estimated at over Rs. 9000 crore (Source: Probity Research). While subsidies have played the important role of maintaining the prices of common foodstuffs at affordable levels, they have also acted as a disincentive for productivity improving investments. Investments by the public sector/states in irrigation equipment, watershed management systems, research, etc. have been minimal. Figures indicate that gross capital formation in agriculture as a percentage of investments has almost halved over the last two decades. India has among the lowest crop yield rates in the world, in addition to having woefully inadequate crop storage systems. Modernisation of production and storage techniques is essential is to secure a position amongst the top food producing nations of the world. Till recently, many segments in food processing were reserved for small-scale units. This has primarily contributed to the current industry structure, marked by a proliferation of tiny units. As a result, even a large part of the production of the better known companies was outsourced to small units, with the principal focusing on marketing activity. The Abid Husain Committee report recommended the dereservation of certain segments, on grounds of technology and hygiene. As a result, select segments such as bread, biscuits, ice cream, and synthetic syrups have been dereserved with effect from April 3, 1997. However, malted foods, alcoholic beverages, and industries reserved for small scale continue to require prior approval. With the partial opening up of the sector, large players, including some international companies, are expected to step up investments in technology upgradation, leading ultimately to consumer benefits.

The table below provides a list of product categories subject to various forms of restriction:

<table>
<thead>
<tr>
<th>Food Products</th>
<th>Form of restriction</th>
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<tbody>
<tr>
<td>Tallow/fats &amp; oils of animal origin, animals rennet.</td>
<td>Imports are prohibited.</td>
</tr>
<tr>
<td>Concentrate of alcoholic beverages, wine, saffron, cloves, cinnamon and cassia seeds, plants and animals, Flavoring essences, perfumery compounds/ synthetic essential oil.</td>
<td>Imports are restricted.</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>Oils &amp; oil seeds, Fatty acids &amp; acid oils, Cereals</td>
<td>Imports are canalised (only through Government agencies)</td>
</tr>
<tr>
<td>Pickles and chutney, Vinegar, Rice milling, dal (pulse) milling, Confectionery (excluding chocolates, toffees, chewing gums). Saccharin Poultry feed extract in pellet form</td>
<td>Reserved for small-scale sector.</td>
</tr>
<tr>
<td>Corrugated paper/boards Paper bags/cups/plates</td>
<td>Reserved for small scale sector</td>
</tr>
</tbody>
</table>

Reforms by the Government in the food processing sector over the last few years include:

- Dereservation of icecream, biscuit, synthetic syrups, poultry food (except pellet form), rice milling, dal milling.
- Removal of price and other controls on wheat.
- Removal of controls on movement and price of sugar molasses.
- Reduction in import duty on capital goods for agro-processing industry.
- Cheaper imports of packaging materials.
- De-control of licensing requirements for investment in sugar and other sectors.
- De-reservation of some agro industries from small scale sector.
- According high priority status and automatic approval for 51% foreign equity or 100% NRI equity in areas like fruits, vegetables, meat and poultry processing.
- Upto 24% foreign equity is allowed in SSI units.
- ERA and MRTP regulations have been relaxed.
- Restrictions on imports/export have been eased.
- Foreign brand names are allowed to be used freely.
- Raising of investment limits in small scale units to Rs. 3 crore with effect from Dec 1997.
- Amendment of the Fruit Products Order to encourage investments in fruit processing.
- Priority sector status for bank lending with effect from Jan 28, 1999

Some of the above reforms have prompted the accelerated entry of multinationals on the scene over the last couple of years. However, these companies are largely targeting impulse purchase segments such as snack foods and chocolates. Far greater potential lies in traditional food items. Here, the success of the Indian foods industry, both domestically as well as in the international market, is predicated upon improvements in agricultural technology, sustained brand building, distribution strengths, and friendly government policy.

### 5.6 KEY SUCCESS FACTORS OF PROCESSED FOOD BUSINESS IN INDIA
Brand equity: Food products have a strong association with health. Hence, consumers need to be convinced about the quality of the product, achieved partially through sustained advertising campaigns. Further, most impulse purchase items such as chocolates and light snacks are essentially sold through an “advertising push” strategy, wherein the consumer is almost pummeled into making a purchase decision, through relentless promotional effort. Companies with strong brands are either those who have cultivated a customer base through years of supplying quality products, or large companies, such as MNCs, with equally large advertising budgets. While returns on brand building investments do not accrue in the short term, other things being equal, the companies that make the most noise about themselves are also more likely to sell the maximum biscuits.

Distribution network: Apart from their obvious brand equity, it is the impressive distribution network of industry leaders such as Hindustan Lever, ITC, Parle and Britannia that separates them from other players in the industry. Since sales are largely retail in nature, geographical coverage and number of outlets become critical to a company’s ability to sell in large volumes. Besides sheer geographical coverage, the quality of a company’s outlets in terms of storage facilities available, shelf space etc. also plays an important part.

Raw material sourcing: The raw material intensive nature of the industry necessitates having access to wide raw material supplier base, in order to capitalise on regional demand supply imbalances and price fluctuations. The importance of raw material sourcing increases for upstream activities such as sugar manufacturing, where a company’s profitability is highly dependent on the assured supply of sugar cane.

Quality: The importance of quality and hygiene standards cannot be overemphasized, particularly in the exports market where companies are expected to meet the relatively stringent standards of the appropriate authorities. As quality and hygiene generally imply a higher degree of mechanisation, companies that are able to invest in the appropriate equipment are likely to gain an advantage over the competition.

5.7 FOOD PROCESSING BUSINESS: NEW OPTIONS
The Food Processing Industry in India is one of the largest in terms of production, consumption, export and growth prospects. The government has accorded it a high priority, with a number of fiscal relief and incentives, to encourage commercialization and value addition of agricultural produce; minimizing pre/post harvest wastage, generating employment and export growth.

Some of the prospective and processing industries are as follows:

1. Comminuted orange beverage base
Mostly, mandarin oranges are processed to traditional products such as squash, canned orange segments in sugar syrup, orange marmalade, orange juice and concentrate. Apart from these, whole orange can also be utilized to prepare novel product like comminuted orange beverage base, having a good market potential. The process developed for this product would be economical if integrated into an existing fruit and vegetable processing unit where facilities are already available.
Such units can also be established in rural areas in the vicinity of orange growing centers for the benefit of the rural people in terms of economy and employment generation. The above unit can be established by rural co-operatives in large interests of the orange growers. The process consists of selection of fruits, washing, steaming, cutting into pieces and blending with known quantity of sugar syrup etc., passing through pulper to get homogenous extract and bottling. All the equipments needed are available in the country and they include blender, pulper, steaming tank, S.S. vessels, bottle filling machine, etc.

2. Beverages from sugarcane
Raw sugarcane juice is a popular drink in India. Sugarcane juice is a nutritious product containing natural sugars, minerals and organic acids. At present, in the country, sugarcane juice is extracted by street vendors using hand operated crushers in most unhygienic way and offered to consumers. Further, sugarcane juice cannot be stored even for couple of hours as it deteriorates in quality very fast. Sugarcane being available in plenty can be utilized hygienically for making prepared and processed beverage. This product has good market potential. Small units can easily be started in rural areas and the products can be sold in semi-urban and urban areas. The process is simple and consists of crushing the fresh and well matured sugarcane to extract the juice, clarification and filtration to obtain a clear beverage and adding the permitted preservatives, additives and flavours in suitable level and then bottling.

3. Ready-To-Serve (RTS) fruit based beverages
The fruit-based nutritious beverages are becoming more popular and are in good demand in urban areas. Any of the pulpy fruits, such as mangos, orange, grapes, acid limes, passion fruit, banana, lichi, apple and pomegranate can be utilized to prepare RTS beverages. These can be marketed in urban areas. Such units can also be established by rural co-operatives for the benefit of growers and also to generate employment. FPO license has to be taken for establishing such units. The raw materials required for installing such units are fruit pulp/juice, sugar, citric acid, preservatives, permitted colour, flavour and other additives. The process consists of blending of the preserved fruit pulp/juice sugar syrup, citric acid, preservatives, colour and flavour according to specification, homogenising, bottling and pasteurization.

4. Production of rice flakes (Poha)
Rice flake is a traditional product of India and is known locally by many names like aval, avalakki, poha, chewda and beaten rice. CFTRI has has made improvements in the traditional method of making poha, resulting in more yield and less breakage, besides enabling economic utilization of by-products. Flaked rice is found suitable to prepare many products, bhath and chewda (deep fried product) such as seasoned mixture, energy/weaning food, tamarind bhath, upma, sweet/ savoury pongal, sweet gravy, etc. rice flake is being consumed by all income groups and the demand for the same is ever increasing.

5. Jowar flakes
Jowar is a coarse grain difficult to pound and make flakes. However, with the available modern machines, a process for flaking jowar has been made possible by CFTRI. The flaked jowar can be used for preparing snack products like chewda. The flakes can be used similar to rice flakes. Jowar is extensively grown in the states of Maharashtra, Karnataka and Madhya Pradesh. With the available technology for making jowar flakes the units based on the same can be established in rural areas where jowar is grown. Such cottage scale units may help rural economy in the larger interests and also create employment opportunities.

6. Potato flour
Products from potato are quite popular in our country. Many ready to eat products can be prepared by utilizing potato. Units based on potato products can easily be established in potato growing areas and the market for these products can be exploited in urban and semi-urban centers. A cottage scale process for the production of potato flour has been standardized by CFTRI, using easily available indigenous equipment. The process involves the operation of peeling, cutting, pre-treatment with salt and permitted preservatives, soaking, granulating in mixer and drying. The dried product is ground and then packed. The flour obtained by this process can be easily reconstituted with boiling water to get the mashed potato product and this can be used for making a variety of products like tikkia, stuffed parota, pakoda, kotta etc.

7. Osmo-air dried fruit products
Osmo-air dried fruits are the dehydrated fruit products based on the novel approach towards dehydration. Osmo-air dehydration involves dehydration of the fruit slices like pineapple, jackfruit, and mango in two stages. The first phase is the removal of water using sugar syrup as an osmotic agent. The second phase of the dehydration is the air-drying where the moisture content is further reduced to about 15%. The product of the osmo-air-dehydrated product is found to be near to the fresh fruit in terms of colour, flavour and texture. It can be consumed as a snack. It can also find use in military rations in suitable packing. The osmo-air dried fruit products can be used in ready-to-eat type of foods, ice cream, fruit salad, kheer, cakes and bakery products. Such osmo-air-dried fruit product based units, can be set up in rural areas nearby fruit gardens, for the benefit of rural people.

8. Energy Flour-Atta
Poushtik atta is a low cost protein rich food, especially suitable for rural food, especially suitable for rural areas. Poushtik atta is a blend of 75 parts of whole wheat flour, 17 parts of tapioca flour and 8 parts of specially prepared groundnut flour. It is nutritious supplementary food which can be manufactured at rural level. Trials have indicated that poushtik atta is generally found acceptable to wheat consumers. The poushtik atta can be used for the preparation of chapathi and poori.

9. N-triacontanol
N-tracontanol is a plant growth promoter isolated from the active fraction of tea waste/sugarcane press mud. Successful trials have been conducted by many agricultural universities and its efficacy in higher yield have been noted in crops
like corn, paddy, maize, brinjal, cucumber etc. Even in low concentration (1-2mg/acre) it is effective. Plant growth promoter like N-triacontanol is most beneficial to farmers and gives better returns. Wherever tea waste/sugarcane press mud are easily available, N-triacontanol based unit can be established under co-operative sector. It has got an excellent market potential. The raw materials required are tea waste/sugarcane press mud, packaging materials, plastic bottles, solvents and chemicals.

10. Aflatoxin detoxification filter pads for groundnut oil
It has been reported that more than 80% of the groundnut oil produced in the country contained aflatoxin—a carcinogenic substance, at levels higher than the permissible limit, thus posing a serious public health problem. Further, nearly 35% of it is present in the solubilized state, and the rest in suspended form not being easily removed by adsorption and micro filtration. CFTRI has developed a special filter pad, designed to remove both the suspended as well as dissolved particles of the toxin. These filter pads can be manufactured at cottage scale in rural areas.

5.8 IMPACT OF INFLATION ON FOOD INDUSTRY

Inflation is now well above 8 percent. Basic food items are much costlier now. Government actions to stop steel export and tightening the money supply has not yet made any impact in the reduction of inflation rate. Although finance ministry and planning commission is still hopeful that the inflation rate will soon come down but market is yet to see any impact of the initiatives taken so far. There will be thus direct and indirect impact of the rising inflation rate on the performance of the processed food industry as well. Let us examine the kind of impact inflation can have on our processed food industry.

Firstly, the rise in input cost will increase the cost of production and entire escalation in cost cannot be passed on to the consumers resulting in lower profitability of processors. The lower profit will force the manufacturers to cut down on other costs such as R&D, advertisement and promotion as well as the manpower cost. These are short-term measures to maintain the bottom line performance of the company in tact to keep the shareholders confidence as well as market price of the stock at desired level otherwise the value of the company or the shareholders'
wealth and return on investment will go down which would not be an acceptable proposition. These are however, counter productive in the long run in the sense that there will be consequential impact on the product performance for temporary withdrawal of promotional support.

Secondly, manufacturers will not be able to absorb entire cost escalation and therefore will resort to price increase which will reduce the demand for the products. As processed food products do not fall under essential goods and therefore consumers will use discretion to spend in this product category. The result is sales number will be difficult to achieve which will force people (sales and marketing staff) to look for alternative employment to avoid working under constant pressure. This will force organizations to constantly restructure the sales system and even work with less experienced people. The exodus will have impact in the business.

Thirdly, consumers in general, will have less cash surplus (disposable income) to indulge in buying products, which are sometimes impulse purchase. Middle class population that constitutes the large part of the market will resort to drastic reduction in budgetary allocation for purchase of processed food products. School children will get lesser amount as daily allowance to buy snacks and ready to eat foods from school canteens. The end result is that the demand will come down impacting the sales of the products.

Fourthly, the rise in prices has also resulted into short supply of the basic agricultural input. This is also partly the result of low growth in agricultural sector. The manufacturers will have difficulty to get the regular supply of the basic agro commodities of uniform quality and price resulting into fluctuating manufacturing programme in the process plant or the fluctuating cost of production which makes the supply chain management issues more complex.
Fifthly, the rising cost of production will impact the exporters of processed food products. Those who are highly dependent on the export sales or those who are in the international trade of processed food are already passing through difficult phase as rupee started becoming stronger in relation to dollar. A weak dollar coupled with the rising cost of production will have greater impact on the export trade. There are new generation processed food industries that have come up post liberalization. They are largely dependent on the large overseas contract with the giant global retailers. They will have difficulty if there is no escalation clause built into the contract linked with rise in cost of production arising out of inflation.

For example, Capital Foods in Gujarat and Satnam Foods in Haryana largely depend on the supply contract to Tesco. They are likely to pass through difficult phase. Government also stopped rice export as part of the measures to control inflation as well as to maintain supply line in the domestic market. What will these rice exporters do? Will they be able to switch to any other agro commodity so easily and fast? Merchant exporters will have more difficulty than the manufacturer exporters, as they are likely to face more problems in procurement of products at competitive price and still make money.

Sixthly, as we all know that processed food industry is consisting of mainly small and medium players. The large and established players are very few. Although small players have more flexibility they cannot have capacity to absorb shock and thus have less staying power which large players have. Small players often survive as being subcontractors. These days more than sixty to seventy percent of production of large domestic players are outsourced and when cost pressure comes the same is passed on down the line to contract manufacturers and as they are helpless. They even start bleeding or there are cases when they are forced to even close down.
We can thus see the ripple effect of inflation in the entire business of processed food. Of course, some of these observations will be true for other categories as well but processed food industry is going to experience direct impact, which others are not possibly experience.

### 5.9 IMPACT OF RETAIL REVOLUTION ON FOOD INDUSTRY

Wal-Mart, the world’s number one company in the fortune 500 list has finally firmed up a plan to enter India through a 50:50 joint venture with Bharti Telecom. Bharti Group had been discussing their retail business with the Tesco for quite sometime and it was reported earlier that they are going together. Only recently Bharti has withdrawn from that discussion and the very next day announced the formation of JV with Wal-Mart. This only indicates that the discussion continued by Bharti parallely with both Tesco and Wal-Mart and finally the decision was taken in favour of Wal-Mart who were very actively scouting around for the joint venture partner in India and the choice was for the large all India group with significant presence. Reliance could have been the other choice for Wal-Mart along with some of the big groups like Raheja Construction including the existing players in retail domain like Shopper Stop, Pantaloons etc. Even the domestic group like Godrej was also named as prospective partners for Wal-Mart. Finally the issues are resolved and Bharti-Wal-Mart joint venture is formed. Mr. Sunil Mittal of Bharti gave the press statement that it is not necessarily the joint venture of equal equity participation but a joint venture of two equals. The real term retail revolution therefore is about to begin in India and that will impact the prospects of our processed food industry.

The success of processed food business requires intensive distribution. Our retail universe is very complex. There are about 12 million retail outlets in India. More than 80 per cent of these retail outlets are run by small family businesses which use only household labour. We are therefore, a “nation of shopkeepers” and the retail industry is highly
fragmented and unorganized. Organised retailing is still in a very nascent stage. With Wal-Mart's entry and Reliance Group's foray into the retail business things are going to be different now on.

Indian retail distribution is so complex that it becomes an enormous task for the marketers to build a good and efficient distribution system. And as efficient distribution is at the core of creating any success story in business and more so in fast moving consumer goods (FMCG) business like processed food, many MNCs have gone ahead for acquisition of domestic business form this consideration itself. For example, the major attraction of Coke acquiring Parles brand is to get access to their distribution. Similarly P&G and Pillsbury have tied up with Godrej Soap only for the consideration of easy access to the retail universe to ensure the availability of the products. Hindustan Lever is the most efficient in distribution of FMCG goods. HLL has direct access to over 1 million outlets which they serve directly. Most of the other FMCG companies in food and personal care products category service anything between 2 to 5 lacs outlets directly through their channel distribution systems. Smaller companies even cater to even lesser number of the outlets directly. The companies have to thus depend on largely secondary distribution triggered through the wholesale route. The wholesaler play a very important role in the entire distribution system to ensure that goods and merchandise reaches other outlets which company cannot cover through direct route coverage. Our distribution cost is thus more and between C&F agent, distributors, superstockists, wholesaler together constitute about 25 to 35 % of the product cost given away as commission including freight and insurance cost at primary level. The Wal-Mart entry and Reliance investment in the efficient supply chain management will significantly reduce the length of this chain and will be more cost effective. Reliance and Wal-Mart will also bring in quality merchandise at lower cost because of their scale of operation. The product will thus be available in these organized retail outlets at costs which will not be more than the price at
which neighborhood retailers are selling. It could be even less costly because of efficiency of the system and in addition there will be daily low prices at these stores. Many new investors willing to play a role in the entire supply chain linkage for Wal-Mart and Reliance. This is a new found investment opportunity by setting up cold chain and logistics provider businesses. Apparently therefore, one can think that our traditional retailers are going to face a threat.

In processed food industry small and new players will be able to find ways to place their products in these stores by producing store label brands for them. This will also help them to sell their products abroad through say Wal-Mart itself. Processed food industry should therefore welcome this new development. Everything is going good for them. Food processors should quickly line up to capture this new opportunity.

5.10 NEW FOOD VENTURES ENCASHING ON HUGE OPPORTUNITY FROM GLOBAL RETAIL GIANT

Many local food ventures collapsed because they could not create sufficient local demand to support the investment. These units struggled for existence. We have cited many such examples in past in the same series. Institutional funding also, as a result, got blocked creating low prospect category for investors. When domestic market was not growing, players found their fate got sealed as no one ever thought of building capability to market finished product in international trade. The lifting of the trade barrier and related force of globalization have definitely opened up new horizon for some of these capable food ventures. These new generation food-processing industries have been able to create some success stories which stories that others should try to emulate. They have been able to see new market opportunities beyond the geographical boundaries of our country and were able to make their products acceptable in global market. The volume of business is so high that over fifty percent of the capacity is utilized by one retail chain. That has made their task of marketing much easier and they can now focus and
concentrate on improving technology, cost and quality and at the same time will have time and resources to gradually build the domestic market over a longer period of time. And this is what exactly they are doing.

As per the FICCI estimate, the size of the processed food industry is USD 91 billion whereas the exports constitute only USD 17.47 billion. The industry is likely to grow at the rate of 9 percent becoming USD 600 billion in size by the year 2014-15. With global players eying India as a sourcing point this is the time for small companies to forge the right connection. Indian food industry is largely dominated by the small players. Most of these are not able to make any domestic presence worth mentioning. Their struggle thus continued to no end in sight. But now with increasing globalization and integration of markets Indian companies have found new opportunities to tie up with large global players with assured market. There are a few companies as mentioned above who are encashing on these opportunities.

Large players, particularly the global food retail giants and food marketers will be selective in terms of ensuring meeting quality, hygiene, safety and GMP standards. The companies here, therefore, have to comply with these requirements. Technology, process and quality assurance practices will have to meet the global standards. Not only the awareness but the implementation of certification standards like HACCP, ISO etc are essential to meet the expectations.

Some players even are making fortunes by supplying the processed foods to the local food marketers. Many, I am sure, may not have heard of their names. Chatha Foods, operating out of Mohali in Punjab produces frozen processed meats mainly for quick service restaurant chains. They supply to Domino's pizza, Subway and also to many star hotels and restaurants. They also supply ready-to-eat non-vegetarian meals to ITC's Kitchen of India brand.
Saraf Foods has installed Freeze drying technology with latest packaging system in their plant. They are talking to Reliance and ITC to be a part of their supply chain. To test the domestic market they selectively launched in some metro markets their Fairy brand. But still 60 percent of the capacity is dedicated for the export market.

Exporters are obviously also impacted by the exchange rate fluctuation of Rupee against US dollar like other industries which are export oriented. Rupee has hardened by over ten percent against dollar during last ten months and hence those who have signed contracts particularly long term contracts in USD has suffered in terms profitability. This has turned some of these players to focus also in the domestic market.

What we are seeing is that new players who have set up projects in last couple of years have been more active in terms of exploiting the opportunities. They are smarter lot.

5.11 HEALTH FOODS ARE GETTING MORE FOCUS

Health Foods, dietary supplements and nutraceuticals are increasingly gaining grounds and the category is growing fast. Even in the regular category, marketers are increasingly focusing on communicating the nutrition and health aspects of the product more than the associated fun and convenience that goes with the consumption of any processed food. This trend is now more visible and as younger generation has become more health conscious marketers are trying to focus on this attribute. As safety, health and nutrition become more important and the regulatory mechanism has become more stringent the nutritional quality assumes significance. There is a distinct shift from consumption of so called junk foods to health foods.

Traditional soft and synthetic beverages are declining in growth rate whereas fruit beverages are rapidly growing. This trend has even percolated down to alcoholic beverages. There are increased social awareness about what you drink in public. Those who still drink hard liquor have also shifted to white variety. Therefore, there is preference for white rum, vodka and gin. All these go well with fruit juices or cold drink. Therefore, in social gathering you will not be able to make out what he or she is drinking. Otherwise, there is rapid growth of wine consumption. Although this increased trend on health is mainly still a urban phenomenon but this is gradually influencing the other smaller towns as well. We can see that there is a significant shift to promoting products on health platform.
For example, Frooti is talking about ‘if you want mango without stone (bena gotli wala aam) then you have to go for only Frooti’. This communication tries to communicate that Frooti is selling pure mango only and nothing else. Others also try to show that fresh mango is squeezed out into the bottle of beverage. The fight is now on the health platform. Who can capture the nature’s freshness and nutrition intact better is the key. This was not so even a decade ago.

Nestle launched yoghurt earlier also. It did not work well. They have relaunched the product again taking health platform. They now say that millions of microbes are working for you for better digestion. The product has now been clearly positioned on nutraceutical platform as a probiotic. We can also see that in the market there are many brands of flavored soya milk. Even soya based products are introduced in the market by many which were very limited earlier and only a few oil seed processing company had their products marketed as a commodity. Voltas tried earlier to promote soya based nuggets and meat analogues but failed. Now soya based products are launched by many companies. Even leading protein isolate manufacturer E.I.DuPont also introduced a range of high quality soya products under the brand ‘Soyday’ produced for and on behalf of Solay, USA. The product is imported from Brazil and repacked in India for local market.

Health is wealth is what modern consumers now believe. For a healthy life quality of food is a must. Food Safety and Standards Act, being implemented in phases would be expected to take care of the claim of the marketers. The nutraceuticals and functional foods market is now said to be growing at a rate of 25 to 30 percent in volume terms. There are many players now in the market. Notably amongst those are Herbalife, Amway, Nestle etc. Nutraceuticals are being promoted as an alternative medicine. Most of these companies are following multilevel marketing approach to promote their products in India. They are clearly avoiding mass media but depending on the well organized distribution set up and a dedicated sales force, most of whom are working part time in the system.

The health connotation is so important that apparently not so healthy food like butter is also trying to appear in the market with healthy note. Taking into account the changing life style Amul reduced salt in butter and introduced reduced salt butter in the market. Amul reduced salt butter has almost 50% less salt than table butter. This product is targeted for high blood pressure patients for whom salt intake is restricted. Sedentary lifestyles have given rise to health problems like high blood pressure, cardiac arrest etc. These set of people have to restrict the salt intake. The product has been launched in two sizes 100gms and 500gms at a price Rs 20 and Rs 95 respectively. The company claims that it is value for money. It is difficult to say whether the reduction of salt in butter make it healthier or not but it definitely gave Amul an alternative positioning option. This also helps them to establish its leadership over functional dairy products.

The increased urbanization has given a boost to demand for health products. With rise of disposable income and educational level, the awareness for nutrition and health improves which fuels the demand of these health products. Keeping this trend in mind Amul had drawn up the plan and introduced a range of functional
foods like sports drink ‘Srtamina’, pro-biotic ice cream, probiotic lassi and curd and high calcium milk and now low sodium (salt) butter.

It is interesting to note that some of these products like lassi, dahi, ice cream are same as before but are being promoted on a different platform highlighting health aspects of the products. The trend is now health and as long as it works we have no quarrel.

5.12 Investment in Food Processing Industry Increases Jobs in India

The food processing industry in India is a major driver of economic growth with multiplier effect of investment in this industry on employment generation is 2.5 times more than other sectors, a top government official said. Addressing a session at the Food Forum India global convention, Union Ministry of Food Processing Industries Director S S Chahal said that while the country's Gross Domestic Product (GDP) growth rate had increased from 3.5 per cent in 2002-03 to 9 per cent in 2006-07, the food-processing sector had grown from 7 per cent to 13.1 per cent during the same period.

Work

The work involved in the food industry spans the gamut of its sectors, from grain milling and fruit and vegetable processing, fisheries and dairy products to soft drink concentrates, instant mixes, and oil extracts. It concerns the practical application of the principles of several disciplines of science for the manufacture or production, the preservation, processing and handling, and the canning and packaging of food materials. Thus food technologists, chemists, bio-technologists, technicians and engineers are generally involved in this industry. The method of processing varies for each commodity. However, broadly it involves preparation of the raw material for processing, which could be selection, or cleaning of the raw material, followed by the actual processing, which could be chopping, mixing or even cooking of the food item, the addition of preservatives and the final packaging. All stages require hygiene and attention to quality.

The key person in any food processing industry is the food technologist, who supervises the production of processed foods. This involves the examination of foodstuff, checking for contamination and adulteration, and controlling the nutritional value. Food technologists also devise new and improved techniques for the processing, conservation and preservation of food items, and can specialise in a particular food area, such as fruit and vegetable processing, or dairy products, sugar, alcohol and so on. With increasing consumer demands, food technologists also develop newer varieties of food items, new flavours and nutritional supplements. Another important task is that of quality control,
normally handled by a chemist or food technologists, which involves the regular examination of the raw material, ensuring that proper hygiene conditions are maintained in the processing plant, and devising methods to improve the quality of the foodstuff through proper handling, preservation and packaging.

Organic chemists, bio-chemists and analytical chemists are also employed by the industry to provide expert advice, study and analyse raw materials and food products and suggest improvements in flavour, texture, storage and quality.

Engineers, such as chemical, mechanical, industrial, electrical, agricultural and civil, are also required for planning, designing, improving and maintaining the processing systems for accomplishing a variety of activities and services.

ENTRY

Although the food processing industry is still developing, and there are limited training facilities for a career in this field, it nevertheless requires some formal training. Those candidates looking for management jobs in the food industry would need to undertake degree and research qualifications.

JOB PROSPECTS

The food processing industry is a nascent field, and those with training can find jobs in various areas. Some of them are listed below:

* Food processing companies, (for human consumption or animal feed) food research laboratories, food wholesalers, retailers and even in hotels, restaurants, hospitals and other catering establishments.
* Industries working on the development of goods and services which convert a raw farm crop into ready-to-use food, according to the demands of the customers.
* Public sector undertakings in the Department of food recruit people in this field.
* In towns and cities there are ample opportunities for self-employment in the form of dynamic delivery networks and home catering services operated by food entrepreneurs. The packaging and distribution of home-made condiments, pickles, and sauces are other avenues of self-employment.
* Research and development laboratories offer many openings for scientists in the food sciences disciplines to conduct experiments to help improve the yields, appearance, flavour, nutritive value and general acceptability of the packaged foods, and develop alternatives from different food sources.

FOOD MANUFACTURING

SIGNIFICANT POINTS

* The industry has a high incidence of injury and illness; meat packing plants have the highest incidence among all food manufacturing industries.
* Production workers account for more than half of all jobs.
* Most jobs require little formal education or training; many can be learned in a few days.

NATURE OF THE INDUSTRY
Workers in the food manufacturing industry link farmers and other agricultural producers with consumers. They do this by processing raw fruits, vegetables, grains, meats, and dairy products into finished goods ready for the grocer or wholesaler to sell to households, restaurants, or institutional food services. Food manufacturing workers perform tasks as varied as the many foods we eat. For example, they slaughter, dress, and cut meat or poultry; process milk, cheese, and other dairy products; can and preserve fruits, vegetables, and frozen specialties; manufacture flour, cereal, pet foods, and other grain mill products; make bread, cookies, and other bakery products; manufacture sugar and candy and other confectionery products; process shortening, margarine, and other fats and oils; and prepare packaged seafood, coffee, potato and corn chips, and peanut butter. Although this list is long, it is not exhaustive—food manufacturing workers also play a part in delivering numerous other food products to our tables.

WORKING CONDITIONS
Many production jobs in food manufacturing involve repetitive, physically demanding work. Food manufacturing workers are highly susceptible to repetitive strain injuries to hands, wrists, and elbows. This type of injury is especially common in meat-processing and poultry-processing plants. Production workers often stand for long periods and may be required to lift heavy objects or use cutting, slicing, grinding, and other potentially dangerous tools and machines. In an effort to reduce occupational hazards, many plants have redesigned equipment, increased the use of job rotation, allowed longer or more frequent breaks, and developed training programs in safe work practices. Although injury rates remain high, training and other changes have reduced those rates. Some workers wear protective hats, gloves, aprons, and shoes. In many industries, uniforms and protective clothing are changed daily for sanitary reasons. Because of the considerable mechanization in the industry, most food manufacturing plants are noisy, with limited opportunities for interaction among workers. In some highly automated plants, “hands-on” manual work has been replaced by computers and factory automation, resulting in less waste and higher productivity. While much of the basic production—such as trimming, chopping, and sorting—will remain labor intensive for many years to come, automation is increasingly being applied to various functions, including inventory control, product movement, packing, and inspection. Working conditions also depend on the type of food being processed. For example, some bakery employees work at night or on weekends and spend much of their shift near ovens that can be uncomfortably hot. In contrast, workers in dairies and meat-processing plants work typical daylight hours and may experience cold and damp conditions. Some plants, such as those producing processed fruits and vegetables, operate on a seasonal basis, so workers are not guaranteed steady, year-round employment and occasionally travel from region to region seeking work. These plants are increasingly rare, however, as the industry continues to diversify and manufacturing plants produce alternate foods during otherwise inactive periods.

TRAINING AND ADVANCEMENT
Most workers in production-line food manufacturing jobs require little formal education or training. Graduation from high school is preferred but not always required. In general, inexperienced workers start as helpers to experienced
workers and learn skills on the job. Many of these entry-level jobs can be learned in a few days. Typical jobs include operating a bread-slicing machine, washing fruits and vegetables before processing begins, hauling carcasses, or packing bottles as they come off the production line. Even though it may not take long to learn to operate a piece of equipment, employees may need several years of experience to enable them to keep the equipment running smoothly, efficiently, and safely. Some food manufacturing workers need specialized training and education. Inspectors and quality control workers, for example, often are trained in food safety and may need a certificate to be employed in a food manufacturing plant. Formal educational requirements for managers in food manufacturing plants range from 2-year degrees to master’s degrees. Those who hold research positions, such as food scientists, usually need a master’s or doctoral degree. In addition to specialized training, a growing number of workers receive broader training to perform a number of jobs. The need for flexibility in more automated workplaces has meant that many food manufacturing workers are learning new tasks and being trained to effectively work in teams. Some specialized training exists for bakers and some other positions. Advancement may come in the form of higher earnings or more responsibility. Helpers usually progress to jobs as machine operators, but the speed of this progression can vary considerably. Some workers who perform exceptionally well on the production line, or those with special training and experience, may advance to supervisory positions. Plant size and the existence of formal promotion tracks may influence advancement opportunities. Requirements for other jobs are similar to requirements for the same types of jobs in other industries. Employers usually hire high school graduates for secretarial and other clerical work. Graduates of 2-year associate degree or other postsecondary programs often are sought for science technician and related positions. College graduates or highly experienced workers are preferred for middle-management or professional jobs in personnel, accounting, marketing, or sales.

OUTLOOK
Overall wage and salary employment in food manufacturing is expected to increase by 5 percent over the 2002-12 periods, compared with 16 percent employment growth projected for the entire economy. Despite the rising demand for manufactured food products by a growing population, automation and increasing productivity are limiting employment growth. Nevertheless, numerous job openings will arise in many segments of food manufacturing, as experienced workers transfer to other industries or retire or leave the labor force for other reasons. Job growth will vary by occupation but will be concentrated among food manufacturing workers—the largest group of workers in the industry. Because many of the sorting, cutting, and chopping tasks performed by these workers have proven difficult to automate, employment among handworkers will rise along with the growing demand for food products. Handworking occupations include slaughterers and meat packers and meat, poultry, and fish cutters and trimmers, whose employment will rise as the consumption of meat, poultry, and fish climbs and more processing takes place at the manufacturing level. Other production workers also will benefit from the shift in food processing from retail establishments to manufacturing plants.
Although automation has had little effect on most handworkers, it is having a broader impact on numerous other occupations in the industry. Fierce competition has led food manufacturing plants to invest in technologically advanced machinery to be more productive. The new machines have been applied to tasks as varied as packaging, inspection, and inventory control. As a result, employment will not increase as rapidly among some machine operators, such as packaging machine operators, as for industrial machinery mechanics who repair and maintain the new machinery. Computers also are being widely implemented throughout the industry, reducing employment growth of some mid-level managers and resulting in decreased employment for administrative support workers, but increasing the demand for workers with excellent technical skills. Taken as a whole, automation will continue to have a significant impact on workers in the industry as competition becomes even more intense in coming years.

5.13 GOOD MANUFACTURING PRACTICES IN FOOD PROCESSING INDUSTRY

In this section, discussion on some of the design errors, commonly visible in many of the food factories, which are facing quality management problems has been made. It is important to note that it is very difficult to ensure food safety and quality in badly designed food factories. It is also observed that, the maintenance and operation cost of badly designed food factories is very high. This means, such companies are losing on both fronts i.e. their production costs goes up and the manufactured products are also of inferior quality. This all happens when the architects and the consultants involved in designing food factories gives more importance to external beauty of the building and other comforts for managers than the functional need of the food factories which are essential features of Good Manufacturing Practices.

While designing a food factory or processing unit the two basic features should be given top most priority:
* Cleanability
* Durability

In order to ensure cleanliness, without compromising on safety of workers and food safety in the factory, following points, which are vital, should be considered.

Floors, Walls, and Ceilings

The floors, floor coverings, walls, wall coverings, and ceilings in food processing factories can be source of contamination therefore they should be designed, constructed, and installed in such a manner that they are smooth and easily cleanable. There are various construction materials available now-a-days but selection criteria should consider the requirements of the process like hot water, acid, alkali, cleaning materials, spillage, etc.

At the same time precautions should be taken to ensure anti-slip floor coverings may be used for safety reasons in work areas.

Utility Lines
Common utilities for any food factories are like tap water, hot water, compressed air, steam, electricity, etc. Utility service lines and other pipes may not be unnecessarily exposed because these can be ideal place for accumulation of dirt and dust and breeding ground for contamination. At the same time, exposed utility service lines and pipes should be installed in such a way so that they do not obstruct or prevent cleaning of the floors, walls, or ceilings or movement of goods and people when required. Exposed horizontal utility service lines and pipes should not be installed on the floor to avoid smooth movement of goods and people when required.

**Floor and Wall Junctures**

Floor and Wall Junctures are critical points. In food establishments in which cleaning methods other than water flushing are used for cleaning floors, the floor and wall junctures should be covered and closed to no larger than 1 mm. The floors in food establishments in which water flush cleaning methods are used should be provided with drains and be graded to drain, and the floor and wall junctures should be covered and properly sealed.

**Floor Carpeting and Attachments**

All floor coverings such as carpeting or similar material may not be installed as a floor covering in food preparation areas where the floor is subject to moisture, flushing, or spray cleaning methods like walk-in cold-storage, ware-washing areas, toilet room areas, refuse storage rooms, or other areas. If carpeting is installed as a floor covering in areas other than those specified above, it should be:

* Securely attached to the floor, by using a stretch and tack method, or by another method; and
* Installed tightly against the wall under the covering or installed away from the wall with a space between the carpet and the wall and with the edges of the carpet secured by metal stripping or some other means.
* Temporary coverings like mats should be designed to be removable and easily cleanable. At the same time, Wall and ceiling covering materials should be attached so that they are easily cleanable.
* Areas used for dry storage only, concrete, porous blocks, or bricks used for indoor wall construction should be finished and sealed to provide a smooth, non-absorbent, easily cleanable surface.
* Not only Walls and Ceilings but also attachments to walls and ceilings such as light fixtures, mechanical room ventilation system components, vent covers, wall mounted fans, decorative items, and other attachments should be easily cleanable.

Functionality of Factory Design is very important, otherwise the cost of rectification of quality problems and maintenance of factory will be very expensive.

**Light Bulbs with Protective Shielding**

Light bulbs should be shielded, coated, or otherwise shatter-resistant in areas where there is exposed food; clean equipment, utensils, and linens; or unwrapped single-service and single-use articles. An infrared or other heat lamp should be
protected against breakage by a shield surrounding and extending beyond the bulb so that only the face of the bulb is exposed.

**Heating, Ventilating, Air Conditioning System Vents and Ducts**

Heating, ventilating, and air conditioning systems should be designed and installed in such a manner that make-up air intake and exhaust vents do not cause contamination of food, food-contact surfaces, equipment, or utensils. Proper air filters and air cleaning system should be followed and properly maintained. Selection of air filters will depend upon the flow rates and quality of air required.

**Design and Installation of Insect Control Devices**

Insect control devices that are used to electrocute or stun flying insects should be designed to retain the insect within the device. Insect control devices should be installed so that the devices are not located over a food preparation area; and dead insects and insect fragments are prevented from being impelled onto or falling on exposed food; clean equipment, utensils, and linens; and unwrapped single-service and single-use articles. At the same time devices are installed in such a manner that it should not become obstruction to the smooth movement of man and material and should not cause any harm to the employees due to prolonged exposure.

**Toilet Rooms**

The toilet rooms located in the premises should be completely enclosed and provided with a tight-fitting and self-closing door. This requirement does not apply to the toilet room that is located outside the food establishments and does not open directly into the food establishment areas for e.g. toilet room that is provided by the management in the administrative area away from the food production area.

**Outer Openings like windows and doors**

Outer openings, like windows and doors of a food establishment should be protected against the entry of insects and rodents by filling or closing holes and other gaps and sloops along floors, walls and ceilings; also by closed, tight-fitting windows; and Solid self-closing and tight-fitting doors. If the windows or doors of a food establishment, or of a larger structure within which a food establishment is located, are kept open for ventilation or other purposes it should be protected against the entry of insects and rodents. Combinations of insect resistant screen; properly designed and installed air curtains; or other effective means can achieve the purpose.

**Exterior Walls and Roofs and Gardens**

Perimeter walls and roofs of a food establishment should effectively protect the establishment from the weather and the entry of insects, rodents, and other animals. Very often the gardens and trees around the food factories act as a breeding ground for insects and rodents and is an ideal place for birds nesting.

**Outdoor Walking and Driving Surfaces**
Exterior walking and driving surfaces should be graded to drain to avoid water logging. Exterior walking and driving surfaces should be made of easily cleanable material and should not act as a source of contamination.

**Outdoor Refuse Areas**
Outdoor refuse areas should be constructed in accordance with provisions of law and should be curbed and graded to drain, to collect and to dispose of liquid waste that results from the refuse.

**Change Rooms**
Change rooms provided for lodging and rest of workers should be separated from rooms and areas used for food establishment operations by complete partitioning and solid self-closing doors.
All washrooms, lunchrooms and change rooms should be separate from the food processing areas and should be properly ventilated and maintained. Washrooms should be equipped with a sufficient number of properly installed sinks and plumbed with hot and cold potable water.
Processing areas and areas where employees are in direct contact with microbiologically sensitive product should contain conveniently located hand-washing stations controlled by foot, knee or a timer with sensors.
Clear signs should be posted in these areas, in appropriate languages, requiring employees to wash their hands.

**Outdoor food handling areas**
Storage area, despatch and other food handling areas should be provided with proper overhead protection. Areas used only for the loading of water or the discharge of sewage and other liquid waste, through the use of a closed system of hoses, need not be provided with overhead protection.
The above article discussed few important dimensions of the food factory designing and constructions. The next section will discuss various other dimensions of food safety, quality and application of Good Manufacturing Practices in food industries.

**Role of Properly Designed Food Processing Equipment and Machinery in GMPs**
Properly designed food factories can only provide protective covering but the role of properly designed machines is as vital as the quality of raw material. Food machines are contact surfaces in food establishment, any negligence while selecting food machines can be as fatal as selecting an inferior quality of raw material for processing.
While selecting and designing any food processing or handling equipment we must consider the following attributes of the system

**Durability and Strength**
Equipment and utensils shall be designed and constructed to be durable and to retain their characteristic qualities under normal use conditions. This is essential because food factories most of the time runs round the year and in various climatic conditions. At the same time food as well as workers safety should be the integral part of the design.
Food temperature measuring devices may not have sensors or stems constructed of glass, except that thermometers with glass sensors or stems that are encased in a shatterproof coating.

Cleanability
Food-Contact Surfaces: In order to ensure cleanability, multiuse food-contact surfaces shall be
(A) Smooth;
(B) Free of breaks, open seams, cracks, chips, pits, and similar imperfections;
(C) Free of sharp internal angles, corners, and crevices;
(D) Finished to have smooth welds and joints; and
(E) Accessible for cleaning and inspection by one of the following methods:
1. Without being disassembled,
2. By disassembling without the use of tools, or
3. By easy disassembling with the use of handheld tools commonly available to maintenance and cleaning personnel such as screwdrivers, pliers, open-end wrenches, etc.

Accuracy
The food processing equipment must ensure accuracy for processing parameters. Accuracy is vital to ensure proper processing of foods. Under-processing may lead to serious food safety hazard and over-processing leads to deterioration of food quality and nutrients, high cost of production due to over spending of energy and uncomfortable working conditions. In extreme cases it can be a serious safety hazard.
Accuracy is required for:
* Temperature Measuring Devices
* Pressure Measuring Devices

Temperature Measuring Devices:
In a mechanically refrigerated or hot food storage unit, the sensor of a temperature measuring device shall be located to measure the air temperature in the warmest part of a mechanically refrigerated unit and in the coolest part of a hot food storage unit. Except as specified in the following para of this section, cold or hot holding equipment used for potentially hazardous food shall be designed to include and shall be equipped with at least one integral or permanently affixed temperature measuring device that is located to allow easy viewing of the device's temperature display. Above para of this section does not apply to equipment for which the placement of a temperature measuring device is not a practical means for measuring the ambient air surrounding the food because of the design, type, and use of the equipment, such as, heat lamps, cold plates, steam tables, insulated food transport containers, salad bars, etc.
Temperature measuring devices shall be designed to be easily readable.
Food temperature measuring devices and water temperature measuring devices on ware-washing machines shall have a numerical scale, printed record, or digital readout in increments no greater than 1°C or 2°F in the intended range of use.

Temperature Measuring Devices for Food
Food temperature measuring devices that are scaled only in Celsius or dually scaled in Celsius and Fahrenheit shall be accurate to $\pm 1^\circ C$ in the intended range of use. Food temperature measuring devices that are scaled only in Fahrenheit shall be accurate to $\pm 2^\circ F$ in the intended range of use.

**Temperature Measuring Devices for Ambient Air and Water**
Ambient air and water temperature measuring devices that are scaled in Celsius or dually scaled in Celsius and Fahrenheit shall be designed to be easily readable and accurate to $\pm 1.5^\circ C$ in the intended range of use. Ambient air and water temperature measuring devices that are scaled only in Fahrenheit shall be accurate to $\pm 3^\circ F$ in the intended range of use.

**Pressure Measuring Devices, Mechanical Warewashing Equipment**
Pressure measuring devices that display the pressures in the water supply line for the fresh hot water sanitising rinse shall have increments of 7 kilopascals (1 pound per square inch) or smaller and shall be accurate to $\pm 14$ kilopascals ($\pm 2$ pounds per square inch) in the 100-170 kilopascals (15-25 pounds per square inch) range.

**Functionality**
In order to maintain the good working condition inside food factory and proper maintenance of the equipment, the functionality of the machines must be properly considered.

**Ventilation Hood Systems, Drip Prevention**
Exhaust ventilation hood systems in food preparation and warewashing areas including components such as hoods, fans, guards, and ducting shall be designed to prevent grease or condensation from draining or dripping onto food, equipment, utensils, linens, and single-service and single-use articles.

**Equipment Openings, Closures and Deflectors**
A cover or lid for equipment shall overlap the opening and be sloped to drain.
* An opening located within the top of a unit of equipment that is designed for use with a cover or lid shall be flanged upward at least 5 millimetres (two-tenths of an inch).
* Except as specified under the following para of this section, fixed piping, temperature measuring devices, rotary shafts, and other parts extending into equipment shall be provided with a watertight joint at the point where the item enters the equipment.
* If a watertight joint is not provided:
  * The piping, temperature measuring devices, rotary shafts, and other parts extending through the openings shall be equipped with an apron designed to deflect condensation, drips, and dust from openings into the food; and
  * The opening shall be flanged.

**Dispensing Equipment, Protection of Equipment and Food**
In equipment that dispenses or vends liquid food or ice in unpackaged form:
* The delivery tube, chute, orifice, and splash surfaces directly above the container receiving the food shall be designed in a manner, such as with barriers, baffles, or drip aprons, so that drips from condensation and splash are diverted from the opening of the container receiving the food;
* The delivery tube, chute, and orifice shall be protected from manual contact such as by being recessed;
* The delivery tube or chute and orifice of equipment used to vend liquid food or ice in unpackaged form to self-service consumers shall be designed so that the delivery tube or chute and orifice are protected from dust, insects, rodents, and other contamination by a self-closing door if the equipment is:

Located in an outside area that does not otherwise afford the protection of an enclosure against the rain, windblown debris, insects, rodents, and other contaminants that are present in the environment, or
Available for self-service during hours when it is not under the full-time supervision of a food employee; and

* The dispensing equipment actuating lever or mechanism and filling device of consumer self-service beverage dispensing equipment shall be designed to prevent contact with the lip-contact surface of glasses or cups that are refilled.

**Vending Machine, Vending Stage Closure**
The dispensing compartment of a vending machine including a machine that is designed to vend prepackaged snack food that is not potentially hazardous such as chips, party mixes, and pretzels shall be equipped with a self-closing door or cover if the machine is:

* Located in an outside area that does not otherwise afford the protection of an enclosure against the rain, windblown debris, insects, rodents, and other contaminants that are present in the environment; or
* Available for self-service during hours when it is not under the full-time supervision of a food employee.

**Bearings and Gear Boxes, Leakproof**
* Equipment containing bearings and gears that require lubricants shall be designed and constructed so that the lubricant can not leak, drip, or be forced into food or onto food-contact surfaces. Selection of lubricant is equally crucial.

**Acceptability**
Food Equipment for Certification and Classification:
As far as possible food equipment shall follow various 3-A guidelines for food equipment designing or guidelines suggested by BIS standards.

**CIP Equipment in Food Factory**
CIP equipment shall meet the characteristics specified above and shall be designed and constructed so that:

* Cleaning and sanitizing solutions circulate throughout a fixed system and contact all interior food-contact surfaces, and
* The system is self-draining or capable of being completely drained of cleaning and sanitizing solutions; and

CIP equipment that is not designed to be disassembled for cleaning shall be designed with inspection access points to ensure that all interior food-contact surfaces throughout the fixed system are being effectively cleaned.
5.14 HACCP: HAZARD ANALYSIS AND CRITICAL CONTROL POINTS
COMPETITIVE STRATEGY FOR FOOD PROCESSING BUSINESS

While consumption of food gives material pleasure and a healthy life, contaminated food can be dangerous to health. Therefore, quality of food is very important. Even from the producers’ point of view, selling high quality food can be viewed as a competitive strategy to overcome competition. With the recent agreement on Sanitary and Phytosanitary (SPS) measures, World Trade Organization (WTO) has made it mandatory for all member states to follow international food standards guidelines in the sphere of foreign trade. An important element of these guidelines is the compliance with Hazard Analysis and Critical Control Points (HACCP), a management system for food safety. Indian firms will have to adopt these guidelines; else they will have to face non-trade-barriers in the export market. It is hoped that food processing industry takes a lead in developing HACCP plans for the diverse range of domestic food products. This has a potential not only to improve food quality but also to give Indian firms a competitive advantage over others both in the domestic and export market.

A unique feature of food products is that their consumption gives material pleasure and they directly contribute to the sustained healthy life as well. However, spoiled, contaminated, adulterated, irradiated and inferior quality food can be harmful to one’s health irrespective of its taste, and, at times can have fatal effects. Similarly, high levels of pesticide residues in food are carcinogenic. Therefore, food industry is perhaps the only industry where the age-old warning, Caveat Emptor is just not enough. Consumer concerns about food quality worldwide have found expression in the objectives of quite a few international institutions. Food and Agriculture Organization (FAO) and World Health Organization (WHO) jointly established Codex Alimentarius Commission (CAC) in 1962 with the aim to protect consumer health, harmonize food standards, and promote international trade (CAC, 1996). Realizing that mere ex-post inspection methods of processed foods do not guarantee safety to consumers, in 1993, CAC recommended adoption of a food safety management system: Hazard Analysis and Critical Control Points (HACCP). The recommendations of CAC had no legal backing of any international law. However, the CAC recommendations have been endorsed and made mandatory by virtue of the 1995 agreement on Sanitary and Phytosanitary measures (SPS) reached by the member countries of the World Trade Organization (WTO, 1995). Since then, there has been a spurt of news reports regarding HACCP in the Indian context. Multinational companies like Nestle India, have planned to implement HACCP in their plants (ET, 1997). Indian seafood processing companies, in their bid to remain competitive in the US market, are taking help from foreign consultants to implement HACCP in their production units (CP, 1997). In past, about 100 crores of herbal product exports targeted for 1997-98 were severely affected as the United States (US) planned to impose ban on imports of these products from India if they did not confirm to HACCP (EFP, 1997). These events show that the WTO agreements and its implications for food quality are a fait accompli. Multinational companies are gearing up for it already. However, if the domestic companies do not get their act together fast, then the Indian food products will
face severe non-trade-barriers in the global trade. Further, one need not focus on export markets alone. The edible oil episode of 1998 is just an indication that Indian domestic food processing industry has a lot of room to improve their food processing and food quality. While HACCP will be the upcoming management system for food processing, a comprehensive treatment of this system is not available. There is a need to inform the domestic industry about HACCP, and do the groundwork for developing Indian product specific HACCP plans for which one need not have to depend on foreign consultants or certifiers.

THE HACCP SYSTEM
HACCP is a management system based on logical, scientific approach to controlling safety problems in food processing in a timely manner. By using HACCP, control is transferred from end product testing (i.e. testing for failure) to the design and manufacturing of foods (i.e. preventing failures). HACCP is product specific and plant specific, and therefore, a unique plan has to be chalked out for each product and/or process. In Principle, HACCP can be applied throughout the food chain, starting from the primary producer to final consumer. Here, I present a generic plan for a typical food processing plant (USDA, 1997 and FDA, 1997). There are five preliminary steps and 7 HACCP principles that completely describe this system.

Preliminary Steps
First step is to have full commitment and involvement of management and the workforce.

Management must form an active team of managers, microbiologist, agronomists, public health scientist, food technologist, veterinarians, production personnel, and/or medical experts depending upon the complexity of processing. Second, the HACCP team must specify the name of the product, how it is to be used, the type of packaging it requires, what is its expected shelf life, what are its labelling instructions, where will it be sold, and how the product to be distributed is. Third, a complete list of ingredients used must be made, and a process flow diagram be prepared that identifies all the steps under the control of the establishment. Finally, the team must ensure that regulatory requirements for sanitation standards, and good management practices (GMP) covering operating procedures and equipment maintenance are adhered to. Having taken the preliminary steps, the team is ready to apply the seven principles that produce the HACCP plan best suited to a plant or a process.

Principle 1: Conduct Hazard Analysis
A food safety hazard is a property that may cause a food to be unsafe for human consumption. Essentially, there are three types of hazards in food: Hazards – biological, chemical and physical
The HACCP team will at this stage, identify the potential hazards at each step in the process flow diagram, and, identify any preventive measures available. For example, any product that uses groundnuts, it is necessary to check for naturally occurring aflatoxin.

Principle 2: Identify Critical Control Points
A critical control point (CCP) is defined as a point, step or procedure at which control can be applied and a food safety hazard can be prevented, eliminated or reduced to acceptable levels. A CCP decision tree is used to assess each step in the process to determine whether it is a critical control point. Using the decision tree for each step in the process, the team would write down the hazards, the preventive measures available, and the critical control points.

**Principle 3: Set Critical Limits for Preventive Measures Associated with Each CCP**
The critical limits are the maximum and minimum values within which a physical, biological or chemical hazard must be controlled at a CCP to prevent, eliminate or reduce the occurrence of an identified safety hazard to an acceptable level. The HACCP team has to come up with such limits based on regulatory requirements, scientific literature, experimental studies and/or expert opinion, and prepare a chart for the critical limits. Depending upon the product and the process, the critical limits will be based on parameters such as: Time/temperature, Humidity, Water Activity, pH levels, salt concentration and Chlorine level.

**Principle 4: Establish Monitoring Procedures**
Monitoring is a sequence of measurements to assess whether a CCP is under control and to produce an accurate record for future use and verification. Monitoring can give signals as to whether or not system is losing control. E.g., if the pH levels in milk are steadily rising though within the critical limits, action has to be initiated to prevent this trend from exceeding the critical limit. Monitoring can be continuous or discrete. Automatic time/temperature gauges can facilitate continuous monitoring; however, the gauge itself should be checked for accuracy at fixed time intervals. For non-continuous monitoring such as visual examinations, ingredient specifications etc., the HACCP team must ensure that frequency of monitoring is enough and random to ensure that hazard is under control. For some processes, statistically based sampling may be used here. Monitoring cannot take place efficiently unless the team clearly identifies the persons responsible for monitoring. Further, team should ensure that the persons at the job understand the importance of monitoring.

**Principle 5 Establish Corrective Actions**
Corrective actions are the procedures to be followed when a deviation occurs, where deviation is a failure to meet the critical limits. HACCP is a pro-active system, in that the team should determine in advance what it will do when the critical limits are not met at a CCP. The employees must be trained to take timely corrective actions, and they must sign the corrective action documentation. All corrective actions cannot be anticipated. An unlisted corrective action should be incorporated into the corrective action document. The corrective action will consist of: decision regarding disposal of non-complying material, correcting the cause of deviation, demonstrating that CCP is once again in control, and, finally, maintain record of the corrective action.

**Principle 6: Establish Record Keeping Procedure**
HACCP attached great importance to record keeping. The records must be kept in an orderly manner which will include information on title and date of record,
product identification, critical limits, time of observation, and, finally, the records must be signed by the monitoring employee and the reviewer to maintain accountability. Such a complete and accurate record keeping is helpful in more than one ways: First, records serve as a documentation of a firm’s compliance with HACCP plan. Second, it allows to trace history of an ingredient, a process or a product if there is a problem and, third, well-maintained records are good source of evidence against potential lawsuits against the firm.

**Principle 7: Verification and Validation of the System**
After the HACCP plan is put in place, the team should verify if it is working the way it was expected to. The HACCP team should check for calibration of process monitoring instruments, and make sure that employees are keeping specific, accurate and timely records. Internal auditing must be conducted once every six months. Moreover, the team has to validate the norms set in the HACCP plan by referring to scientific literature, product testing results, experimental research results, and, of course, regulatory requirements. This completes the HACCP system plan. A HACCP plan developed in this manner has to be audited by a certifying agency before and after its completion. A firm will receive HACCP certification only upon successful completion of the audit.

Thereafter, the certifiers will do auditing of the HACCP plan every six months.

**5.15 SUMMARY**
Economic reforms have brought new opportunities and challenges before food processors in the competitive market environment. To meet the emerging demand for processed food products due to change in consumption preference, there is a need to offer innovative products, which consequently require technological intervention to achieve production efficiency. In India, most of the food items are basically consumed in fresh form and very meager quantity is further processed for value addition. But in recent years, demand for branded processed food products is gaining momentum. This has induced increased investment in food processing sector to meet both domestic and export demand. The structure of Indian food processing industry reflects that food production is mainly constrained due to lack of productivity augmenting technologies as the major quantity of food products are being produced in the unorganized sector, where resource utilization is very limited. The organized food processing units are also facing various kinds of challenges which have emerged due to opening up of the economy in the recent decade. To meet the emerging challenges, there is an urgent need to bring efficiency in production process through either maximizing the output or minimizing the cost.