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# Organic Food Manufacturing Industries

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## 1. INTRODUCTION

India is the world ‘s second largest producer of food next to China and has the potential of being the biggest in the World. Food and food products are the biggest consumption category in India, with spending on food accounting for nearly 21% of India‘s GDP and with a marketsize of $181 billion. The Indian domestic food market is expected to grow by nearly 40% ofthe current market size to $344 billion by 2025.India‘s agricultural base is quite strong but wastage is very high and processing of food products is very low. While processing of foodto consumable standards are at levels of up to 80% in some developed countries, the overallprocessing level in India has recently reached 10%.

India has made vast progress overtime in providing food security for its people and has become largely self-reliant in agriculture. Accordingly, the policy focus has shifted from attaining self-sufficiency to generating higher and stable income for the farming population. Food processing industry (FPI) is one area which has the potential to add value to farm output, create alternate employment opportunities, improve exports and strengthen the domestic supply chain. India, with about 11.2 % of total arable land in the world, is ranked first in the production of milk, pulses and jute, second in fruits and vegetables and third in cereals (Government of India, 2019). It is also the sixth largest food and grocery market. In 2017-18, the food processing industry accounted for 7.9 % of manufacturing Gross value added and 9.5 % in agricultural value added. It is also a major employment provider, contributing to 11.4 % of organized manufacturing employment.

Recognizing the immense potential of FPI in promoting inclusive growth, it has beenidentified as one of the key thrust areas under the ‘Make in India’ Program. The scope for higher growth in this sector in the medium run challenges. Therefore, India‘s food processing sector comparatively is small and its share in exports of processed food in world trade has remained at about 1.5%. Generally, in developing country markets, higher incomes result in diet upgrades, with increased demand for meats, dairy products, and other high value products. In India also sustained economic growth and increasing urbanization are fueling rapidgrowth in demand for high value food commodities like fruits, vegetables, milk, meat, eggs and fish.

Strength, Weakness, Opportunities and Threats analysis (SWOT) is used to highlight opportunities and threats facing the food processing industry and consider strategies to develop markets worldwide for processed food products. Food processing sector in India is poised to be one of the largest in terms of

production, consumption, export and growth prospects. Unprocessed foods are susceptible to spoilage by biochemical processes, microbial attack and infestation. The right post harvest practices, such as good processing techniques and proper packaging, transportation and storage can play a significant role in reducing spoilage and extending shelf life. The market for processed foods in India is growing significantly with its increased consumption by the present-day consumers. Easy marketing and distribution tasks, consumer's convenience, hygiene, increased food consistency, around the year availability of product, foods' shelf life, etc. are the key factors, which are attracting the food processing technology to be geared up.The food processing sector comprises of two segments- Primary processed food and Value added food. Primary segment comprises of packaged fruit and vegetables, milk,flour, rice, spices etc and constitutes around 62% in value terms of the processed foods. Value added segment includes processed fruits and vegetables, juices, jam & jelly etc. and holds around 38 % share in the total processed food. In an emerging country like India, where growth withequity is a primary policythrust, the optimum development of the food processing sector willcontribute significantly in tackling several developmental concerns such as disguised unemployment in agriculture, rural poverty, food security, food inflation, improved nutrition,prevention of wastage of food etc. By serving as a bridge between agriculture and manufacturing and by dealing with a basic need of all Indian citizens– the assured supply of healthy and affordable food at all locations in the country, this sector has the potential to be a major driver in India 's growth in the coming years. In fact the food processing sector has been growing faster than the agriculture sector.


Fig−1− sectors in India

## 2. LITERATURE REVIEW

### Introduction

The Demand For Organic Food Products Has Been Growing Rapidly In Recent Years, Driven By Increasing Consumer Concerns About Food Safety, Environmental Sustainability, And Health. The Manufacturing Of Organic Food Products Presents Unique Challenges And Opportunities Compared To Conventional Food Manufacturing. This Literature Review Seeks To Explore The Current State Of The Art In The Manufacturing Of Organic Food Products, Including The Key Considerations, Challenges, And Best Practices In This Growing Industry.

### Consumer Demand For Organic Food Products

Consumer Demand For Organic Food Products Has Been On The Rise, Driven By Various Factors Such As A Growing Awareness Of The Health And Environmental Benefits Of Organic Foods, Concerns About Agrochemical Residues In Conventional Foods, And A Desire To Support Sustainable Agricultural Practices. Studies Have Shown That Consumers Perceive Organic Products As Healthier, Safer, And More Environmentally Friendly Than Their Conventional Counterparts (Hughner Et Al., 2007). As A Result, Food Manufacturers Are Adapting To This Changing Landscape And Are Increasingly Focusing On The Production Of Organic Food Products.

### Organic Certification And Standards

One Of The Key Considerations In The Manufacturing Of Organic Food Products Is Compliance With Organic Certification And Standards. Organic Food Products Must Adhere To Strict Regulations And Standards Set Forth By Regulatory Bodies Such As The USDA National Organic Program (NOP) In The United States, The European Union Organic Regulation, And Various Other National And International Organic Certification Bodies.These Standards Encompass Various Aspects Of Production, Including Soil And Water Management, Pest And Disease Control, Livestock Management, And Processing Practices. Meeting These Standards Is Essential For Organic Food Manufacturers To Gain Consumer Trust And Access Organic Food Markets.

### Challenges In Sourcing Organic Ingredients

Sourcing Organic Ingredients Can Be A Significant Challenge For Manufacturers Of Organic Food Products. Organic Ingredients May Be Limited In Supply And More Costly Than Conventionally Produced Ingredients. Additionally, Ensuring A Consistent Supply Of Organic Ingredients That Meet Quality And Certification Requirements Can Be A Logistical Challenge. As A Result, Organic Food Manufacturers Must Establish Robust Supply Chain Relationships With Organic Ingredient Suppliers To Ensure A Reliable And Sustainable Source Of Raw Materials.

### Ingredient Handling And Processing

The Handling And Processing Of Organic Ingredients Present Unique Challenges Compared To Conventional Ingredients. Organic Ingredients Are More Susceptible To Spoilage And Contamination Due To The Absence Of Synthetic Preservatives, And They May Require Special Handling To Maintain Their Organic Integrity.

Processing Methods For Organic Food Products Must Also Adhere To Organic Standards, Which May Limit The Use Of Certain Processing Aids And Techniques. Therefore, Organic Food Manufacturers Must Carefully Consider The Selection Of Processing Equipment, Packaging Materials, And Storage Practices To Maintain The Organic Integrity Of Their Products Throughout The Manufacturing Process.

Quality Assurance And Food Safety Maintaining Quality Assurance And Food Safety Is Paramount In The Manufacturing Of Organic Food Products. Organic Certifications Require Rigorous Quality Control Measures To Ensure That Organic Integrity Is Preserved Throughout The Production Process. Additionally, Organic Food Products Must Meet The Same Food Safety Standards As Conventional Products To Ensure Consumer Safety.

Implementing Stringent Quality Control Checks, Sanitation Protocols, And Traceability Systems Is Essential To Guarantee The Safety And Quality Of Organic Food Products.

**Packaging And Labeling Considerations**

Packaging And Labeling Play A Critical Role In The Marketing And Sale Of Organic Food Products. Organic Food Packaging Must Conform To Organic Standards And May Need To Be Sourced From Specific Organic-Certified Suppliers. Furthermore, Accurate And Transparent Labeling Is Essential To Communicate The Organic Certification, Ingredients, And Nutritional Information To Consumers.

Packaging And Labeling Considerations For Organic Food Products Require Careful Attention To Detail To Ensure Compliance With Organic Standards And To Effectively Communicate The Organic Attributes Of The Products To Consumers.

**Sustainability And Environmental Impact**

A Key Driver Of Organic Food Production Is Its Potential To Reduce Environmental Impact And Promote Sustainability. Organic Farming Practices Emphasize Soil Health, Biodiversity, And Natural Resource Conservation, And These Principles Extend To The Manufacturing Of Organic Food Products. Integrating Sustainable Practices Into The Production Process, Such As Energy- Efficient Manufacturing, Waste Reduction, And Eco-Friendly Packaging, Is Essential For Aligning With The Ethos Of Organic Food Production And Meeting Consumer Expectations For Sustainable Products.

**Innovation And New Technologies**

Advancements In Manufacturing Technologies And Processes Continue To Drive Innovation In The Organic Food Industry. From Novel Processing Techniques To Advances In Packaging Materials, Organic Food Manufacturers Are Exploring New Technologies To Enhance The Quality, Shelf-Life, And Sustainability Of Organic Food Products. For Instance, Advancements In Non-Thermal Food Processing

Technologies, Such As High-Pressure Processing And Pulsed Electric Field Technology, Offer Alternatives To Conventional Thermal Processing Methods, Enabling The Preservation Of Organoleptic And Nutritional Qualities Of Organic Foods While Meeting Organic Standards.

Several Key Areas Are Typically Covered In Literature Related To Manufacturing Food Products:

1. **FOOD PROCESSING TECHNOLOGIES:** Literature Often Delves Into The Various Techniques And Technologies Used In Food Processing, Including Meth- ods For Converting Raw Agricultural Materials Into Consumable Products. This May Include Discussions On Thermal Processing, Extrusion, Dehydration, Fermen- tation, And Other Advanced Processing Techniques.

2. **FOOD SAFETY AND QUALITY ASSURANCE**: Quality Control And Food Safety Are Paramount In Food Manufacturing. Literature In This Area May Cover Topics Such As Hazard Analysis And Critical Control Points (HACCP), Good Manufacturing Practices (GMP), Food Safety Management Systems, And Quality Assurance Protocols To Ensure That Food Products Meet Regulatory And Consumer Standards.

3. **INGREDIENTS AND FORMULATION:** Literature May Explore The Selec- tion, Sourcing, And Utilization Of Ingredients In Food Manufacturing. This In- cludes Discussions On Ingredient Functionality, Formulation Considerations, And The Role Of Additives, Preservatives, And Flavorings In Food Product Develop- ment.

4. **PACKAGING AND PRESERVATION:** The Role Of Packaging In Preserv- ing And Safeguarding Food Products Is A Critical Aspect Of The Manufacturing Process. Literature May Focus On Packaging Materials, Technologies, And Strate- gies For Extending Shelf Life, Ensuring Product Integrity, And Meeting Sustaina- bility Goals.

5. **MANUFACTURING EFFICIENCY AND PROCESS OPTIMIZATION:** Literature Often Addresses Strategies For Optimizing Manufacturing Process- es, Maximizing Efficiency, Reducing Waste, And Minimizing Environmental Impact. This May Include Discussions On Automation, Lean Manufacturing Principles, And Continuous Improvement Methodologies In Food Production.

6. **REGULATORY COMPLIANCE AND STANDARDS**: Given The Highly Regulated Nature Of The Food Industry, Literature Often Explores The Legal And Regulatory Frameworks That Govern Food Manufacturing, Including Food Labeling Requirements, Industry Standards, And Compliance With Government Regulations Pertaining To Food Safety And Quality.

7. **EMERGING TRENDS AND INNOVATIONS:** Literature On Food Manu- facturing May Also Encompass Emerging Trends And Innovations In The Indus- try, Such As Novel Processing Technologies, Sustainable Practices, Clean Label Initiatives, Plant-Based Food Production, And The Integration Of Digital Tech- nologies In Manufacturing Operations.

Researchers, Industry Professionals, And Students Interested In The Field Of Manufacturing Food Products Can Explore A Rich Body Of Literature Encompassing These And Other Related Topics. From Academic Publications And Textbooks To Industry Reports, White Papers, And Research Papers, There Is A Vast Array Of Resources Available To Support A Comprehensive Understanding Of Food Manufacturing Processes And Practice.

## 3. RESEARCH METHODOLOGY

Food processing dates back to the prehistoric ages when crude processing incorporated slaughtering, fermenting, sun drying, preserving with salt, and various types of cooking. Salt- preservation was especially common for foods that constituted warrior and sailors' diets, until the introduction of canning methods. Evidence for the existenceof these methods can be found in the writings of the ancient Greek, Chaldean, Egyptian and Roman civilizations as well as archaeological evidence from Europe, North and South America and Asia. These tried and tested processing techniques remained essentially the same until the advent of the industrial revolution. Examples ofready-meals also exist from preindustrial revolution times such as the Cornish pasty and Haggis. During ancient times and today these are considered processing foods.

Food processing has also helped create quick, nutritious meals to give to busy families.
Modern food processing technology in the 19th and 20th century was largely developed to serve military needs. In 1809 Nicolas Appert invented a vacuum bottlingtechnique that would supply food for French troops, and this contributed to the development of tinning and then canning by Peter Durand in 1810. Although initially expensive and somewhat hazardous due to the lead used in cans, canned goods wouldlater become a staple around the world.

In the 20th century, World War II, the space race and the rising consumer society in developedcountries (including the United States) contributed to the growth of food processing with such advances as spray drying, juice, freeze drying, concentrates andthe introduction of artificial sweeteners, coloring agents, and preservatives such as sodium benzoate.

In Western Europe and North America, the second half of the 20th century witnessed arise in the pursuit of convenience. Food processing companies marketed their products especially towards middle-class working wives and mothers. Frozen foods (often credited to Clarence Birdseye) found their success in sales of juice concentrates and "TV dinners". Processors utilized the perceived value of time to appeal to the postwar population, and this same appealcontributes to the success of convenience foods today.

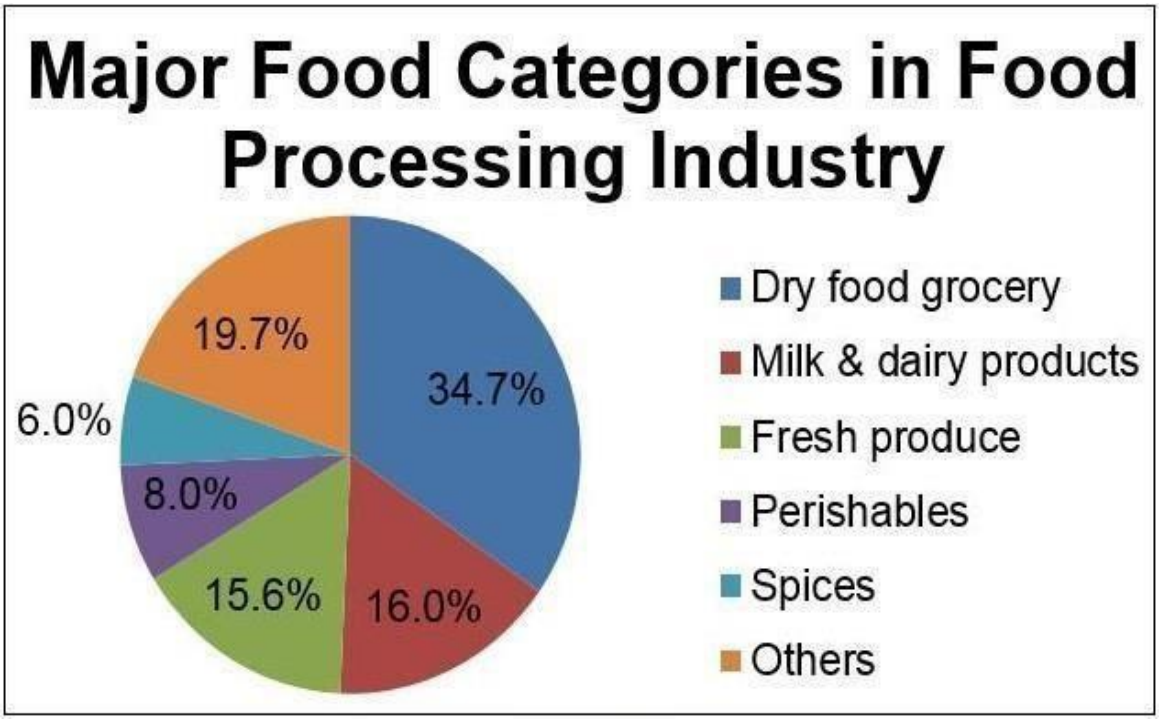
THE 20TH CENTURY: READY-TO-EAT MEALS

Throughout the 1900s, a number of rapid, important developments led to food processing as we know it today. Just as WWI popularized the tin can at the start of thecentury, WWII and the space race in the middle of the century helped to speed up the development of ready-to-eat packaged meals. During this time, the working middle class also began to expand around the world, bringing increased demand for fast mealswith a long shelf-life. Food processing in the 20th century. Spray drying, evaporation, freeze drying and the use of preservatives made it easier to package different types of foods and keep them on the shelf. Artificial sweeteners and colors helped to make these preserved foods more palatable. The home

oven, microwave, blender and other appliances provided an easy way to quickly prepare these meals. Factories and New processes as well as new ingredients and new appliances contributed to the history of mass production techniques made it possible to quickly produce and package foods. These developments paved the way for globally popular foods like frozen dinners, instant noodle cups, baking mixes, and more.

## 21ST CENTURY: FOOD SAFETY AND REGULATION

Though processed foods were fast and affordable, concerns began to rise about their nutritionalvalue in the late 20th and early 21st century. Many preservation processes reduce the vitamin and mineral content of otherwise healthy foods. Added fat, sugar and oil increases calorie content without increasing nutritional value. Concerns about preservatives and their long-termhealth effects began to rise. The toll of disposable plastic packaging also began to rise. Though food processing made many foods easierto buy and prepare, there were trade-offs that had, so far, not been addressed. In 2004,the USDA studied the nutrient content of foods prepared in varying ways. In 2010, First Lady Michelle Obama spearheaded the Let's Move! Campaign designed to reduce childhood obesity and reduce sugar and salt levels in processed foods, particularly those targeted towards children. A number of food manufacturers agreed to reducesalt levels in response.




Fig– 2– Major food categories in food processing industries

## 4. DATA ANALYSIS & INTERPRETATION

FOOD PROCESSING INDUSTRY IN INDIA

The Indian food processing industry stands at $135 billion and is estimated to grow with a CAGR of 10 per cent to reach $200 billion by 2015. The food processing industry contributed 7% to India's GDP. The industry employs around 13 million workers directly and about 35 million indirectly. Theindustry is segmented into sectors namely, milk and allied products (dairy), meat and poultry, seafood, bakery and confectionery, fruit and vegetables, grain, pulses and oil seeds (staple) products, alcoholic and non-alcoholic products (beverages), and packaged foods. The classification is not distinct as manyprocessed products overlap different segments.

India ranks No. 1 in the world in production of Milk (Fresh, whole, buffalo), Pulses, Ginger, Chick Peas, Bananas Guavas, Papayas and Mangoes. Further, India ranks No.2 in the world in production ofRice, Wheat, Potatoes, Garlic, Cashew Nuts, Groundnuts, Dry Onion, Green Peas, Pumpkins, Gourds, and cauliflowers. With the huge production base India can easily become the leading food supplier to the world and at the same time serving its vast growing domestic market with over a billion people.

Investments in the registered food processing units have been growing in the recent years. In 2007-08 the fixed capital of registered food processing units have increased by 18.93% over the previous year.

Food processing industry in India is increasingly seen as a potential source for driving rural economy as it brings synergy between industry and agriculture. A developed food processing industry is expected to lead increase in farm gate prices translating into increased rural incomes, reduce wastages, ensure value addition, promote crop diversification, generate employment opportunities as well as export earnings. With such a large and diversified production base coupled with low manpower cost and modern technology, the Indian food processing sector is poised for growth, if the advantages are leveraged optimally. The growth is driven by the fact that the central government has given a priority status to all agro-processing businesses. Government incentives in the field of mega food parks, cold chain and exports benefits are also playing an important role in promoting food processing.

The major challenges are investments at different points of the supply and value chain, proper research, farm and lab connectivity, upgradation of technology, increase in farm holding, skill and manpower training, backend and front-end integration and cold chain integration. India has the second largest arable land of 161 million hectares and has the highest acreage under irrigation. Next to China, India ranks second largest food producer in the world and has the potential to immerge the biggest with its food and agricultural sector. India accounts for less than 1.5% of international food trade despite beingone of the world's major food producers, which indicates huge potential.

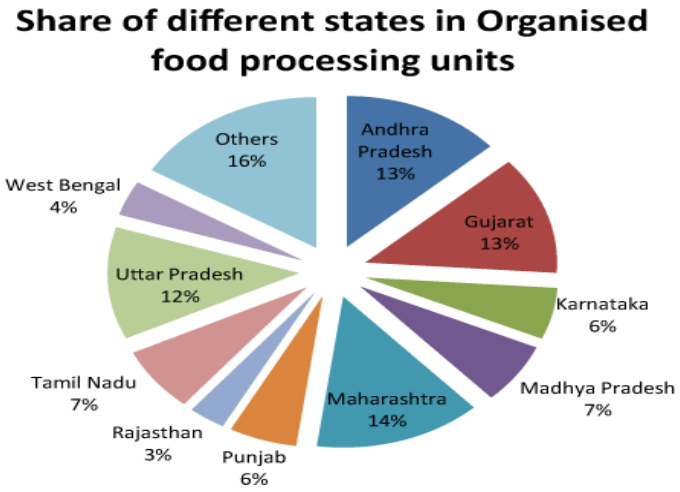



**Fig- 3- Share of different stated n organized food processing unit**

**Key growth drivers of Food Processing Sector in India-**

a. Increasing spending on health and nutritional foods.
b. Increasing number of nuclear families and working women
c. Changing lifestyle
d. Functional foods, fresh or processed foods
e. Organized retail and private label penetration
f. Changing demographics and rising disposable incomes

**Key opportunities in Food Processing Sector-**

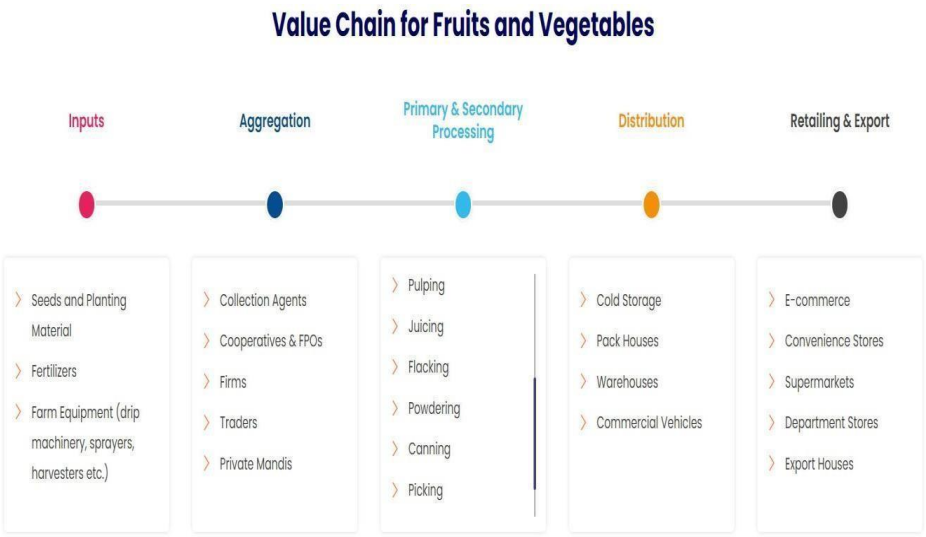
g. Processable varieties of crop
h. Contract farming
i. Investments in infrastructure through Public Private partnership (PPP)
j. Mega Food parks
k. Logistics and cold chain infrastructure

MAJOR AREAS OF FOOD PROCESSING INDUSTRYIN INDIA

The sector comprises of the following major areas –

**1- Fruits & Vegetables**

Beverages, Juices, Concentrates, Pulps, Slices, Frozen & Dehydrated products, Wine Potato Wafers/Chips Banana, mango, citrus, papaya, guava and grape account for major share in total fruit production. Potato, tomato, onion, brinjal, cabbage, cauliflower and tapioca account for maximum sharein vegetable production




Fig– 4– value chain for fruit and vegetable

## 2- Fisheries

Frozen & Canned products mainly in fresh form

a. Inland sector 7.10 MT

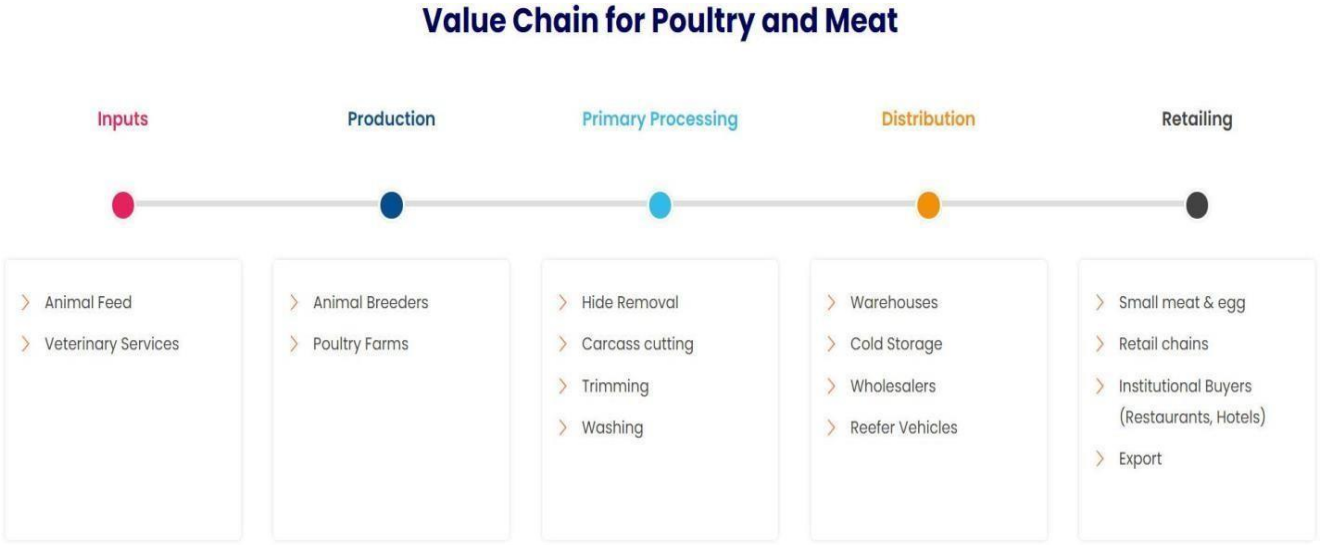
b. Marine sector 6.35 MT

c. Contributes 1 per cent to overall GDP and 4.6 per cent of agriculture GDP Production offisheris


Fig 5: Value Chain for Fisheries & Marine Sector

### 3- Meat & Poultry

Frozen and packed mainly in fresh form, Egg Powder. World's largest population of livestock and world's 5th largest producer of meat. Ninth- largest producer of poultry meat, fifth largest egg producer and the eighteenth largest producer of broilers in the world. Egg production – around 66.45billion in, about 5% over the previous year Poultry meat production estimated about 2.47 million tones.




Fig– 6– value chain for poultry and meat

### 4- Milk & Dairy

Whole Milk Powder, Skimmed milk powder, Condensed milk, Ice cream, Butter and Ghee.

OPPORTUNITIES OF FOOD PROCESSING INDUSTRY IN DIFFERENT SECTOR IN INDIA

The Ministry of Food Processing Industries (MoFPI) has undertaken 10 major schemes to boost up the food processing sector in India by spending Rs- 591.38 Crores under them. The government is trying to create a congenial environment for the food processing sector to grow and flourish; now the private enterprises should *also* come forward in food processing and tap this new avenue. The major schemes that have beenundertaken by MoFPI.

**Untapped market with strong growth potential**

- Fragmented market leads to lower processing levels and value addition
- The government plans to raise value addition to 35 per cent by 2015 from 20 percent in 2005

- PPP modules ideal for the private sector
- Strong demand growth; household consumption set to double by 2022

**Potential global outsourcing hub**

- Global supermarket majors looking at India as a major outsourcing hub
- India enjoys favourable supply-side fundamentals (abundant raw materialssupply, cost advantages)
- The government has helped by investing in AEZs, mega food parks, easiercredit
- The establishment of food parks – a unique opportunity for en- trepreneurs,including foreign investors to enter in the Indian food processing sector.

Supply chain infrastructure and contract farming

- Both firms and the government are eager to boost efficiency and access tomarkets
- Investment potential of USD22 billion in food processing infrastruc- ture; 100 percent FDI in this area
- Firms increasingly taking recourse to contract farming in order to secure supply
- Supply chain infrastructure – this niche has investment poten- tial in food processing infrastructure, the government's main focus is on supply chainrelated infrastructure like cold storage, abattoirs and food parks.

| Sl.No. | Zaire *of* the Scheme | 2019-2020(in crore) | | |
|---|---|---|---|---|
| | | *BE* | *RR* | *AE* |
| 1. | Scheme for Mega Food Parks | 390.00 | 182.86 | 181.47 |
| 2. | Scheme for Infrastructure for Agro Processing Clusters | 20.00 | 30.00 | 22.65 |
| 3. | Scheme for Integrated Cold Chain and Value Addition infrastructure | 4o0.00 | 271.59 | 244,74 |
| 4. | Scheme for Creation/Expansion of Food Processing and Preservation | 395,00 ’ | 90.00 | 74.BS |
| 5. | Scheme for Creation of Backward and Forward Linkages | 20.00 | 18.80 | 11.50 |

Table−1− Statement of Budget Estimates, Revised Estimates and Actual Expenditure during 2018−19

**1- Fruits and Vegetables Sector**

- India witnesses 4.58%- 15.88% wastage in fruits and vegeta- bles thus , opportunity lies in investing in initiatives that help reducing wastage levelsincluding infrastructure (cold chain, processing infrastructure)
- New Technology in F&V Processing.
- Cold Chain and Pack houses- Farm level, logistics, end product storage andpoint of retail.
- Packaging Technology
- Food Testing Labs with latest equipment and technology

**2- Dairy Sector**

- Advanced technology equipment for increasing milk procurement efficiency, value addition for dairy products etc.
- Innovation in packaging solutions
- New product development for cattle feed
- New veterinary care technology & cattle diagnostics services

**3- Poultry & Meat Sector**

- New technologies for meat & poultry processing
- Innovations in cold chain for better utilisation efficiency
- New veterinary technology/services
- Food Testing Labs
- New products value added products frozen/chilled products, RTC/RTE, Indianethnic products/snacks
- Egg powder plants
- New feed formulations and manufacturing

Fisheries & Marine Sector

- Upgradation and capacity expansion for cold chain.
- Innovations in packaging for increased shelf life and product differentiation.
- Infrastructure development for fishing harbours/landing cen- ters/wholesalemarkets as per international standards.
- Value addition and product development, especially RTE/RTC products for thedomestic as well as export market

▪ Potential to process value added products with Indian taste like fish/shrimppickle, fish/shrimp curry, skewers, marinated fish with Indian spices etc.

**The major factors that are responsible for the growth of food processing are:**

1. Increased spending on food products:
2. Increase in the number of nuclear families and working women.
3. Increase in the demand for functional foods.
4. Change in demographics has led to a rise in disposable income.
5. Increasing urbanization: changing lifestyle and aspirations.
6. Growth in organized retailing and penetration of private labels/brand names.

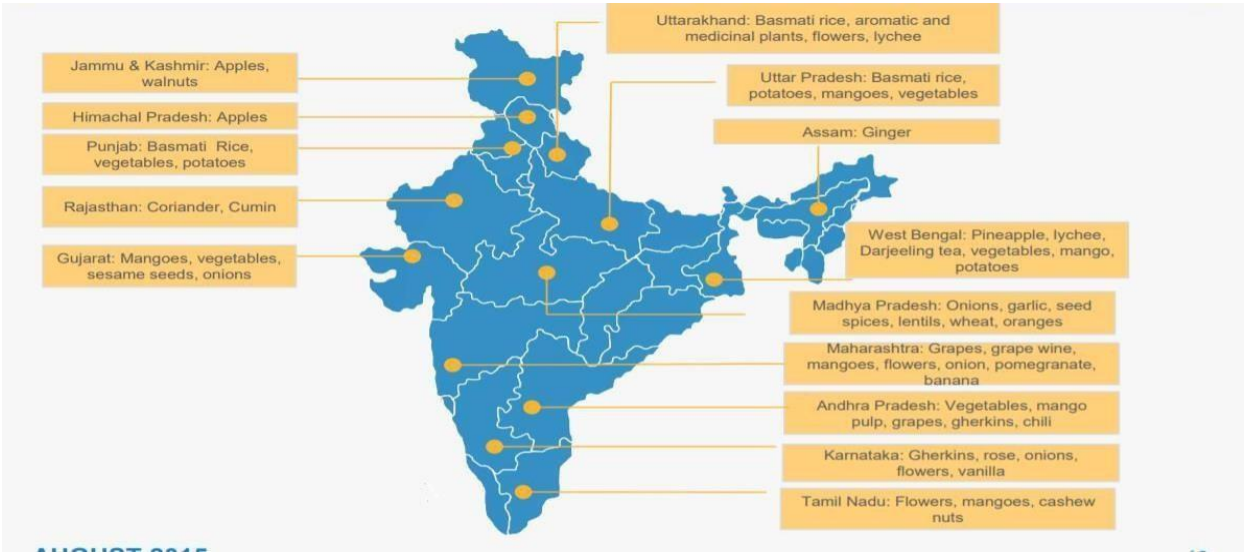



Fig – 7– figure showing famous crops and vegetable across india

| Item | Value added to output | Share in output | Share in employment | Share in exports |
|---|---|---|---|---|
| Manufacture of macaroni, noodles, couscous and similar farinaceous products | 35.9 | 0.2 | 0.3 | 0.1 |
| Manufacture of prepared meals and dishes | 30.1 | 0.4 | 0.6 | - |
| Manufacture of cocoa, chocolate and sugar confectionery | 25.5 | 1.5 | 1.8 | 0.6 |
| Processing and preserving of fruits and vegetables | 20.9 | 1.5 | 3.3 | 3.7 |

| | | | | |
|---|---|---|---|---|
| Manufacture of bakery products | 18.9 | 2.8 | 4.6 | 1.0 |
| Manufacture of other food products *n.e.c.** | 16.6 | 9.8 | 28.4 | 5.1 |
| Manufacture of sugar | 16.1 | 14.1 | 18.1 | 6.4 |
| Manufacture of starches and starch products | 16.0 | 1 | 1.4 | 0.6 |
| Processing and Preserving of Meat | 12.7 | 1.7 | 1.2 | 13.1 |
| Manufacture of dairy products | 9.9 | 13.1 | 7.4 | 1.6 |
| Manufacture of prepared animal Feeds | 9.8 | 3.9 | 2.3 | 0.5 |
| Processing and preserving of fish | 9.1 | 2.8 | 2.8 | 22.8 |
| Manufacture of grain mill Products | 7.4 | 22.8 | 21.0 | 26.2 |
| Manufacture of vegetable and animal oils &fats | 5.7 | 24.6 | 6.7 | 17.2 |
| **Total** | **10.7** | **100** | **100** | **100.0** |

Table -2- STATUS OF FOOD PROCESSING INDUSTRIES IN INDIA

CHALLENGES FOR FOOD PROCESSING INDUSTIES

The food processing industry in India is at a nascent stage, accounting for less than 10per cent of total food in India (Government of India). It is expected that improvement in food processing would reduce wastages in agricultural produce. At present food wastages are very high. According to the report of Central Institute of Post-Harvest Engineering and Technology (CIPHET), wastages in major crops, in general, remained at high level during 2010-2017. The FPI accounts for a prominent place among sectors in terms of share in employment in the manufacturing sector and because of its labour- intensive nature it has higher multiplier effect on the overall economy. As per ASI data, FPI has emerged as the highest employment provider among the industry groups2. However, its share in manufacturing and total GVA declined reflecting slower growth compared with other sectors of the economy. The exports of processed food in proportion to exports of raw food, on the other hand, havesignificantly increased during this period.

There is no common data set available for comparing FPI units in organized and unorganized sectors. However, a comparison can be made using ASI data, which provide information on the organized sector and National Sample Survey Organization's Unincorporated Non-Agricultural Enterprises Survey data provide information on the unorganized sector. A comparison of these two data sets for 2016-17 and 2015-16, respectively, showed abysmally low percentage of FPI enterprises in organized sector, even

though the organized sector accounts for more than 80 per cent of gross value added in overall FPI. As per ASI data, there were 39,748 food processing enterprises in the organized sector in 2016-17 while the number of unincorporated enterprises as per NSSO data stood at 24,59,929 in 2015-16 Nearly half of 23 organize enterprises were in three states – Andhra Pradesh, Tamil Nadu and Telangana – while Uttar Pradesh and West Bengal had the highest number of unincorporated food processing units. In terms of employment also, the 23 unorganized sector dominates. As per ASI 2017- 18, total number of persons engaged in registered food processing entities was 17.7 lakhs accounting for 11.4 per cent of total employment generated in the registered manufacturing sector. The unorganized food processing sector in turn, provided employment to 51.1 lakh workers constituting 14.2 16 % of employment in the unregistered manufacturing sector. In terms of value generated in the organized sector, three states, Maharashtra (17.3 %), Uttar Pradesh (11.6%) and Karnataka (11.3 %) together contributed around 40%.

| | As per CIPHETRe- port 2010 | As per CIPHET Report 2015 |
|---|---|---|
| Cereals | 3.9 – 6.0 | 4.65 – 5.99 |
| Pulses | 4.3 – 6.1 | 6.36 – 8.41 |
| Oil seeds | 2.8 – 10.1 | 3.08 – 9.96 |
| Fruits & Vegetables | 5.8 – 18.0 | 4.58 – 15.88 |
| Milk | 0.8 | 0.92 |
| Fisheries (Inland) | 6.9 | 5.23 |
| Fisheries (Marine) | 2.9 | 10.52 |
| Meat | 2.3 | 2.71 |
| Poultry | 3.7 | 6.74 |
| Horticultural Crops | | |
| Guava | 18.0 | 15.9 |
| Mango | 12.7 | 9.2 |
| Apple | 12.3 | 10.4 |
| Grapes | 8.3 | 8.6 |
| Papaya | 7.4 | 6.7 |
| Banana | 6.6 | 7.8 |
| Cereal Crops | | |
| Wheat | 6.0 | 4.9 |
| Paddy | 5.2 | 5.5 |
| Bajra | 4.8 | 5.2 |
| Maize | 4.1 | 4.7 |

Table 3– Wastages in Key Horticulture and Cereal Crops

1. Seasonality of processing operations and low capacity utilization: Theagricultural produce is seasonal and perishable in nature, there- fore, itsavailability is limited to a certain period of time. The lack o1 adequate cold-house storage structure/warehouse storage structures makes the situation even worse for the processing operations to car- ry during the off- season.
2. Inadequate focus on quality and safety standards: The FSSAI and HACCP standards are widely accepted by the consumers. It is easy for a factory/ start-up to acquire these certifications but the follow-up procedures that whether the samestandard protocol is followed or not for processing is stillunder question. The consumers have still not forgotten about the Maggi incident, wherein harmful levels or MSG were found in it and the stand lostin trust amongst the consumers.
3. Lack of product development and innovation: There is a lack of private or public-funded research and development(R and D) in the food processing sector.

4. Supply chain institutional gaps: The procurement of food grains primarily depends upon the APMC markets wherein the PCI pro- cures food grains for maintaining its buffer stock on behalf of the government. These food grainsare further allocated under targeted public distribution system (TPDS) to reach the under-deprived sec- tion of the society. But there are certain leaky pipes and constraints in this system also.
5. Supply chain infrastructural gaps: The six stages through which the inputsare transformed into end product by undergoing processing ac- tivities for final consumption. Lack of primary processing storage and distribution facilities leads to additional post-harvest losses of food items.

6. Inadequate and inefficient link between production and processing.

| | **Productions** | **Output Trading** | **Processing** | **Distribution / Retailing** |
|---|---|---|---|---|
| **Skill** | Traditional methods of farming | Trading by whose skills sets are Traditional | Exposure to low scale operations. Limitations in retail management purchase skill & management of large operations | Skills required for modern retail formats relatively unknown |

| | | | | |
|---|---|---|---|---|
| **Technology** | No/low use of low levels of mechanization. Low use of hybrids, biotechonolgy | Very low investment in storage & handling technology few upcoming commodity ex – changes | Outdated technology due to small scale operations low capacity units | Use of technology is low barcoding, supply chain linkages & use of IT is low |
| **Regulations** | Coporates not allowed in non plantation farming no enforceability in contract farming | Procurement intervention by govt. agencies. MSP policy restriction on storage & movement | Favorable to small scale investments. Scope for large processors limited. | Foreign direct investment allowed land cost high due to inaction on land development |
| **Capital** | Funds availability to farmers is poor 80% borrow from adthivas at very high rates | Controlled by small trader financiers | High cost finance | Flow of capital is restricted due to ban on FDI |

**Table 4- Factors Affecting Production, Processing, andDistribution in India**

SWOT ANALYSIS OF FOOD PROCESSING INDUSTRY

Though there are many promising dynamics which support good growth of this industry, there are still some significant constraints which, if not addressed sooner, canimpede the growth prospects of the Food Processing Industry in India. One of the biggest constraints is that this industry is capital intensive. It creates a strong entry barrier and allows limited number of players to enter the market. Players mean competition which reduces efforts to improve quality standards. Major challenges faced by the Indian food processing industry include: educating consumers that processed foods can be morenutritious; dealing with low price elasticity for processed food products; need for distribution network; development of marketing channels; streamlining of food laws; improving food quality standards and strengthening food testing network; strengthening institutional framework to develop manpower for improving R&D capabilities to address global challenges. These challenges must be addressed to achieve full potential

of the Indian food processing industry.

STRENGTHS

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

- Easy availability of raw materials as per the industry requirements
- Vast network of manufacturing facilities
- Wide spread domestic market
- Widened international market
- Social recognition to this industry as a source of livelihood
- Various government initiatives from time to time

**WEAKNESSES**

High requirement of working capital low availability of new reliable and better accuracy instruments and equipment's inadequate automation w.r.t. information management. Remuneration less attractive for talent in comparison to contemporary disciplines. Inadequately developed linkages between R&D labs and industry.

- Requirement of investment
- Low technological equipment
- Inadequate automation with respect to information management
- Low salary/wage in comparison to other industry

OPPORTUNITIES

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

- Large population of the country
- Increase in level of living of the individuals

- Increase in both earning concept among the new generation
- Opening of the global market
- Development of supportive industries like electronics, computer science etc.

**THREATS**

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

- Huge competition from global leaders
- Frequent changing nature of global laws on food production
- Non availability of adequate land for the raw materials and land
- Reduce in interest among the works for this sector


Fig 8 : SWOT Analysis

| *Strengths* | *Weakness* |
|---|---|
| • To provide basic food grains at subsidised price to the poor<br>• To guarantee minimum support to farmers | • The sufficient funds are not being planned in the budget 2013 to cover the 2/3rd of poor population<br>• Weak policy with regard to implementation of the same at ground level<br>• The implementations are left to state which may vary across India.<br>• The procurement, transportation storage and distribution from fair price shops are not defined<br>• Lack of infrastructure may lead to leakage and spoilage during storage and transportation.<br>• Adequate quantity and availability of food grains with public authorities<br>• Weak agricultural practices to ensure sufficient quantity and quality of the produce |
| *Opportunity* | *Threats* |
| • Reform of current Public Distribution System both at central level and at the state level<br>• Use of technological advancements in agricultural practices to meet the requirements of food grains in the countries<br>• Exploring new science of biotechnology and nanotechnology to develop improved crop varieties and production.<br>• Use of Information and Communications Technology in distribution and supply chain<br>• Effective communication system is required to create awareness about the scientific principle, available policies etc.<br>• Appropriate information sharing mechanism with regard to agricultural practice, geographical and climatic conditions for sustainable production<br>• Dynamic Policy initiatives to integrate different ministries involved in Ministry of Agricultural, Ministry of Environment and forest, ministry of Consumer Affairs, Ministry of Railways and various state authorities.<br>• Reaching out to people for equal participation to achieve Food Security in India | • Huge size of population widely distributed across the country<br>• It is a challenge to identify right target consumer as the distribution is both in rural and urban area<br>• Enforcing the implementation without prior risk assessment<br>• Non-availability of appropriate tools to deliver the desired production and distribution at all levels<br>• Wastage of food grins due to lack of access to correct, clear and complete information<br>• Lack of coordination between various Ministries and decision makers<br>• Loop hole is the existing system and flow of Inappropriate use of the scheme by non-needy person |

PORTER FIVE FORCES ANALYSIS

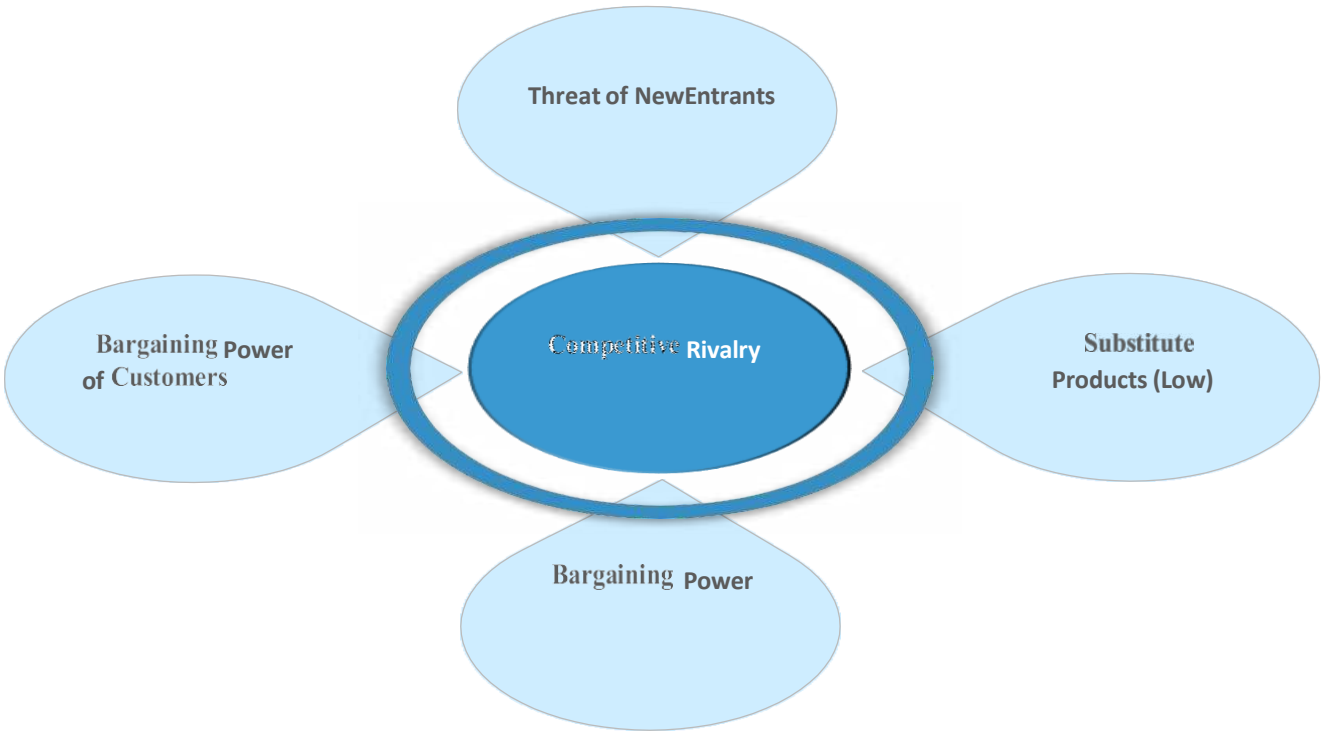



Fig 9: Competitive Rivalry

**COMPETITIVE RIVALRY**

- Due to a large influence of unorganized sector in the industry, the competition is intense.
- Existence of brand loyalty in certain products towards existing firms such as Amul in case of butterlimits competition in these products.

**THREAT OF NEW ENTRANCE**

- Capital Intensive - High investments are required to set up processing units;this acts as an entrybarrier for new players.
- Possibilities of wastages in processing.

**SUBSTITUTE PRODUCTS**

- No close substitutes of products such as milk, fresh fruits and vegetables are available in the market

**BARGAINING POWER OF CUSTOMERS**

- Tastes and preferences of consumers in certain products change and hence brand loyalty is low inthese products
- Low switching cost makes consumers switch from one supplier to another

**BARGAINING POWER OF SUPPLIERS**

- Low bargaining power of suppliers as the population largely relies on unorganized sector forproducts such as milk and vegetables.

STRATEGIES ADOPTED TO OVERCOME THECHALLANGES

**Rising business and product innovation**

- Companies have been moving up the value chain; for example, cooperatives aretransi- tioning from beingpure producers of milk to offering a wide range of dairy products
- Both domestic and global firms have been focusing on product innovation to cater to domestic tastes, while also introducing international flavours; for example Ruchi Soya is innovating by entering into the ready-to-cook segmentto meet the needs of people with significant time constraint to provide a rich source of protein in the breakfast cat- egory

**Low - cost price strategy**

- Low-cost price strategy is adopted so as to make the product affordable to the consum- ers by guaranteeing them value for money. The main aim is to providequality products to the consumers at minimum cost, e.g., Amul Milk
- Parle and Sun feast works on their pricing and costs so as to make the products availa- ble at economicalprices

**Joint Ventures**

- Many global and Indian companies are getting into joint ventures to makeglobal productsavailable in India.
- Starbucks and TATA Alliance is one of the largest joint ventures

- Bharti Enterprises and Delmonte Pacific Ltd is the largest fresh baby cornexporterin In- dia.

**Encouragement to private sector**

- 100 per cent export-oriented units allowed to sell up to 50 per cent of theirproduce in thedomestic market
- Export earnings exempt from corporate taxes

Tax incentives and other sops

- Import duty scrapped on capital goods and raw materials for 100 per centexport-oriented units
- 100 per cent tax exemption for five years, followed by 25 per cent taxexemp- tion for the nextfive years for new agro-processing industries
- Full excise duty exemption for goods that are used in installation of cold storagefacilities

**Focus on infrastructure**

- The sector has been assigned priority status for bank credit.
- 60 Agri Export Zones (AEZ) have been set up across the country
- According to Vision 2015 formulated by MOFPI, the government plans to establish 30 mega food parks in public-private partnership mode across the country; out of these, 10 have already been approved in the first phase

**Incentives for development of storage facilities**

- Investment-linked tax incentive of 100 per cent deduction of capital expenditurefor setting up and operating cold chain facilities (for specified products), and forsetting up and operating warehousingfacilities (for storage of agricultural produce)

**Relaxed FDI norms**

- 100 per cent FDI permitted under automatic route (except for alcohol, beer, andsec- tors reserved forsmall scale industries)
- Repatriation of capital and profits permitted

**Mega Food Parks**

- The scheme based on "Cluster" approach, which creates a well-defined agricul- ture/horticulturalprocessing zone with better support of infrastructureand well- established supply chain
- Aims at providing mechanisms to link agricultural production to the market bybringing

- farmers, processors and retailers together

- Out of 10 projects planned in phase 1, 9 have been given final approval. CCEAfur- ther approved 15new projects in 2011 by allocating USD0.4 billion

**Focus on R&D and modernization**

- The government launched initiatives such as for the Setting Up/Upgradation ofQuality Control/Food Testing Laboratory, R&D and Promotional Activity scheme and the Technology Upgradation/SettingUp/Modernisation/Expansionof Food Processing In- dustries Scheme

**National Mission on Food Processing**

- MOFPI launched a new Centrally Sponsored Scheme (CSS) National Mission on Food Processing topromote facilities for post-harvest operations, including setting up of food processing industries in India.

TECHNOLOGY IMPROVISATION

In Indian food processing technology, refinement of traditional equipment and processes for production of different foods, feeds, fibers and fuel materials for best quality, higher capacity, energyefficiency and reduced drudgery to workers have taken place steadily. The conventional dryers found throughout the food industry are spray dryers, freeze dryers, vacuum dryers, rotary dryers, fixed bed dryers, fluidised bed dryers, etc. The low temperature and better control in the heat pump assisted dries shows serval advantages over others. Over the past decade, advances in hardware and software for digital images processing have motivated serval studies in the development of these system to evaluate the quality of diverse and processed foods

.Computer vision has long been recognised as a potential technique for the guidance or control of agricultural and food processes.Traditionally, quality inspection of agricultural and food products has been performed by human graders. However, in most cases, these manual inspections are time-consuming and labor-intensive, tedious, repetitive and subjective task. Moreover, the accuracy of the tests cannot be guaranteed. It has been found by contrast that, the computer vision inspection of food products was more consistent efficient and cost effective.

**CONTROLLED ATMOSPHERE (CA) TECHNOLOGY**

For long-term storage of food grains: The chemical fumigation that is widely used for storage, although effective at an extent, is not environment friendly. As an alternative, a Pressure Swing Adsorption N2 generator was designed and established at IIT Bombay. This aids the creation of nitrogen and carbon dioxide-rich and oxygen-depleted atmosphere in a storage unit. Bag-stacked items such as, cereal grains, seeds and black tea have been successfully stored without any infestation, moisture pick-up and with superior qualitymaintains in terms of taste, colour and aroma.

## BIOTECHNOLOGY

Biotechnology is a systematic science which utilises the benefits of micro-organisms or componentsproduced by micro-organisms, in agricultural or industrial process.

There are evidences from history for usage of micro-organisms in food preparation preservation andtransformation of raw agricultural commodities into edible products for human consumption. Biotechnology is a combination of diverse technologies that can be applied in different food and agriculture sectors. It includes technologies such as gene modification (manipulation) and transfer to achieve desired characteristics in plants, development of recombinant vaccines and DNA-based methods of disease characterisation/diagnosis. Biotechnology can be utilised in reproductive techniques like in-vitro vegetative propagation, embryo transfer etc. for increased production. The science and art of biotechnology can be utilised in plant and animal origin food products to achievehigher yields. This area requires relatively more focused research to achieve the goal of food security in developing countries. There are cases of development of transgenic plants with commercially useful traits such as resistance to herbicides, insects and viruses. In the year 1990s transgenic plantswere approved by regulatory agencies in the USA for commercial use after evaluation and testing, thereafter, the commercial production of transgenic plants as genetically modified (GM) crops started in the USA. The research must ensure the food safety and lethality aspect for usage of such bioengineered crops. The bioengineered crops require less usage of pesticide and in turn result in reduce cost to farmer, crop protection and benefit both environment and public health. GE helps to achieve better productivity by providing grains with increased yields and reduced inputs costs, which is required to feed a growing global population, introduce resistance to pests and disease without high cost purchased inputs, increased crop's tolerance to adverse weather and soil conditions, improve the nutritional aspects of some foods and enhance the durability of products during harvesting or shipping.

The application of molecular biology-based science to agriculture has been focused mainly on large farm in developed countries An area of concern in exploitation of biologicalscience in agriculture is with regard to Intellectual Property Rights (IPRs) and the allocation of benefits between developed and developing countries' farmers and Agribusiness Corporation that provide the GM seeds. However, there are questions and concerns regarding health impacts especially related to the role of allergens in crop biotechnology. An alternative approach with enhanced policy initiatives all around the world for better investments in agricultural biotechnological research is required. Further, there are instances of opposition to GM food in some countries like India, resulting in serve setback to the research in agricultural sector. Also, it may be important to understand the implications due to over use of such technologies and their hazardous impact, if any to living organism.

There should be motivation for private sector to develop technologies for poor people by offering to buy exclusive right to newly developed technology and make it available either for free or for a nominal charge to small farmers. A more comprehensive public and private sector involvement can lead to research. This can beachieved by converting some social advantages to the private gains.

## NANOTECHNOLOGY

Nanotechnology is a new subset of science, dealing with nanoparticles which are of the tenth magnitude. Nanotechnology is not yet widely exploited to achieve food security. However, it is progressing rapidly by usage of interdisciplinary research. Nanotechnology is the science which helps scientist to understand the structure at molecular level and relate the same to microscopic level. This technology has the potential to improve the efficiency of crop production, improve food processing and food safety, minimise environmental impact of crop production and food products andin crease storage and distribution capabilities. Nanotechnology can be applied in agricultural food system for reproductive methods for conversion of agricultural and food wastes to energy and other useful by- products using enzymatic Nano- bio processing, disease prevention and health protection of plants and animals. The combination of nanotechnology with available technology like genomic and micro- electronics can be utilised in development diagnostic kits to detect and monitor the spread of plant and animal diseases. Nanotechnology can be utilised in the area of packaging and storage to increase the shelf life. However, it is equally important to establish the safety aspect while exploiting any of these technologies .Some of the plastic wraps can be developed to prevent food from spoiling by inhibiting the growth of bacteria and even edible coating can be developed using nanotechnology application .

## INFORMATION TECHNOLOGY

IT can be utilised as a strategic tool for agricultural development and welfare especially in rural India. The potential of IT can be explored for direct contribution to agricultural productivity by empowering farmers to take relevant information and timely quality decision which will have positive impact on the agriculture and allied activities. Precision farming extensively uses IT to make direct contribution to agricultural productivity. Other techniques such as remote sensing using satellite technologies, GISand agronomy, soil science help to increase the agricultural output. These techniques provide useful information where large scale agriculture production is practiced .With the advent of corporate in agricultural retail sector these technologies are explored to the benefits of retailers. Agricultural production in India is primarily at small scale farms owned by small farmers generally less than 1 acre. Mobile enable information sharing will be useful for India as it provides timely and reliable sources of information for decisions making to individual farm owners. At present, the farmer depends on trickling down of decision inputs from conventional sources which are slow and unreliable. The changing environment faced by Indians farmers makes information not only useful, but necessary to remain competitive. Consideration must be given to generating investment in IT and communications in the developing countries including India and parts of African countries so farmers can gain benefits of communicationand technology.

## METREOLOGICAL ADVANCEMENT

The biggest threat to food security comes from the current imbalances caused by the climate change. With every 1ºC increase in temperature, there is an estimated decreasein crop production by 5%. Technology, including computers, advanced radars and the weather satellites, are keys to collecting data needed for weather forecasting for decision making. The correct weather forecasting helps the farmers to sow the seeds and harvest the plants at right time and locations.

DIGITAL TECHNOLOGIES IN AGRI-FOODSYSTEMS

Digital transformation has the potential to deliver significant economic, social and environmental benefits. The following examples demonstrate how digital technologiescan be applied to improve the efficiency and functioning of agrifood systems:

- The use of mobile applications providing price information to farmers can re- duce market distortions and help farmers to plan production processes. For ex- ample, the M-Farm application in Kenya led to farmers changing their cropping patterns and some reported receiving higher prices at market as a result (Bau- müller, 2015).
- Agricultural robots (‘agro bots’) are seen as a key trend that will deeply influ- ence agriculture in the future. Field agro bots are already being deployed to help farmers measure, map and optimize water and irrigation use. Fleets of small lightweight robots are now seen as a replacement for traditional high masstrac- tors, allowing a gradual reduction of compaction, re- aeration of the soil and benefits to soil function.
- Technologies can also support farmers to anticipate and respond to pest at- tacks, crop failures and climatic changes through timely weather-based agro- advisory messages.
- Precision Agriculture (PA) is an example of an application of the Internet of Things (IoT) in agriculture. The use of Guidance Systems during planting and fertilizer application can lead to cost savings in terms of seed, fertilizer and tractor fuel, and can reduce working hours in the field. Variable Rate Technol- ogies (VRT) and drones (UAV) can also reduce water and pesticide use and re- duce labour and resource costs.
- The importance of ERP software in agriculture is high, as it has the potential to- help streamlineevery process, from procurement to production to and distribu- tion. ERP can enable a farm (or related business) to respond more organically to environmental challenges, adjust systems accordingly, and grow into more cost-efficient businesses.
- Over the last few years, the growth in Artificial Intelligence technology (AI) has strengthened agro- based businesses to run more efficiently. Companies that use AI help farmers to scan theirfields and monitor every stage of the production cy- cle. AI technology is transforming the agricultural sector, as farmers can depend on the data that satellite or UAV record to determinethe state of the farm rather than walking all the distance. AI can improve resource use, support early deci- sion making through predictive models and maintain 24/7 monitoring systems.

## EXAMPLE OF DIGITAL TECHNOLOGY

### 1- EMA-I App Animal Health System Support by FAO

EMA-I is an early warning app developed by FAO to facilitate quality and real time livestock disease reporting captured by animal health workers in the field. EMA-i is integrated in the FAO’s Global Animal Disease Information System (EMPRES-i) where data are safely stored and used by countries. EMA-i is easily adaptable to countries existing livestock disease reporting system. By supporting surveillance and real time reporting capacities at country level and improving communication between stakeholders,

EMA-i contributes to enhance early warning and response to animal disease occurrence with high impact to food security and livelihood. EMA-i is currently used in six countries in Africa (Cote d'Ivoire, Ghana, Guinea, Lesotho, Tanzania and Zimbabwe).

**2- Dino Agrobot For Agriculture And Viticulture**

The Nano Technologies team developed agricultural robot to improve working conditions and profitability for farmers. To help farmers tackle the increasing regulations on phyto sanitary products, the growing concerns withpesticides, and the lack of workers in the agricultural sector, Dino provides a new and effective solution. The Dino weeding robot allows vegetable farmers to manage crop weeding with a high level of precision, while helping them save time all through the season. Dino is highly effective to weed vegetables that are grown in the field, both in raisedvegetable beds and in rows, such as lettuce, carrots, onions, etc.

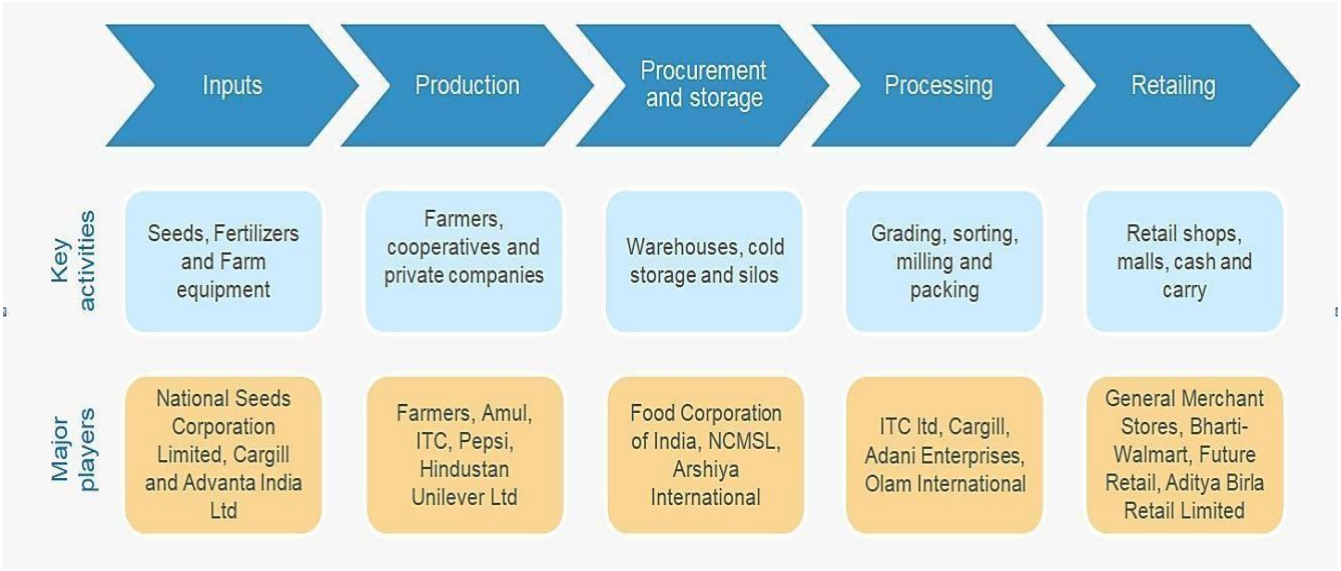



Fig 10: value chain in food processing sector & key players

MYCROP COMPLETE FARM AND FARMER MANAGEMENT SYSTEM

My Crop a technology-enabled initiative for farmers, which empowers them through delivering information, expertise and resources, to increase productivity and profitability, hence improving standard of living. It is a collaborative platform that strives to combine cutting edge technology (Big Data, machine learning, smartphones/tablets, etc.), innovative business model (agriculture platform as a service), and focused human efforts (agriculture insights, products, and services) to serve smallholder farmers. My Crop facilitates farmers in taking and executing optimum decisions by providing geo- mapping, crop planning, individual farm plans and farm automation customized for each farmer based on weather, soil, pest and crop data on an almost real-time basis. My Crop is a sustainable data- driven, scalable, intelligent, self-learning, real-time collaborative Agrifood system, which serves as a farm as well as farmer management solution.

VALUE CHAIN IN FOOD PROCESSING SECTOR AND KEY PLAYERS

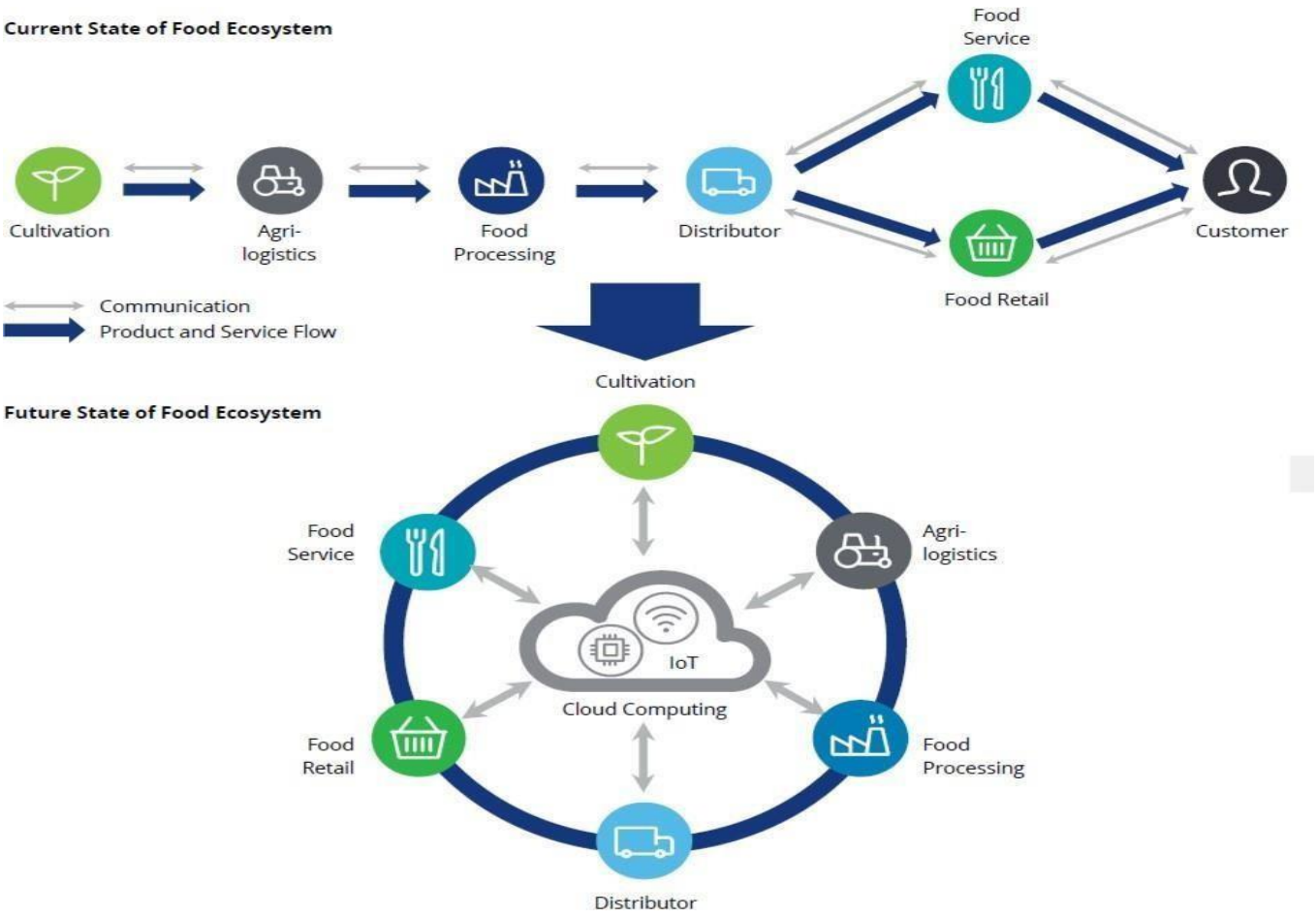



Fig 11− current state of food ecosystem

## 5. CONCLUSION

The Food Processing Industry sector in India is one of the largest in terms of production, consumption, export and growth prospects. The government has accordedit a high priority, with a number of fiscal reliefs and incentives, to encourage commercialization and value addition to agricultural produce. This sector is having ample sector to prosper in future years ahead. These sector could be a good potential for the Company Secretary professionals who wants to start their own enterprises.

in spite of the problems, agro-processing technology in India has continued to make steady progress towards modernization. For future growth, new initiatives need to be called for. The main focus should be directed towards minimizing pre and post-harvestwastage, employment generation and export growth. Furthermore, there is a need in the growth of accurate, fast methodologies of food processing technologies for the ever increasing population and the increased expectation of food products of high-quality standards.It has been noticed in the study that plenty of good research is being carried out in biotechnological area and IT; however the same is not available at the point of use. One of the ways to achieve effective information update is through mobile application. It is recommended thatmore user-friendly ways to implement these researches may be explored in future research.A reinvention of the

global food security system is recommended. The research and development activities should be shared globally in order to avoid drainage of resources in reinventing the same technology. This paper recommends that involvement of Public Private Partnership in research, production practices and supplycan provide solutions to the increasing concern on food security globally. New policies and incentives should be available for investment in this sector.

The important areas identified from the study where technological research needs to be focused include:

- crop improvement by development of new and better quality of seeds and agricultureextension facility.
- usage of water and fertilizers which are low cost and environment-friendly
- crop protection and effective management to avoid resistance prob- lems by use of biodegradable ways
- sustainable livestock farming and aquaculture with improved veteri- nary drugs usagepractices
- Reduction of post- harvest losses at storage and distribution.
- coordinated information sharing among the various stakeholder of the food chain
- Effective strategies to communicate risk and reduce the gaps created by de- layed access toinformation

**WEBLIOGRAPGHY**

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