CHAPTER III
AGRO PROCESS INDUSTRIES

3.1. Introduction

Agro processing could be seen as a set of techno-economic activities carried out for conservation and handling of agricultural produce and to make it usable as food, feed, fiber, fuel or industrial raw material. Hence, the scope of the agro-processing industry encompasses all operations from the stage of harvest till the material reaches the end users in the desired form, packaging, quantity, quality and price. Ancient Indian scriptures contain vivid account of the post harvest and processing practices for preservation and processing of agricultural produce for food and medicinal uses. Inadequate attention to the agro-processing sector in the past put both the producer and the consumer at a disadvantage and it also hurt the economy of the nation.

Agro-processing is now regarded as the sunrise sector of the Indian economy in view of its large potential for growth and likely socio economic impact specifically on employment and income generation. Some estimates suggest that in developed countries, up to 14 per cent of the total work force is engaged in agro-processing sector directly or indirectly. However, in India, only about 3 per cent of the work force finds employment in this sector revealing its underdeveloped state and vast untapped potential for employment. Properly developed, agro-processing sector can make India a major player at the global level for marketing and supply of processed food, feed and a wide range of other plant and animal products.

3.2. Historical Background of Agro Processing Industry

By the middle of the nineteenth century, common agro processing industries included hand pounding units for rice, water power driven flour mills, bullock driven oil ghanies, bullock operated sugarcane crushers, paper making units, spinning wheels and handloom units for weaving. In British India, during the year 1863, a note was written by the Governor of Madras state, Sir William Denison to the government of Madras state for laying greater stress on agriculture and agro processing (Royal Commission, 1928). Based on this, a set of improved machinery was brought from England for demonstration and adoption. It included threshing machines, winnowers and chaff cutters, besides steam ploughs, steam harrows, cultivators, seed drills and horse hoes. Importance of agro-processing sector was first realized and documented after the disastrous famine of Bengal during 1870’s. Report of the Famine Commission, set up by the British Government, in its report submitted in 1880, clearly stated the need for agricultural improvement and improved post harvest infrastructural development specifically, rail network. Need was also felt for incorporating chemical interventions in the agricultural sector and precision farming through agricultural mechanisation manned by engineers. The Royal Commission on Agriculture setup by the British Government conducted a detailed study. In its report published during the year 1928, it called for scientific approach to the sector and stressed for developing rural industries and cooperatives. Realizing the importance of
the agro-processing sector for rural development as a tool for POORN SWARAJ (complete self rule).

Post independence era in India witnessed rapid growth in agro processing sector specifically during 1980s. It followed the first phase of the Green Revolution that had resulted in increased agricultural production and the need for its post harvest management. The importance of the sector was realized by the business community leading to diversification from grain trading to processing. Agro processing activities were initiated by the rice processing industry, followed closely by wheat milling, paper and pulp industry, milk processing sector, jute industry, sugarcane processing and oils extraction through solvent plants. In some areas like the solvent extraction industry, the growth in installed processing capacity has been far higher than the supply of the raw materials. However, in other areas like fruits and vegetable processing, the growth has not been encouraging on account of poor demand for processed products by the consumers. In such cases, the industry has also not been able to develop the demand adequately.2

3.3. Importance of Agro Processing Industry

Agro-industry, i.e. the processing, preservation and preparation of agricultural production for intermediate and final consumption, performs a number of crucial functions that support development and poverty alleviation. Hence, agriculture in connection with industry needs to be recognised by policy makers and industry leaders as a competitive, value-adding business sector that has a positive development impact and contributes to economic growth. Rather than focusing on agricultural productivity only, policy makers must consider the competitiveness of the entire agro-value chain. A comprehensive approach could include e.g. supporting small agro-producers and SMEs, enabling market access and developing a supportive institutional environment.

3.3.1. Employment and Income Generation

Agro-industry plays a fundamental role in employment creation and income generation. Particularly the food and beverages processing sector remains important at all levels of economic development. Taking only into account countries where data is available the ILO calculates global employment in the formal food and beverages sector at 22 million. However, one should bear in mind that in developing countries an estimated average of 60% of workers in food and beverages are employed in the informal economy. In addition to the direct employment effect, vibrant agro-industry is found to generate employment in downstream and upstream sectors such as agriculture, commerce and services.

Agro-industry can play a strategic role in pro-poor growth strategies, particularly in developing countries where 75% of the poor live in rural areas. As possibilities for income generation are restricted in rural areas, rural non-farm earnings from trading, agro-processing, manufacturing, commercial, and service activities constitute a significant part of household income. For developing countries as a whole, non-farm earnings account for 30 to 45% of rural household income. They complement agricultural wages and serve household risk diversification and the earning out of consumption patterns. With low capital requirements and undemanding
local marketing channels the rural non-farm economy offers opportunities for poor households (particularly women headed households), small-scale farmers and other smallholders, representing an important instrument for rural poverty alleviation. The development of agro-industry can also have an important impact on the local agricultural sector as well as the livelihoods of small holder farmers, provided they can produce on a stable basis, supplying regular quantity and quality.

According to the International Standard Industrial Classification (ISIC), agro-industry consists of:

i) food and beverages;
ii) tobacco products;
iii) paper and wood products;
iv) textiles, footwear and apparel;
v) leather products; and
vi) rubber products.

In terms of employment composition, rural industries (manufacturing) account for approximately one fifth of rural non-farm employment, consisting mostly of occupations in agro-industries. Indirectly, however, other activities such as commerce and retailing, construction, equipment manufacture, transport, logistics and trade are typically associated with agro-related manufactures and agribusiness. The importance of agro industry for employment is further emphasized by high and increasing levels of female involvement, especially in the non-traditional, high-value agro-chains (i.e. horticulture, fruits and fish products). Female employment in such sectors can range between 50 and 90%. However, strong gender segmentation in production and processing tends to consign women to more vulnerable forms of work (casual, temporary and seasonal), lower paid and more labour-intensive preparation and/or processing.\(^3\)

### 3.3.2. Contribution to GDP and Manufacturing

An extended definition of the agro-processing sector which includes not only agro industries but also distribution and trading activities, would roughly account for more than a third of the GDP in Indonesia, Chile, Brazil and Thailand, and between 20 and 25% in Sub-Saharan countries. The entire food system, including the production of primary goods and commodities, marketing and retailing, would account for more than 50% of developing countries’ GDP (based on World Bank, FAO and UNIDO databases).

The agro-processing sector contributes more than 50% of total manufacturing value added in low income countries, 36% lower middle and 32% upper middle income countries. Or, put differently, agro industry contributes a share of 61% to total manufacturing in agriculture based countries, 42% in countries in transformation and 37% in urbanized developing countries (WDR 2008).

Agro industries have the potential of value-adding, employment generation and improvement of farm and rural non-farm income, food security and rural living standards. Trends illustrate that there are large value-adding opportunities in agro-industry relative to agriculture. In low and middle income countries, the food processing sector
is typically one of the largest industrial activities in terms of value-adding. Using the UNIDO Industrial Statistics Database 2005, agro-processing value added as a share of GDP amounts to 4.3% for low income countries and 5% for lower middle and upper middle income countries.4

Within manufacturing, the agro-processing sector occupies a significant position in overall turnover and value added in developing countries – though huge heterogeneity may exist among them. On average, productivity levels in food processing are above the manufacturing average, making it one of the more efficient economic sectors in least developed countries (classified according to the Human Development Index).

3.3.3. Promotion of Socio-Economic Development

Strong synergies can exist between agro-industry, agriculture and poverty alleviation. Agro-industry provides capital and services to farmers (e.g. seeds and equipment, training, production and market information), promotes entrepreneurship, raises demand for agricultural products and connects farmers with markets through the handling, processing, marketing and distribution of agricultural products. As a result, productivity and quality of agricultural production, farm returns, and economic stability for rural households, food security and innovation throughout the value chain can be enhanced. Efficient agro-industry can therefore spur agricultural growth. As economies become more sophisticated, economic structures are transformed and capital and labour are transferred from agriculture to the expanding agro-industrial and related service sectors. Accordingly, the agribusiness-to-agriculture ratio increases.

3.3.4. Stabilization and Regeneration

The development of rural agro-industries can play a major strategic role in stabilizing and regenerating countries and in consolidating rural and regional development. It can do this by providing employment and supporting wealth creation and economic growth in a decentralised manner in areas that have been affected by internal conflicts and migration resulting from uneven regional development.

Developing agro-industry in such areas promotes a more balanced, decentralised growth within the country by generating productive employment alternatives. It thus not only reduces migration, especially of young unskilled labour into crowded cities, but it can even reverse migration trends by offering new employment opportunities in those affected areas, thereby alleviating social pressures and demands on public services within the city.

3.3.5. Integration into Global Markets

By introducing and accelerating technical innovations, promoting entrepreneurship and improving business practices along the chain, agro-based SMEs not only provide access to new domestic market outlets, but can essentially act as a launching pad for the integration of developing countries into global markets. Developing countries have a natural comparative advantage in global markets in many agro-industry sectors. They have shown that they can be competitive in
traditional tropical crops, but also in non-traditional exports and in components of the animal protein complex. Non-traditional food exports such as fruits, horticulture and fish products, as well as livestock products, have already become an important part of exports.

Despite continuing barriers to trade, it is believed that developing countries can identify and explore export market opportunities by developing their agro-industry. The markets for organic, fair trade and origin products, for instance, are high-value outlets for agricultural products and demand from developed and some middle income developing countries has been growing strongly over recent years. With the help of a competitive agro-industry that increases value-added and improves product safety and quality, the efficiency of technical processes and business practices, access to such potentially lucrative specialty markets would be facilitated. However, issues like adherence to standards, consistency in quality, volume requirements and timely delivery are crucial for successful integration into global agro-markets.

3.4. Changing Environment for Agro Industry

Emissions of carbon dioxide, methane and other greenhouse gases are changing the future world climate and raise new challenges for agriculture (e.g. via solar radiation, temperature and precipitation). Climate change, including global warming and increased climate variability, is considered to significantly impact on food supply and food security. The effects include a shift in climate and agricultural zones towards the poles, changes in production and precipitation patterns and increased vulnerability of the landless and the poor. In terms of global food supply, stability will be affected by an increase in climate variability and extreme weather events, as well as higher crop vulnerabilities to infection, pests and weeds as a result of changing weather patterns. Developing countries are considered vulnerable to climate change due to their location in mostly lower and warmer latitudes. Furthermore, their resources to deal with the effects of climate change are usually inadequate. The most negative impact will therefore be in areas where food production is already deficient today.

As fears over climate change increase and oil prices continue to rise, bio-fuel production in Europe, Asia and the Americas has surged. While offering an alternative to fossil fuels, the expansion may be controversial in some regions – both environmentally and politically. By converting food to energy crops (e.g. wheat, soy, palm oil, corn and sugarcane), bio-fuel production is often considered one of the drivers of food cost inflation and food security deterioration. Other factors that have been identified as drivers include increasing demand for food, rising energy costs, speculation in commodity markets, etc.

The implications for the agro-food industry are evident: raw material sourcing will become a greater challenge with food price inflation and in areas where food production is negatively affected by climate change or where demand for bio-fuel raw materials is strong. At the same time, the contribution of the agro-food industry to raising food security in those developing countries will be ever more important. As the bulk of the output of agro-industries in developing countries is destined for the domestic market, their performance needs to be improved for domestic food supply.
Through enhancing efficiency in agro-industries, costs can be reduced to be competitive with imported commodities and/or to contribute to the reduction of soaring food prices in the local market.

3.5. New Opportunities for Growth of Agro Processing Industries

In this new era of LPG the agro industries are having many new challenges as well as opportunities; these opportunities should be required to be exploited by the Indian rural farmers as well as by the producers. The following are some of the new challenges in front of API, which can be converted into opportunities. (Fig 3.1)

![Figure 3.1](image)

Opportunities for Growth of Agro Processing Industries

3.5.1. New Markets

Already around 80% of global food and beverage sales consist of processed products, with 60% being consumed in high income countries (Wilkinson and Rocha, 2008). Although households in developing countries spend a large share of total expenditures on food, most is on non-processed products. In 2002, per capita retail sales of packaged food in high income countries were more than 15 times the value found for low income countries. But growth in consumption of packaged food is fastest in the developing countries: 7% in upper middle, 28% in lower middle and 13% in low income countries, compared to just 2 to 3% per year in high income countries (1996-2002). Such high growth can be expected to continue:

a) Ongoing population growth and growth in per capita consumption

Changing diet and increasing variety and quality of products with rising incomes, drive demand for processed foods and services embodied within the products.
b) **Increased ownership of refrigerators and microwave ovens**

Household purchases of perishable and frozen foodstuffs and higher consumption of prepared foods and ready meals are increased due to holdings of refrigerators and ovens.

c) **Internationalisation of Retail**

There is considerable shift in consumption patterns because of internationalisation of retail.

d) **Urbanisation**

Population growth in developing countries is increasingly an urban phenomenon which raises the importance of food preservation and convenience of utility.

e) **Further Demographic Changes**

Increasing participation of women in the labour market, ageing of the population and rising importance of single-person households will drive sales of ready meals, convenience food and food services.

### 3.5.2. Customer Needs

Although a major share of agro-industrial output in developing countries is consumed domestically, various niche and speciality export markets can provide further opportunity for an agro-industry expansion in developing countries:

a) **Organic food and drink** are receiving considerable demand now-a-days because of customer awareness for nutrition and health.

b) **Fair trade**, exist for food products such as tea, coffee, cocoa, honey, juices, wine grapes, fruit and vegetables, nuts and spices, and non-food products such as flowers, plants and cotton seed.

c) **Origin-based products** associate quality with social and cultural values relating to collective local development. Many new features are incorporated, such as indigenous products, non-food products and products associated with the values of sustainability.

d) **Functional or nutritionally enhanced foods** are expected to be a major source of market opportunities in the long-term. They respond to increasing preoccupations with health issues and food safety, which have generated such modified products and acted as a major innovation driver in the food industry.

These various niche markets certainly provide important export opportunities and development stimuli for agro-industry in developing countries.
3.5.3. New Technologies

As competition in markets for traditional products increases and pressures to meet the growing demand for food rise, agro-industries will need to increase the application of existing technologies and develop new ones which maximize the use of raw material inputs. A number of practical technologies, which are already widely used in the agro industries of high income countries, can be transferred and adapted in developing regions: e.g. packaging, pre-processing at farm levels, traceability technologies, cold stores and chains, as well as the information and communication technologies underlying inter-firm logistics and business planning.

In terms of new technologies, biotechnology, for instance, has the potential to produce crops better suited for changing climate, soil, as well as processing conditions (e.g. higher starch content, better quality proteins, or modified oils and fats). New industrial materials will be derived from biomass (plants and bacteria), which may, as economies of production change, replace part of today’s fossil-based, synthetic materials and plastics. Similarly, numerous other energy efficient, environmentally friendly technologies, including bio-processing, non-thermal, and drying technologies, will be increasingly important in preserving scarce natural resources, improving food availability and promoting social and economic sustainability.

The transition to a knowledge-based bio-economy is already underway in many parts of the world, fuelled by massive investments and new policy measures to sustain the new industries. The development of global agro-industrial complexes will dictate additional changes in technological patterns. Developing countries must consider introducing innovative technologies, including the manufacture of high value bio related products such as speciality chemicals, tailor made enzymes, vaccines, drugs and bio-pesticides, if consistent with the overall development strategy.

3.6. Agro Production Trends

In the beginning of the twentieth century, Indian agriculture was in a stage of subsistence. By the year 1925-26, the total area under some major crops in India was: rice – 32 mha, wheat – 9.6 mha, sorghum – 8.2 mha (Royal Commission on Agriculture (1928). The yields were very low. In the year 1950-51, India produced only 50 million tonnes of food grain and a variety of other crops. By the year 2000-2001, India started producing about 700 million tonnes (Mt) of biological materials per year including food grains, oilseeds, fruits, vegetables sugarcane, milk, eggs, meat, fish, tea, coffee, fiber crops, floricultural produce, forest produce and so on. The country has diverse agro-climatic conditions and consumer preferences and hence it produces a vast variety of agricultural and livestock materials. The change in agriculture production over the last sixty years is given in Table 3.1. India holds a major share for some of these products in the global context. However, their market potential is not being fully realized due to poor post harvest management and inadequate infrastructure and programme for processing of agro-produce. The commodity-wise growth of agro-processing industries in the country during the years 1950 to 2008 has been as given below.
### Table: 3.1.
Change in Production Status over Last Sixty Years (Mt)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Commodity</th>
<th>1950-51</th>
<th>2007-2008</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Food Grains</td>
<td>50</td>
<td>210</td>
<td>420</td>
</tr>
<tr>
<td>02</td>
<td>Oil Seeds</td>
<td>05</td>
<td>026</td>
<td>520</td>
</tr>
<tr>
<td>03</td>
<td>Fruits</td>
<td>12</td>
<td>045</td>
<td>375</td>
</tr>
<tr>
<td>04</td>
<td>Vegetables</td>
<td>10</td>
<td>075</td>
<td>750</td>
</tr>
<tr>
<td>05</td>
<td>Milk</td>
<td>17</td>
<td>085</td>
<td>500</td>
</tr>
<tr>
<td>06</td>
<td>Fish</td>
<td>01</td>
<td>006</td>
<td>600</td>
</tr>
<tr>
<td>07</td>
<td>Spices</td>
<td>NA</td>
<td>005</td>
<td>500</td>
</tr>
<tr>
<td>08</td>
<td>Sugarcane</td>
<td>57</td>
<td>310</td>
<td>544</td>
</tr>
<tr>
<td>09</td>
<td>Fibre Crops</td>
<td>02</td>
<td>006</td>
<td>300</td>
</tr>
<tr>
<td>10</td>
<td>Meat</td>
<td>01</td>
<td>005</td>
<td>500</td>
</tr>
</tbody>
</table>


### 3.7. Post Harvest Losses and Agro Processing Industries

Due to poor post harvest management, the losses in farm produce in India are of a very high order. Various studies have estimated post production losses in food commodities to the tune of Rs. 75,000-1,00,000 Crore per annum. Table 3.2 provides a view of the extent of losses and the monetary value of the lost produce in terms of quantity and quality. It may be mentioned that the estimated loss includes losses during storage, handling and processing. It does not include losses at consumer’s end. It is also estimated that the extent of losses could be brought down to less than 50 per cent of the existing level on proper transfer and adoption of agro processing technology. For reducing the rest of the losses, new initiatives need to be called for. Hence, it would be in the long term interest of the economy to invest in developing suitable infrastructure such as proper grain storage structures, cold stores and processing systems to avoid the losses.

### Table: 3.2.
Present Production of Food Commodities and Estimates of Post-Harvest Losses

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Commodity</th>
<th>Production</th>
<th>Post Harvest Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Quantity</td>
<td>Average Price (Rs / T)</td>
</tr>
<tr>
<td>1</td>
<td>Durables (Cereals, Pulses, Oil Seeds etc)</td>
<td>230</td>
<td>10000</td>
</tr>
<tr>
<td>2</td>
<td>Semi-Perishables (Potato, Onion etc.)</td>
<td>40</td>
<td>3000</td>
</tr>
<tr>
<td>3</td>
<td>Perishables (Fruits, Vegetables, Meat.)</td>
<td>210</td>
<td>15000</td>
</tr>
<tr>
<td>Total / Average</td>
<td></td>
<td>480</td>
<td>11604</td>
</tr>
</tbody>
</table>

3.8. Research & Development in Agro Processing Sector

Research & Development Work in agro-processing carried out in India during the last 50 years categorized as follows:

- Studies on physical, biochemical, nutritional, and engineering properties/characteristics of different food, feed, fibre, and industrial raw materials.
- Response studies of different biological materials regarding their storage, handling, and moisture conditioning.
- Refinement of traditional equipment and processes for production of different foods, feeds, fibres and fuel materials for better quality, higher capacity, energy efficiency, and reduced drudgery to workers.
- Development of new produces and processes for better nutrition, convenience and taste.
- Enhancement of shelf life of the produces, safe storage/packaging and development of better performing materials.
- Better economic utilization of agricultural residues, by-products and recycling of wastes.
- Design and Development of instruments and equipment for post harvest operations and their evaluation, feasibility analysis, field trails/multi-location evaluation etc.
- Design, layout planning and development of pilot plants, agricultural produce bulk handling systems and area specific agro-processing models.
- Studies and modeling/simulation of post harvest systems and industry for the purpose of optimization, forecasting and policy analysis.
- Energy auditing and use of non-renewable sources of energy for post harvest operations.
- Product quality analysis, sensory evaluation and consumer acceptance studies.
- Work conditions, safety and pollution control.

3.8.1. Most Popular Developed Technologies

1. Agriculture produces’ refinement equipment such as, cleaners, graders and driers for on-farm operations as well as industrial operations.
2. Processes and equipment for parboiling of rice, preparation of puffed rice and flaked rice.
3. Development of processes and equipment for processing of pulses to produce dal for higher recovery and better quality.
5. Adoption and development of processes, and equipment for production of protein rich produces such as full fat soya flour, soya drink/ soya milk, soya paneer and soya fortified baked products.
6. Development of equipment such as, leaf cup and drona making machine, multipurpose mills, mini flour mill, grain peelers, maize de-huskers, shellers, groundnut decorticators, fruit graders, juice extractors, high recovery mechanical oil expellers and improved storage structures for cereals, pulses, oilseeds, onion and potato.
7. Processes and equipment for production of high quality ground spices and spice mix, development of raw materials and processes for production of instant sweets, curries, snack foods, instant soft drinks, idli, dosa, sambhar mixes/powders, egg powder, production and packaging of milk products such as shrikhand, butter milk, paneer, ghee and sweets.

8. Equipment for high recovery of sugarcane juice processes for production of high quality jaggery and liquid jaggery.

9. Processes, equipment and pilot plants for production of various industrial raw materials from lac including dyes and pharmaceutical products.

10. Improved technology for processing of jute sticks to yield jute fibre and impregnation, preparation of jute based textile materials and bags.

11. Control of stored grain insects by using chemical and physical methods, storage structures for on farm, trade, and process plant level operations.

12. Processing and canning of meat, meat products and fish.

Some work has also been done in the area of processing forest produce such as oil extraction from oil bearing materials, collection and processing of resins and production of dyes, chemicals and pharmaceutical products. The latest developments have been in the area of floriculture. Due to high export potential, R&D work has been initiated at some centers on pre-cooling, packaging, and transport of cut flowers and low cost designs of green houses. In the area of agro-processing of fruits and vegetables, development of tools and techniques for harvesting, pre-cooling of freshly harvested produce, minimal processing, controlled ripening, juice extraction, concentration and storage has been done.

3.8.2. Recent Position of Agro Processing Sector

Starting with a small number of processing facilities in 1950-51, a fairly well spread network of processing facilities has developed in the Country. Various estimates suggest the numbers of processing units in 2007-2008 are,

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Type</th>
<th>No. of Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Atta Chakkis &amp; Small Hammer Mills</td>
<td>3,00,000</td>
</tr>
<tr>
<td>02</td>
<td>Rice Hullers</td>
<td>1,00,000</td>
</tr>
<tr>
<td>03</td>
<td>Rice Shellers</td>
<td>12,000</td>
</tr>
<tr>
<td>04</td>
<td>Modern Rice Mills</td>
<td>30,000</td>
</tr>
<tr>
<td>05</td>
<td>Oil Ghanis</td>
<td>2,00,000</td>
</tr>
<tr>
<td>06</td>
<td>Oil Expellers</td>
<td>55,000</td>
</tr>
<tr>
<td>07</td>
<td>Dal Mills</td>
<td>12,000</td>
</tr>
<tr>
<td>08</td>
<td>Roller Flour Mills</td>
<td>800</td>
</tr>
<tr>
<td>09</td>
<td>Bakery Units</td>
<td>60,000</td>
</tr>
<tr>
<td>10</td>
<td>Solvent Extraction Plants</td>
<td>1,000</td>
</tr>
<tr>
<td>11</td>
<td>Fruit &amp; Vegetable Processing Plants</td>
<td>5,500</td>
</tr>
<tr>
<td>12</td>
<td>Dairy Plants</td>
<td>500</td>
</tr>
<tr>
<td>13</td>
<td>Meat Processing Plants</td>
<td>200</td>
</tr>
<tr>
<td>14</td>
<td>Fish processing Plants</td>
<td>25</td>
</tr>
</tbody>
</table>

3. 9. Commodity Wise Status and Problems of Agro Processing

The commodity-wise growth of agro-processing industries in India in last sixty years has been as given below.

3.9.1. Rice Processing Industry

Starting with 20.6 Mt of rice production during 1950-51, the country has come a long way to produce about 89.48 Mt of rice in the year 1999-2000. Similarly, in processing sector, the technology has undergone significant changes. Earlier, hand pounding, pedal operated system and huller units were common for milling of paddy. By the year 1998-99, there were nearly 30,000 modern rice mills using rubber rolls for paddy de-husking. Of these, more than 5,000 are large rice mills with parboiling facility and nearly 100 have colour sorters for removal of discoloured rice for export market. Innovations in rice processing include improved process of parboiling developed at IIT, Kharagpur; CFTRI, Mysore; PPRC, Thanjavur and other R&D centres. Starting from sun drying, the technology for drying of paddy now includes use of a variety of driers, specifically for parboiled paddy. Continuous flow LSU type driers have been most commonly used units followed by tray driers (batch type). Thermo fluids are used as medium of heat transfer for heating the air used for drying in a large number of rice mills. Though efforts have been made to improve the rice hullers, limited success was achieved in improving their performance with respect to reduction in broken percentage. Rubber roll technology for de-husking has now been well established. Efforts are ongoing to find use of tafflon to replace rubber rolls for economy. Several types of rice bran stabilizer have been designed and tested. Chemical method could find limited applications in Industry. Stabilization through extrusion technology has also been tried with value-added products of rice include puffed and flaked rice used as snack foods.

Rice and wheat form the major part of government operated procurement system and storage. In the month of March 2001, the total stocks of rice and wheat in FCI/ CWC and other government owned godowns were about 35 million tonnes for the public distribution system, for processing industry and for future use. Significant achievements have been recorded in packaging technology for milled rice for ready-to-cook applications in domestic market and export. Quick cooking rice has been developed at DFRL, Mysore and CFTRI, Mysore. The technology is being used for making available food supplies to defense personnel in boarder areas under war or war like situations. Rice is partially cooked and packed under highly sanitary conditions. It is autoclaved and supplied for safe use up to 6 months of period. Rice bran oil is a common form of edible oil besides its application in industry specifically as soap stock. The rice husk has application as source of furfural, high grade silicon, insulation material; particle board and fuel have been well demonstrated. Similarly, paddy straw has found limited applications as cushioning material in packaging of fruits and for preparation of soft boards. It is extensively used as cattle feed in many parts of the country.

The upcoming areas in rice processing R&D include high capacity de-huskers and more efficient polishers improved technology for storage of paddy and rice, on farm/ community level drying of paddy, mechanical handling systems for grain markets and millers, cold storage of rice and down stream products, products
diversification in the form of flakes, puffed rice, snacks, bakery items, quick cooking and ready-to-eat rice etc.

The recovery of brown rice as obtained from the hullers, shellers, and modern mills could be in the range of 62-64, 65-67 and 68-70 per cent, respectively. The potential yield of rice is 70-72%. The need is therefore, to promote modern rice mills and develop milling technology for fine rice. If all paddies are milled in modern rice mills, 3 million tones of additional rice worth Rs. 15,000 million could be obtained. 

3.9.2. Wheat Processing Industry

Wheat is a major crop of India. In the year 1950-51, the country produced 6.5 Mt of wheat that has increased to 76 Mt by the year 2000-2001. India has emerged as the second largest producer of this cereal in the world. Wheat contains 12% bran, 3% embryo and 85% flour. It is mainly processed for flour (atta), maida, suji and dalia. In last 50 years, harvest and post harvest technology of wheat has advanced substantially. The most significant development has been the use of self propelled harvester combines used for harvesting and threshing of wheat. There were about 27 lakh atta chakkis (7.5-10 kW rating) and 700 roller flour mills in the country. This number has risen from 53,000 atta chakkis and 200 roller flour mills in 1971-72. The figures were much lower 50 years back.

A number of commercial organizations have been offering processing units for handling, cleaning, grading, drying, storage, treatment and bagging of wheat for seed and food applications. Wheat is now increasingly being used in the form of bread, biscuits, suji and atta. Wheat flakes and puffed wheat as breakfast cereals has been gradually picking up. Traditionally used smaller size atta chakkis may face problems of declining clientele. Better mechanized chakkis (with lower pollution level and better energy efficiency) are likely to increase in number. The number of roller flour mills is also likely to increase steadily; however, majority of the mills may continue facing the problems of low capacity utilization and working capital constraints. These units would need to function through vertical integration of operations for sustaining profitability and achieve cost reduction through appropriate automation and computerization. Increase in demand is also expected in grain handling machinery, silo systems in grain markets and seed processing machinery.

Trends in consumer preferences suggest increasing demand for baked products. Demand for bread is likely to grow faster than the demand for biscuits. Presently bread is consumed mostly in large cities. Its consumption is expected to grow in smaller towns also. States with higher per capita income would continue to lead in the consumption of baked products. Among diversified products, full bran wheat bread has also been gaining popularity.

3.9.3. Processing of Pulses

India produced 8.4 Mt of pulses in the year 1950-51. The production grew to a level of about 14 Mt by the year 2000-2001. Starting with nearly 500 dal mills in the country in 1950-51, there were about 15,000 dal mills of 100-500 TPD capacity in the year 2000-2001. Pulses were generally stored in gunny bags or in small tin containers under straw cover during 1950s. By the year 2000-2001, metal bins and gunny bags (with profilectic treatment by insecticides) were in use. Research has revealed that pulse grains need to be stored at 20-22 degree Celsius in partially airtight containers at
8-10 per cent moisture content for long duration storage. A number of plants based mild insecticides and insect repellents (such as, neem seed powder) have been developed for safe storage of seeds.

In the area of milling of pulses, CFTRI developed a dal mill that has the advantage of not being dependent on natural sun shine. It involves subjecting the pulse grain to high temperature (120 degree Celsius) for short time and the de-husking by carborundum rollers resulting in higher dhal recovery. For small entrepreneurs in rural areas, dal mills have been designed. These units in specific regions have gained popularity as these are low investment machines which can be owned and operated with low risk. In a number of dhal mills, improved machinery including cleaners, graders, magnetic separators, washers, driers, polishers, colour sorters and packaging systems are being used. With complete phasing out of hand operated dal chakkis, commonly used during 1950s, the technology has turned fully mechanized. There is a need to evolve more efficient machines and processes for pre-treatment of the grain, de-husking, sorting, polishing and packaging in order to improve dal recovery and consume less energy. Also, there is a need for product diversification and development of technology for quick cooking and ready-to-eat dal.

3.9.4. Oilseeds Processing

Besides, animal based fat specifically obtained from milk and milk products, edible plant oils have been the major source of oils and fats for most of the population in the country. In the year 1950-51, the country produced 5.2 Mt of oilseeds. Production by the year 2000-2001 had increased to 24.5 Mt. In the year 1950-51, most of the oilseeds were crushed in either bullock operated oil ghanies or a few mechanical oil expellers. Both of these resulted in high volume of edible oil left in the cake. By the year 2000-2001, there were nearly 2.5 lakh oil ghanies, 60,000 oil expellers and 700 solvent extraction plants. Besides, there were 200 oil refining units in the country and 100 units for production of hydrogenated oil (Vanaspati). Per capita availability of edible oils is still very low at 8.0 kg per capita per year in the country. Out of this, 2.0 kg/capita is imported oil. R&D Institutions in the country have been working on pre-treatment of oilseeds for higher recovery of oil. Steaming has been found as one of the most useful methods for pre-treatment. Due to shortage of edible oil in the country, efforts have also been directed to obtain edible oil from non-traditional sources including rice bran and oil palm. On refining, the quality of these oils has been reported satisfactory for edible purposes.

In the area of packaging of edible oils, significantly rapid growth has been recorded specifically in commercial sector. Polypacks and plastic containers have gained popularity over traditionally used metal containers about 30-35 years ago. The future areas of research include application of bio-technology for enhancing yield of edible oil from different oilseeds, application of de-oiled cake for food purposes through protein isolation and health applications of edible oil for treating various physiological disorders. Production of oilseeds is 24.5 million tonnes. Out of the total production, 7% is used for seed, 8% for food, and 85% for oil extraction. Export of meal/oilseeds cake has been worth Rs. 15,000 million. Refinement of meal/cake for food products development could be of high importance. Oil expeller with lighter weight have, high energy efficiency and capable of extraction up to 90% oil and above needs to be
developed for decentralized oil milling. Hydraulic press, batch solvent extraction, extrusion-expelling and physical refining, also need to be considered and tried.

Besides other oilseeds, soybean has gradually become an important crop of India. Its production is around 5.3 million tonnes. Soybean is a special legume. It has 40% protein and 20% oil. India has 154 solvent extraction plants and 60 soya food units. Average recovery is 17.7% for oil and 82.4% for meal. Soya meal contains about 48% protein. Its export has been worth Rs.15, 000 million/ year. Soya foods are nutritious and economical and must be promoted. A strategic plan for expanded and diversified use of soyabean for food and feed in India for the next 25 years should be made and implemented. This crop has a great potential to enhance nutrition and health of the people and alleviate poverty.

3.9.5. Processing of Fruits and Vegetables

Joint effort of R&D institutions, farmers, government agencies and the trade has resulted in India emerging as a major producer of fruits and vegetables in the world. In the year 2000-2001, the country produced about 45 millions tonnes of fruits and 80 millions tonnes of vegetables. It was next to China in production of vegetables and topped in production of fruits. However, the growth in post harvest sector has not kept pace with the production. Even during the year 2000-2001, there were only 6,000 fruits and vegetable units in the country that had grown from a figure of about 1,000 during 1950-51. Less than one per cent of the total produce was processed, though the installed capacity of the processing industry has grown steadily from 0.27 Mt in 1980 to about 3 Mt in 2000-2001. Significant developments in technology include better understanding of the process of ripening of fruits, optimum harvesting time, pre-cooling of freshly harvested produce, cold storing of the raw fruits and vegetables, sorting, cleaning, waxing, packaging technology for fruits.

Most significant work has been recorded in the technology for ripening of the fruits under controlled conditions. Production of juices and value-added products including jams, jellies, pickles, canned products etc. has become a commercial success. The industry using indigenous technology includes units engaged in juice extraction, concentration of juices, canning and production of several of the products like jams, jellies, canned fruits, dried vegetables etc. Technology is still being imported for establishment of large scale exported oriented units for production of items like banana paste, concentrates of various fruit juices, sorting, cleaning, washing, waxing and packaging of raw fruits and vegetables.

By the year 1998-99, share of different products in the total processed fruits and vegetables was; pulp and juice 27%, jams and jellies 10%, pickles 12%, ready to serve beverages 13%, syrups 8%, squashes 4%, tomato products 4%, by canned vegetables 4% and other products 18%. The industry has been facing problems of low capacity utilization, technological obsolescence and marketing. It has to work under the constraints of high fluctuations in raw material quality and fluctuating market price, poor technology for handling and storage, inadequate R&D support for product development, high cost of energy and uncertainty in availability of adequate quantity for processing purposes, inadequate and expensive cold chain facilities and varying requirement of processing conditions from one material to another. Future R&D has
to focus on the issues of economically producing value-added products and product diversification, besides the issues mentioned above.

3.9.6. Sugarcane Processing Industry

Sugarcane production was 310 Mt in the year 2000-2001. About 80% of the cane produced is milled, about half for the production of refined white sugar in the organized sector with the sugar mills located in the production catchments in public, private and cooperative sectors and about 42% for the production of Jaggery and Khandsari. Based on sugar recovery, minimum price scheme has been introduced. Mills have loose tie-up with the growers; some of them provide critical input support to the growers. Apparently, it is working well. But there have been cases where farmers burnt their crops in the absence of remunerative prices. For Jaggery, canes are crushed, clarified and concentrated. Gur as sweetener has better nutritional profile than white sugar. It is possible to refine the process and the product for greater competitiveness and realize export potential especially where people of Indian origin are located. Energy efficient furnaces, concentration pans, clarificants, moulds and storage are needed for Gur. Khandasari units used open pan in place of vacuum pans for concentration and the sugar obtained is of lower quality compared to white sugar from mills. Sugar recovery in Khandasari is much lower. Jaggery promotional and regulatory measures have been taken by the Government to improve quality and production. Large numbers of sugar mills are using outdated processes and equipment; some of them not only use entire bagasse but also use wood.

3.9.7. Cotton Processing

Cotton is a natural textile fibre. Traditional cotton textile industry could not face onslaught of modern high speed spinning, weaving and surface finish technologies. Small scale textile industry supported by Swadeshi and Khadhi and Village Industries Commission face serious labour problems also. Cotton seeds are valued as feed and oilseed and the stalks are used as fuel. However, stalks yield excellent paper and pulp, particle boards and microcrystalline cellulose (MCC). Cotton hulls also yield good particle board and furfural. Cotton willow dust can be used for production of bio-gas. Cotton wastes can be used for mushroom production. There is scope for income and employment generation if cotton stalks are utilized for pulp and paper making.

3.9.8. Processing of Medicinal and Aromatic Products

The plant based pharmaceuticals, herbal medicines, perfumery, cosmetics, fragrances and food flavour industries have recorded a phenomenal expansion in last 50 years and as a result, this sector figures in high annual growth rate industries in agri-business. The market for plant based pharmaceuticals in the year 1994 was estimated to range between US$ 32-43 billion. The world essential oil production at raw materials level was estimated to be about Rs. 32 billion of which 55-60% goes to food flavours, 15-20% as fragrances and the remaining is broadly used as starting raw material for isolation of aromatic chemicals. In terms of market share in production value, India is sliding downwards and presently stands at sixth rank with only 6% share in world trade. The thrust has been harvesting of the plants, curing/drying, and extraction of the medicinal and aromatic substances. The export earnings could be
increased by innovations in the field of post harvest technology for increasing productivity and improving quality. In case of medicinal plants, studies need to be conducted to develop testing procedures/analytical facilities to meet stringent international standards and to carry out product/process development for low cost chemicals from both raw materials and other by-products.

3.9.9. Processing of Traditional Foods

India has a very strong base of traditional food products, which have been developed under varied agro climatic, geographical and socio-cultural situations over the centuries. Besides, conventional *chapatties*, these may include expended, puffed, flaked, extruded, fermented products, sweets, instant mixes, breakfast foods, bakery products, beverages, health and special foods. The production of traditional foods during 1996-97 has been estimated nearly 30 times more than that of all western style high cost processed foods in the Indian market. There is an urgent need to upgrade the conventional foods technology so that the industrial manufacturing of products can be promoted and the scope of marketing expanded.

3.9.10. Floriculture

Flowers and plants have always been an integral part of human living. Besides their aesthetic importance, they are also useful in improving the quality of life. Ornamental plants play a very important role in environmental planning of urban and rural areas for abatement of pollution, social and rural forestry, wasteland development, afforestation and landscaping of outdoor and indoor spaces. Floriculture is also an important agri-business with potential for export trade. The area under floriculture in India has increased to nearly 40,000 ha, which constitutes around 17% of total global acreage. In spite of such a large area, production value is very low. The quality of Indian produce is poor and not acceptable in international market. The produce quality deteriorates further due to improper packaging, storage and transportation.

Floriculture is largely an export oriented agro industry. There are 14 flowers in the world cut flower trade. The trade is growing at the rate of 15% per annum. Yet Indian exports are limited only to a few flowers namely, Gladiolus, Chrysanthemums, Jasmine and Orchids. India’s share in the world floriculture trade is a miniscule with 0.59% exports during 1992-93 valued at Rs. 149.1 million. Cultivation of high quality varieties under protected conditions, proper tools and equipment, appropriate packaging and storage can create a niche for Indian flowers in the world market.

3.10. Major Challenges before Rural Based Agro Processing Industries

The value addition of food fortification in India is only 7 percent in comparison to other countries like China, 23 percent; Philippines, 45 percent; and U.K., 188 percent. In various national and international forums, the need of processed and preserved food for the growing population of India is emphasized. The greater the distance between the rural producer and the urban consumer, the greater is the risk of post harvest deterioration. India is one of the largest producers of raw material for the agro processing industry in the world still; the agro process industry is at a developing stage. It is the reality, that, less than 2 percent of fruit and vegetable production is
processed in India compared with 30 percent in Thailand, 70 percent in Brazil, 78 percent in Philippines and 80 percent in Malaysia. In spite of the tremendous growth potential with respect to rural-based agro processing industries in the country there are many challenges, which have diluted pace of development. Some of these challenges are mentioned below. (Figure 3.2)

Figure 3.2
Challenges in Front of Agro Processing Industries

3.10.1. Absence of Market-Driven Approach

Agriculture has largely been for subsistence and has not been market-driven. This has not yielded adequate surpluses for processing, and coupled with the low yields of crops, has been a bottleneck. The lack of awareness and the non-availability of suitable, processable varieties of raw materials, in terms of type, size, color, texture, etc. has contributed to the absence of large volumes of processable varieties and therefore to economies of scale.
3.10.2. Government Policy

The small and unorganized sector accounts for 77 percent of the total agro processing industry. There are only a few organized large industrial houses that make their presence felt in the agro-processing arena in India. The agro processing industries were neglected during previous planning periods. The liberalized economy, poses a threat to the small and unorganized sector from a marketing point of view. When products from other countries are available in the Indian market at lower prices the local small industries are facing lot of problems in marketing their products, so that some of them had to close down in a competitive business environment.\textsuperscript{11}

3.10.3. Tax Pressure

The tax levels on processed agro products in India are among the highest in the world. Few, if any, other countries in the world impose excise duty on locally processed food. There is also a distinction between branded and un-branded products for taxation in India. Excise duty of 16 percent, sales tax, octroi tax, mandi and samiti tax, taxes of the local bodies for entry and exit increase the tax burden on the product from 27 to 35 percent. India is also one of the few countries to levy tax on the machinery and equipment for agro processing industry. Because of these various taxes and duties, the product becomes very highly priced and cannot compete in the national and international market, consequently having to close down. It can be said that multiple and complicated tax regimes have made the food processing industry uncompetitive. The investments in food processing are in any case high risk and yield low returns. Investments are further depressed, despite the advantage of hygiene and quality, as the price sensitive Indian consumer has stayed away from the high priced packaged foodstuffs.

3.10.4. Non Dynamic Laws

The existence of multifarious laws and multiple authorities is another hurdle. Many of the laws were framed some 50 years ago like Prevention of Food Adulteration Act, which was meant to serve the purpose of food safety and to prevent adulteration. The plethora of laws covering food and processed items, involving multiple agencies, at present, hinders growth and makes administration of the processed food industry difficult.

3.10.5. Dependency on Climate

In India the production of food grains and other items is still dependent on the whims of nature, which are rather unpredictable. This also affects the small- and medium-scale rural-based food processing industries to a great extent, because of their dependence on seasonality of production.

3.10.6. Limitations for Value Addition

Many of the small- and medium-sized agro processing industries are engaged in primary processing. They are not involved in secondary or tertiary processing which reduces the scope for value addition.
3.10.7. Technological Backwardness

Almost all the agro processing industries, particularly the small and medium ones, are in the hands of the private sector, which do not have access to latest technology because of the unaffordable cost of technology. In the Information Technology age, many Indian agro processing industries do not have a database, which becomes one of the major constraints in setting up new industries.

3.10.8. Poor Infrastructure

Basic infrastructure required for agro processing industries is very poor. Lack of integrated cold chains, non-availability of transport facilities’ network, interrupted power supply; shortage of water etc. has significantly retarded the growth of agro processing industry.

3.10.9. Financial Limitations

The working capital requirement in this sector is very high, due to seasonality of raw material, non-availability of quality raw materials in time, high inventory carrying cost as it is essential to purchase the raw material only during the season, and very high cost of packaging, i.e., around 40 percent of the product price.

3.10.10. Psychological Barriers

Indian farmers are yet not mentally prepared to accept the challenges before agriculture as well as agro processing sector. Agro processing industries face difficulties due to inappropriate decisions about cultivation, imbalanced utilization of resources and limited yield from the land.

3.10.11. Weak Support Facilities

Agro processing sector depends on agricultural produce as raw material. The production of better quality raw material depends on timely supply of seeds, feeds, fertilizers, pesticides and insecticides. Many times technical consultancy is also required. There is weak chain of all these support facilities which creates problems before agro processing sector.

3.11. Export Trends and Opportunities

India has been a traditional exporter of raw agricultural products like spices. Export of raw products has resulted in huge loss to Indian economy. After GATT agreement and WTO membership, processed products manufactured as per international norms only offered at competitive prices, can be exported. However, our processed products mostly do not meet the international standards. India’s share in over US$ 300 billion world trade in agricultural commodities is less than 1%. Agricultural exports used to be of the order of 30.6% of the total exports during 1980-81, which came down to 19.4% by 1990-91. Currently, it is at about 16% due to rapid growth in other sectors as well. Processed fruit and vegetable products have considerable export potentials and if it is properly utilized, growers, processors, traders as well as national economy will benefit. It requires correct assessment of
world market, high quality of raw produce, high quality of processed product and competitive production cost.\textsuperscript{12}

3.12. SWOT Analysis of Agro Processing Industries in India

3.12.1. Strengths

1. Round the year availability of raw materials.
2. Social acceptability of agro-processing as important area and support from the central government.
3. Vast network of manufacturing facilities all over the country.
4. Vast domestic market.

3.12.2. Weaknesses

1. High requirement of working capital
2. Low availability of new reliable and better accuracy instruments and equipments
3. Inadequate automation regarding information management.
4. Remuneration less attractive for talent in comparison to contemporary disciplines.
5. Inadequately developed linkages between R&D labs and industry.

3.12.3. Opportunities

1. Large crop and material base in the country due to agro-ecological variability offers vast potential for agro processing activities.
2. Integration of developments in contemporary technologies such as electronics, material science, computer, bio-technology etc. offer vast scope for rapid improvement and progress.
3. Opening of global markets may lead to export of our developed technologies and facilitate generation of additional income and employment opportunities.

3.12.4. Threats

1. Competition from global players
2. Loss of trained manpower to other industries and other professions due to better working conditions prevailing there may lead to further shortage of manpower.
3. Rapid developments in contemporary requirements of the industry may lead to fast obsolescence.

The above SWOT analysis of agro processing industries in India can be used for the recognizing the strengths so that expected opportunities can be capitalized successfully. Similarly, weaknesses which create threats can be treated as challenges and converted into the way of growth by overcoming them. The business process reengineering is one of the practical solutions to assist in this direction.\textsuperscript{13}
3.13. Conclusion

Indian agro processing industries can play a vital role in not only preventing the post harvest losses of farm produces, but it can also help in providing the employment and income to the rural youths. Strong forward and backward linkages are to be established to procure raw material and to sell agro processed material. This has triggered development process in terms of improved agricultural practices for sustainability and food surplus. API would also provide the opportunity for investment in rural area and in establishing the infrastructure support for the agricultural produces. Last but not the least, the experience of API has established it as potential solution for rural unemployment and strengthening agriculture by making it more remunerative and fruitful.

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