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Bridging the Skill Gap in the Indian Food Processing Sector: A Review

Preeti Dixit and R. Ravichandran*

Department of Humanities, Science, Education and Research, PSS Central Institute of Vocational Education, Bhopal – 462002, Madhya Pradesh, India; ravincert@gmail.com

Abstract

India has become one of the fastest growing economies in the world today, with a growth rate of 7.2% on an annual basis. The GDP growth rate for 2021 was recorded at 8.95%, indicating a significant increase of 15.54% from 2020. The food processing sector has contributed to this growth significantly as India is one of the world's largest producers of rice, wheat, milk, pulses, a variety of fruits and vegetables. The food processing sector witnessed growth of 11.8% CAGR during 2015-16 to 2018-19 and is currently embracing automation, mechanization and technology to boost production and optimize resource utilisation. The changing face of the industry calls for a number of technical and specialised skills. The Food Processing Industry is predicted to create approximately 44.34 million new jobs by 2022, largely in entry-level and supervisory positions. However, the Food Processing Industry will face a substantial challenge as a result of the industrial revolution. Currently, the agri-food processing sector employs approximately 44% of the workforce, with the majority of workers lacking any formal or informal skill training. As a result, they are unable to make the most of their job. This presents both a challenge and an opportunity to skill the fresher as well as the existing workforce in India with the goal of increasing production and income. Addressing the existing skill gaps between the labour force and industrial demands is essential if the food processing sector is to realise its full potential. In this review, we offer an overview of the food processing industry, employment generation capacities, and skill gaps existing in the Indian food processing industry. The review also presents literature on the major skilling initiatives and strategies for bridging the skill gap in the food processing industry.

Keywords: Food Industry, Food Processing, Government Policies, Skilling, Skill Gap, Skill India, Vocational Education, Workforce

1. Introduction

Food processing is the set of approaches and procedures used to convert food from its original form into another form that can be consumed by people or animals at home or by businesses in the food processing sector[1,2]. Food processing typically transforms clean, harvested crops into appealing, marketable and often long-lasting food products. Food processing benefits include food preservation, marketing and distribution, as well as protection from hazardous and pathogenic chemicals, year-round availability of many foods and consumer-friendly preparation.

Food processing is divided into two major categories: primary and secondary processing. Primary processing includes conversion of food crops or raw materials into food commodities, such as cleaning, sorting, milling etc[3]. Secondary food processing involves further processing of food ingredients which are primary processed[4]. The classic example includes preparation of instant cake mixes from flour, juices and jam from primarily processed fruits, ketchup from tomato and so on. Similarly, the

*Author for correspondence

Food Processing Industry is the location where all food processing activities take place; it can be a large-scale industry or a small-scale home-based industry[5].

India has the potential to become the world's food basket with adequate investment in food processing, technological innovation, and agricultural infrastructure[6]. The dairy sector holds the highest share of about 35% of total produce that is processed, only 15% is processed by the organised sector[7]. The processing level is around 2.2% in case of fruits and vegetables and 21% in meat and poultry products. For agricultural operations to be more diverse, chances for value addition to increase and surplus to be created for exporting agro-food products, a strong and thriving food processing sector is necessary[8].

Food processing ensures reduction of food wastage, nutritional enhancement of foods, crop diversification, better incentives to the farmers, employment opportunities as well as increased export earnings[9]. It is generally acknowledged that the Food Processing Industry is the best sector for giving the rural poor access to employment opportunities, relieving pressure off the agriculture sector to provide their means of subsistence. This is because they are more accustomed to the agriculture industry, which would make it simpler to train and hire them for food processing businesses. Investment in the food processing sector has a greater multiplier effect on job creation than in any other industry[10].

Food Processing Industry of India is one of the most fragmented segments and dominated by unorganised sector. Around 42% of the manufacturing is done by the unorganised sector, 25% by the organised sector and the remaining 35% by local and small businesses shareholders. Although the unorganised component varies among categories, it still makes up about 75% of the market. In comparison to the primary processing segment, the organised sector is significantly larger in the secondary processing segment.

India's consumption patterns are changing as a result of rising urbanisation, an increased focus on nutrition growth of working women, single students and professionals, and nuclear families. The development of organised retails, makes processed food easily accessible[10].

In the light of above-mentioned facts, this paper presents the overview of the Indian food processing industry, employment generation opportunities and highlights skill gaps in Indian food processing industry. The major challenges and underlying opportunities with government initiatives to promote skill development in food processing sector are also covered in this paper. The paper also suggests vital strategies for bridging the existing skill gaps in food processing.

2. Overview of the Indian Food Processing Industry

India experienced rapid growth in the food-processing sector following independence. Further Green Revolution increased agricultural output and emphasized the need for post-harvest management[11]. The manufacturers recognised the economic potential of the food processing sector and started expanding its area from only rice processing to other sectors such as wheat milling, the milk and milk products processing industry, sugarcane processing and oil extraction[12]. Key achievement of Indian food processing and production industry are shown in

The White Revolution transformed the country from a milk deficient nation to a world largest producer in milk production. This was accomplished as a result of favourable policies and an institutional network that has assisted millions of rural households in pursuing their livelihoods through small-scale dairy farming[13]. Millions of rural people now rely heavily on dairy farming as a secondary source of income and it now plays a crucial role in creating employment opportunities for women and small-scale farmers in particular. In 2018–19, the per capita availability of milk increased to 394 grammes per day, which is higher than the global average of 301.6 grammes per day in 2019. Small, marginal farmers and landless labourers generate the majority of the nation's milk. The organised dairy sector collects and processes about one-fifth of all milk produced. However, the Indian milk herd's full potential has yet to be realised and there is room for diversification and growth. As of 2018, India was the world's leading milk producer, accounting for 23% of the global market share. In 2018-19, India's total milk production was 187.74 MMT. During the fiscal year 2018-19, India exported 1,13,721.7046 MT of dairy products to the world, valued at INR 2,422.8547 crores ($ 345.71 Mn). Between FY 2018 and FY 2023, the milk processing industry is expected to grow at a 14.8% annual rate, reaching INR 2,458.7 Bn ($ 32.57 Bn) in FY 2023[14].

India is now the second largest producer of fruits and vegetables and accounts for about 15% of the world's total production. The nation is the second-biggest producer of potatoes, onions, brinjal, cauliflower and cabbage and the largest producer of ginger and okra. In 2020–21, horticulture crops generated 329.86 million tonnes, an increase of 2.05% from the previous year and 8.5% from the preceding five years, even though only 17% of arable land is used for their cultivation (27.2 million ha). Vegetable output totaled 196.27 million MT with an average productivity of 17.11 MT/ha, while fruit production totaled 102.76 million MT with a productivity of 14.51 MT/ha[15]. Additionally, India is the world's top producer of fruits including mangoes (40.4%), papayas (43.6%) and bananas (25.7%). Statistics for 2018–19 show that the fruit and vegetable sector in India exported goods worth INR 10,236.93 crores ($1,469.33 Mn)[16].

Furthermore, India is a major producer of rice, wheat, potato, sugar, cashew nuts and other commodities. Aside from food, India produces a lot of spices coffee and tobacco every year. In 2020–21, the nation produced 10.5 MMT of spices, with the main contributors being garlic, chilies, ginger and turmeric. India produces a variety of spices, with Madhya Pradesh being the country's top producer of ginger, garlic, fenugreek and coriander, along with Rajasthan, Gujarat, Andhra Pradesh, Telangana and Karnataka. In the fiscal year 2020–21, these six states produced over 75% of India's total spice production. Spices export from India has continued its upward trend during 2020-21 and has attained an all-time high of US $ 4.0 billion mark for the first time in the history of spices export despite Pandemic situation[17,18].

India is leading player in egg production with production of 122.11 bn nos. in 2020-21 with per capita availability of egg at 91 eggs per annum[19].

The pandemic accelerated a significant shift in food habits which instigated tremendous development in the food services sector. The food processing sector witnessed growth of 11.8% CAGR during 2015-16 to 2018-19. In 2018-19, the sector was estimated at INR 4,23,865 crore (USD 56.11 Bn) and is projected to reach INR 5,99,78454 crores (USD 79.40 Bn) at a CAGR of 9% by 2022-23[9]. An overview on the production indices is presented in Table 1.

Figure 1. Key achievements of Indian Food Processing Industry.

Table 1. Share of major segments in the Food Processing Industry

Segment	Production in Million Metric Tons (MMT)
Fruits and Vegetables	290.36 (2019-20)
Milk	198.4 (2019-20)
Eggs	122.11
Marine Products	14.7
Grain (cereals and pulses)	310.7 (crop year July-June 2020/21)
Beverages	Aerated soft drinks: 2,659 million liters (2018)
	Packaged drinking water: 8,305.9 million liters

The value of agri-food exports including processed food exports during 2020-21 was of the order of US $ 38.32 Billion accounting for about 13.2% of India's total exports (total exports US $ 291.17 Billion). The share of India's agri-food exports in the world was 2.31% in 2020 and the share of India's agrifood imports in the world was 1.31% in 2020[9].

3. Employment Generation Opportunities in Food Processing Sector of India

The Food Processing Industry employs roughly 13 million people directly and 35 million people indirectly and contributes about 14% of the manufacturing GDP or 2,80,000 crores. Its employment intensity is demonstrated by the fact that, for every 1 million Rs. spent, the organised Food Processing Industry alone generates 18 direct jobs and 64 indirect jobs[20]. According to the Annual Survey of Industries (ASI) 2018-19, total output in India's registered manufacturing sector was Rs.12,76,995 crore, accounting for 12.83% of total output. In 2019-20, the food processing sector generated Rs.2.24 lakh crore in GVA, accounting for 1.69% of total GVA in the country. GVA in the food processing sector was 9.87% of GVA in manufacturing and 11.38% of GVA in agriculture, forestry and fishing[16,20 21].

Processing sector of food engages maximum number of people with 20.05 lakhs accounting for 12.32% of the total employment share in the country[22]. According to the NSSO 73 round, 2015-16, the unregistered food processing sector employs 51.11 lakh people and accounts for 14.18% of employment in the unregistered manufacturing sector as shown below in Table 2[23]. By 2022, the Food

Table 2. Employment in Food Processing Industry[9]

Sector	Food Processing Industry*	Overall Industry	(%) Share of Food Processing Sector
Registered (2018-19)#	20.05 lakh	162.80	12.32
Un-incorporated (2015-16) **	51.11 lakh	360.41	14.18

**Source: MOFPI, Annual report 2021-22*

Processing Industry is expected to generate about 44.34 lakh new jobs, primarily entry-level and supervisory profiles.

The demand for processed food items are significantly increasing with the increased population and thus more Food Processing Industries (FPI) are needed to meet the demand. As per the Annual Survey of India (ASI) and data presented by the Ministry of Food Processing there are around 40579 registered processing industries across India. Creating FPIs in rural India offers a large number of resources in one location as well as affordable labour. Thus, to promote the food processing industries and food parks, the Government of India allocated a fund totaling Rs. 2000 crore through NABARD in 2014 and 2015[24]. Indian farmers would be able to sell their produce to the industry directly with the aid of the food processing industries for increased output.

The need for new skill development and up-skilling in the industry is being driven by industry growth, together with consumer demand for quality standards and industrial technology adoption. The majority of the increase in employment in the industry from 2013 to 22 is attributed to packaged foods, grains and oilseeds. Lower labour elasticity of 0.3-0.4 between 2013 and 22 is anticipated as a result of technological advancements in processing sector categories including meat and beverages. In terms of NSQF categorization, Level 4, 5 and 6 supervisory and technician occupations are predicted to see a significant need for labour from 2013 to 22. Due to the increasing adoption of technology and automation, enforcement of quality standards and the emphasis on exports, techno-quality is another area that will be in demand.

4. Skill Gaps in Indian Food Processing Industry

Every year India adds to 12 million to its workforce[25], however presently only 3.05% of the total workforce in India has undergone formal skills training[26]. By 2022, the country is predicted to have a higher demand-supply mismatch due to the need for an additional 109 million qualified people in the 24 important sectors of the economy[27]. Given the fragmented supply side, the demand for skilled labour in the nation has expanded significantly over the past 10 years, resulting in widening inequalities. The human resource requirement in the agriculture and food processing sectors is estimated to be about 24.5% and 33.7% of the total requirement in 2022 (Table 3), with an increment of 6%[28].

A number of critical skill gaps exist in various stages of the Indian food processing value chain that need to be addressed. Some of the major gaps are:

Table 3. Human resource requirement and incremental training needs[29]

	Human Resource Requirement (million)		**Incremental Human Resources and Training need (million)**
Sector	2017	2022	(2017- 2022)
Agriculture	229	215.5	4.3
Food Processing	8.8	11.6	2.8
Total (Human resource requirement across the sectors)	510.8	614.2	103.4

4.1 Technical Know-how

As discussed earlier, Food Processing Industry is majorly composed of unorganized sector. Unorganized sector relies or engages local workforce. The local workforce is generally lacking in technical know-how in basic hygiene and sanitary practices, storage of raw ingredients, food safety, product development, operational skills etc. The Food Processing Industry is in need of skilled personnel acquainted and trained in basic concepts implemented in the sector. Maintaining food quality and food safety is becoming another critical domain, which demand manpower equipped with knowledge of food safety legislations and regulatory authorities due to enforcing of quality parameters and focus on exports.

4.2 Adaptation of Emerging Technology and Industry 4.0

The rising digitalization brought on by industry 4.0 is causing significant changes in the food industry. The dynamics of the food sector are changing as a result of smart technology, necessitating more automation. The industry may now attain optimal, dependable and efficient processes, services and products thanks to the new automation phase, but it also needs new professional skills from its workforce. As a result, it's critical to pinpoint the industry's future skill needs as well as the skills gaps between the present workforce and what the industry requires[30]. In recent years, 3D printing, edible packaging and many other emerging technologies are entering the market and requires well trained and skilled professionals in the field. Similarly, the industry has felt the growing need of technical specialist who are capable of working on imported machines in specific sub-segments.

4.3 Interpersonal and Green Skills

The demand for managerial, communication and organisational skills has increased significantly[32,33]. Trained front end staff is needed for customer relationship management, building customer trust in brand and popularization of any products. As industrial processes become more automated and digitalized in the next years, the workforce will be accountable for more complex duties. Numeracy, strong literacy, problem-solving abilities, Information and Communication Technologies (ICT) skills, as well as soft skills of autonomy, teamwork, and coordination, will be needed to complete those jobs[34]. The rising emphasis on environmental awareness and sustainability has led to a perception that green skills are essential for maintaining the competitive edge of the manufacturing sector.

4.4 Supply Chain

Farm procurement is an important area for processing units and need to streamline their raw materials' supply

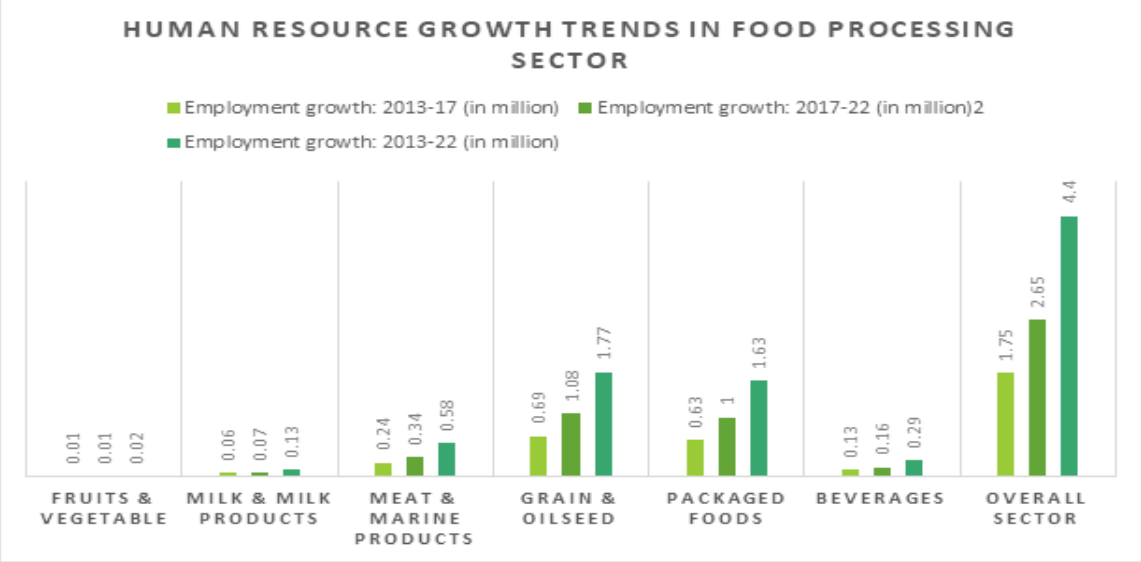

Figure 2. Human resource growth trends in food processing sector.

for the rising demand. At a farm level, the growers are poorly equipped and lack awareness of implementing the best practices for growing. This is where the need for procurement staff to be proactively engaged in crop/production advisory is missing[35].

A NSDC Survey found that there is a significant need for trained personnel in all sectors of the Food Processing Industry (Figure 2), particularly for individuals with short-term course training and education levels below the 10^{th}/12^{th} standard[35]. Majority of workforce engaged in Food Processing Industry have low level of education and poor skills set, posing a big challenge in harnessing the full potential of workers thus causing stagnation of the industry. This gap must be filled as soon as feasible to establish India on the global market. There is a significant mismatch between market supply and demand.

5. Challenges in Food Processing Industry

Major challenges in the food industry across the country include a lack of raw materials, poor quality delivery, a lack of a consistent supply of seasonal raw materials, an inadequately trained labour force, expensive imported packing material, infrastructure and operational inadequacies[35,36]. According to the FICCI survey, inadequate infrastructural facilities, comprehensive national level policy on food processing sector, ambiguous food safety laws, unavailability of trained man power, inconsistency in central and state government policies are key challenges in food processing sector[37]. Six key challenges in the Food Processing Industry as identified by MOFPI are discussed below:

5.1 Gaps in Supply Chain

The biggest hurdle in expanding the food processing sector is inadequate infrastructure during various stages of supply chain including long and fragmented supply chain, inadequate cold storage and warehouses, transportation infrastructure (road, rail and port)[35,38]. Despite India being one of the largest producers of many crops, non-availability of raw materials, poor supply quality and inadequate maintenance of quality in supply chain are challenges facing large food processing enterprises[39].

5.2 Inadequate Linkages between Production and Processing

Effective backward forward and sideways linkages among groups of producers/farmers, the food processors and consumer/markets through well-equipped supply chain is absent in Indian food processing industry[40,41]. This is one of the major causes for post-harvest losses at several stages of food processing. Storage capacity linking consumption centers, farmers and customer interactive platforms needs to be established to harness the full potential of the agri-food industry[42].

5.3 Seasonality of Operations and Low-capacity Utilisations

The raw materials used in the food manufacturing industry are seasonal and labor-intensive. Agricultural seasonality causes substantial changes in the food processing industry[43,44]. Due to the limited food supply (from far-flung, rural locations), which causes food prices to rise and negative dietary and nutritional modifications, the seasonality of operations may also expand to metropolitan areas. Underutilization of human and other resources is another factor that is resulting in low productivity and slowdown in industrial growth[44].

5.4 Institutional Gaps in Supply Chain, *viz.* Dependence on APMC Markets

The APMC market is plagued by weak market infrastructure, leaving farmers with no choice but to sell to intermediaries. More produce is frequently sold outside of the markets in larger quantities. Farmers cannot afford the logistics costs for domestic producers. In order to get MSP, farmers are required to sell their agricultural products only to licensed members of Agricultural Produce and Livestock Market Committees (APMCs). As a result, the free flow of agricultural products was hampered and markets and the supply chain were fragmented. Furthermore, no other industrial producer entity had such a restriction on sales. There are numerous further obstacles including difficult interstate trade and a lack of e-trading regulations.

5.5 Inadequate Focus on Quality and Safety Standards

Consumers anticipate safety against risks that arise at every stage of the food supply chain, from the primary producer to the consumer (often described as the farm-to-table continuum)[45]. Food safety practices with implementation of ISO certification, HACCP (Hazard Analysis and Critical Control Points), TQM (Total Quality Management), GMP (Good Manufacturing Practices), GHP (Good Hygienic Practices), FSSAI (Food Safety and Standards Authority of India) etc. are existing in Indian food industry. However, being the major portion of the industry in unorganized sector, focus on food safety and quality is lacking on a major scale.

5.6 Lack of Product Development and Innovation

The Food Processing Industry in India is incredibly diverse and offers opportunity to all sectors. The key factors influencing the food industry include rising consumer expectations, different lifestyles, shifting preferences and more informed consumers in the internet age who want to learn about new products on the market. The need for innovativeness in food products is not meeting the consumers' expectations due to strong price competition, lack of infrastructure and resources, domination of established market players, and uncertain demand for innovative products in the market. The other barriers at distribution level of the supply chain include high cost of modern transportation facilities, low return, inadequate IT support and communication, high cost of packaging, limited domestic market[45].

6. Opportunities in Food Processing Industry

The Indian Food Processing Industry has enormous growth potential, which has the potential to enhance the socioeconomic situations of the rural population.

6.1 Diverse Agri-climatic Conditions and Strong Production Bases

India ranks second in the world in terms of arable land having advantage of a wide variety of climatic conditions. India has the chance to grow a range of crops simultaneously, including grains, fruits, vegetables, herbs, etc. Due to this climatic diversity, India is one of the largest producers of dairy products, banana, guava, papaya, mango, etc., and ranks second in the world for rice, wheat and some millets. The manufacturers of the country have the access to sufficient supply of raw materials to invest in the Food Processing Industry and for domestic consumption[46].

6.2 Demographic Favorability

India, the youngest country in the world, may benefit from its demographic dividend if it trains its ready-to-recruit cohort in skills. There are several technical and specialised skills that the food processing sector requires. The higher the quality of human resources, the better the performance. Numerous studies have argued that educated, trained and competent people resources play key roles in the success of an organisation. The country's large population (which is growing by 1.3% annually), with a rise in disposable incomes creates a big market and potential for India and even for other countries to sell and buy processed food items[46].

6.3 Foreign Direct Investment in Food Processing Sector

FDI is an international financial flow made with the purpose of controlling or contributing in the management of a foreign firm. India, the second-most populous nation in the world, has tremendous potential for retail growth since urbanisation and consumerism have both been rising over time[47]. The government has implemented a liberal and transparent strategy for attracting Foreign Direct Investment (FDI), with the majority of sectors available to FDI via the automatic route. The goal is to remove the policy barriers preventing investment inflows into the nation and make the FDI policy more supportive of investors. In the area of food processing, 100% FDI is allowed via the automated route, while in the retail trade of food goods made and/or produced in India, 100% FDI is permitted via the government-approved route[48]. The details of year-wise FDI inflow from April 2015 to March 2022 is presented in Figure 4.

From the year 2000 to 2016 the estimated FDI was around USD 7.5 Billion and this was equal to the share

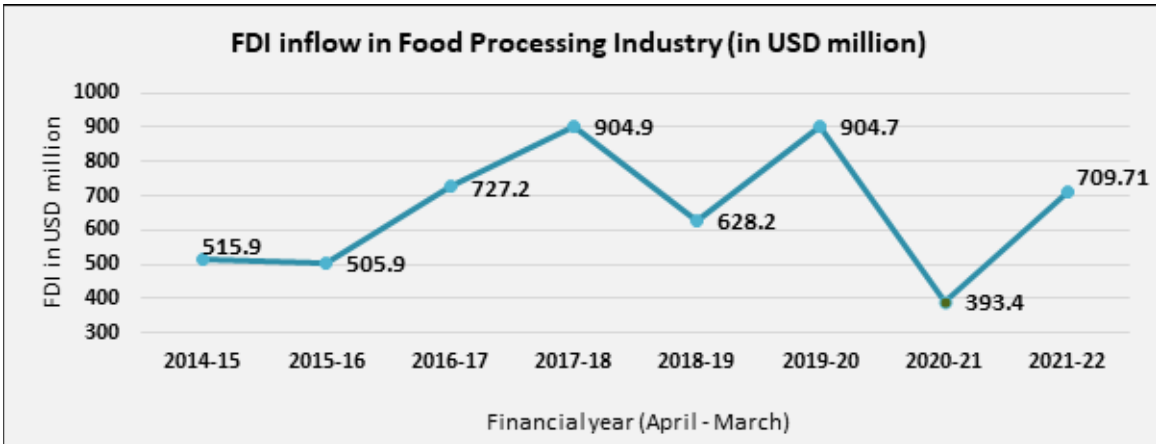

Figure 4. FDI inflow in Food Processing Industry (in USD million).

of India (2.3%) at global level. From 2000 to 2020 highest amount of investment was made in the year 2013-14 i.e., USD 3982. The sector has witnessed FDI equity inflow of USD 4.99 billion during April 2014 to September 2021[49]. Over the years, India has been able to attract investment from food and beverages companies like Nestle, Cargill, McCain, Mondelez, Pepsi, Coco cola etc., and also from retail trade companies like Amazon, Walmart, etc. In 2018, Mondolez International invested US$15 million in India for research after investing US $190 million in a green field project in Andhra Pradesh[20,50].

6.4 Increasing Urbanization and Changing Lifestyle

Food Processing Industry in India has grown at a quick pace during the last decade or so and this trend is expected to continue in the near future. The evolution of the food processing paralleled the rise of the large Indian middle class, a byproduct of liberalisation. Rapid urbanisation, technological advancement, industrialization, influences of western lifestyles, more women entering the workforce and higher disposable money are some of the factors which will contribute to the expansion of food processing industry. This would call for higher utilization of agricultural production as well as significant changes in food delivery and marketing[51]. This also implies a shift in food system employment, with fewer people working in agriculture and more working in transportation, wholesale, retailing, food processing, and vending[52].

6.5 Demand for Functional Foods and Nutraceuticals Foods

The increasing prevalence of diabetes, obesity, thyroid disorders, Coronary Heart Disease (CVD) and other lifestyle diseases has resulted in an increase in the consumption of nutraceuticals and dietary supplements across India. According to the World Health Organization (WHO), around 2.26 million adults died in India in 2020 as a result of CVD, with nearly 4.77 million persons diagnosed. Dietary factors have a substantial impact on the start, progression, morbidity and fatality from chronic illnesses. Dietary inadequacies cause 40-50% of cardiovascular problems, 35-50% of cancers and 20% of osteoporosis occurrences. To avert such a crisis, India has shifted its focus to the usage of vitamins and nutraceuticals. With a global market share of only 1% to 2%, India has a lot of space to grow on global platform. During the Covid-19 pandemic, the market for functional foods and nutraceuticals skyrocketed. The country has access to a vast array of medicinal plants, resulting in a wide spectrum of indigenous components for usage in nutraceuticals. Ayurveda and other traditional medicines accessible in India are in high demand due to their use for a variety of health advantages at reasonable prices around the world. The Union Budget 2021 included a 137% increase in healthcare funds to $30 billion for investments in nutraceutical supplements. Nutritional and herbal supplements are predicted to have comparable market sales in the future, accounting for half of total market revenue[53].

7. Government Initiatives to Promote Skill Development in Food Processing Sector

Food Processing Industry offers an opportunity to reduce dependence on agriculture in the rural areas as the main employment generating sector. Given the difficulties this industry faces, the government has undertaken a number of initiatives to support it. As a result, efforts have been made to improve quality standards, expand access to formal credit, particularly for small and medium-sized businesses and increase the supply of skilled workers in the labour market. The following are some of the main actions the Indian government has done to develop the country's food processing industry:

7.1 National Mission on Food Processing

In April 2012, the Ministry of Food Processing unveiled a programme dubbed the National Mission on Food Processing, which was funded by the federal government and will be implemented by States and UTs. The programme aimed to expand India's food processing industries while also overseeing and keeping an eye on those that already existed. The mission is anticipated to greatly increase the Ministry's reach in terms of planning, supervising and monitoring different initiatives in addition to playing a more major role in policy creation. The NMFP ensures decentralisation of food processing-related programme implementation for significant State Government/UT participation.

The Indian government established a $1.2 billion (Rs 8,000 crore) dairy processing infrastructure fund in the Union Budget 2017–18. The Indian government has relaxed the rules for Foreign Direct Investment (FDI) in the industry, allowing up to 100% FDI through an automatic route in the e-commerce of food products[54]. The Food Safety and Standards Authority of India (FSSAI) plans to invest around Rs 482 crore (US$ 72.3 million) to strengthen the food testing infrastructure in India, by upgrading 59 existing food testing laboratories and setting up 62 new mobile testing labs across the country. The Indian Council for Fertilizer and Nutrient Research (ICFNR) will adopt international best practices for research in fertiliser sector, which will enable farmers to get good quality fertilisers at affordable rates and thereby achieve food security for the common man[55].

7.2 Pradhan Mantri Kisan Sampada Yojana (PMKSY)

PM Kisan Sampada Yojana is an umbrella programme that includes a number of active programmes. This programme encouraged business owners to build food processing facilities adjacent to agricultural areas. Grants under the programme may be used to develop cold storage facilities, specialty packaging units, warehousing facilities, etc. as well as other preservation facilities[56]. In most states, the scheme offers grants equal to 35% of qualifying project costs, while in states in the North-east and Himalayan regions, grants equal to 50% of eligible project costs. Investors, business owners, farmers, farmer organisations, and agriculture cooperatives are to gain from the development of agricultural facilities under the programme.

7.2.1 Creation of Mega Food Parks

This scheme strives to provide a framework that connects agricultural production to the market by bringing together producers, processors and retailers to maximise value addition, reduce waste, increase farmers' income and provide job possibilities, particularly in the rural sector. A Mega Food Park has a minimum area of 50 acres and employs a hub-and-spoke clustering strategy. The Government of India offers financial assistance up to Rs. 50.00 Crore every Mega Food Park project as part of the Mega Food Park Scheme. The majority of food parks offer tetra-packing, food testing labs, spice and agricultural produce drying chambers, refrigerated storage, warehousing, packaging, and printing operations[57].

7.2.2 Integrated Cold Chain and Value Addition Infrastructure

Grant-in-aid for value addition and processing infra including frozen storage – at 50% for general areas and at 75% North East states, Himalayan states, ITDP areas and islands. Grant-in-aid for irradiation facilities – at 50% of eligible project cost in general areas and at 75% of eligible project cost in the northeast region like Sikkim and difficult areas like and J&K, Himachal Pradesh and Uttarakhand[58].

7.2.3 Creation/Expansion of Food Processing/ Preservation Capacities

The setting up of new units and modernization/expansion of existing units are covered under the scheme. The scheme aims to increase the level of food processing, value addition and reduction of wastage through creation and expansion of food processing and preservation capacities. The induction of modern technology is intended enhance efficiencies as well as improving the quality of the end product. Grant-in-aid – at 35% of cost of plant and machinery and technical civil works in general areas and at 50% of cost of plant and machinery and technical civil works in northeastern states and difficult areas (North East including Sikkim and J and K, Himachal Pradesh and Uttarakhand[59].

7.2.4 Infrastructure for Agro-processing Clusters

The programme intends to create contemporary infrastructure and shared facilities to encourage groups of entrepreneurs to establish food processing units based on cluster approaches by connecting groups of producers/ farmers to the manufacturers and markets through well-equipped supply chains with modern infrastructure. Each agro processing cluster under the programme consists of two basic elements: Core Infrastructure/Common Facilities (warehouses, cold storages, IQF, tetra pack, sorting, grading, etc.) and at least 5 food processing units with a minimum investment of Rs. 25 crores. Basic Enabling Infrastructure includes things like roads, water supply, power supply, drainage, and ETP. The construction of shared infrastructure happens concurrently with the installation of the units[60–62].

7.2.5 Creation of Backward and Forward Linkages

The program's goal is to deliver efficient and seamless backward and forward integration for the processed food sector by filling in the supply chain's gaps in terms of raw material availability and connections to the market. The programme offers financial support for the establishment of main processing/collection centers at farm gates and contemporary retail stores at the entrance, as well as connectivity through insulated/refrigerated transport. Perishable produce from both horticulture and non-horticulture industries is included by the Scheme. For the purpose of aiding farmer/producer organisations, the Ministry has hired Technical Agencies (TAs). Grant-in-aid: in general, at 35% of eligible project costs; in the northeast and in problematic areas, at 50% of eligible project costs. A pan-Indian electronic trading platform called National Agriculture Market (NAM) connects current APMC mandis to create a unified national market for agricultural goods[63,64].

7.2.6 Food Safety and Quality Assurance Infrastructure

Quality and food safety have become competitive edge in the global market for food products. The government has been extending assistance for faster analysis of the food samples by reducing transportation time of samples; compliance with international and domestic standards on food in case of exports as well as imports; and establishing a surveillance system for monitoring the quality and composition of food. Central/State government and their organisations/Government universities (including deemed universities) eligible for Grant-in-aid at 100% of cost of equipment. Other implementing agencies/ private sector organisations/universities (including deemed universities) eligible for grant-in-aid: at 50% of cost of equipment in general areas and at 70% of cost of equipment in North East and difficult areas. Grant-in-aid given in the form of reimbursement of expenditure towards implementation of HACCP/ISO Standards/Food Safety/Quality Management Systems: at 50% of eligible project cost in general areas[65].

7.2.7 Human Resources and Institutions

Under the scheme, the Ministry of Food Processing Industries has been extending financial assistance to undertake demand driven research and development work for various components. For promotional activities, organizing all India level seminars, workshops, fair for food processing sector, grant-in-aid at 50% of cost of event or maximum INR 5.00 lakh provided. For studies/ surveys, grant-in-aid decided on merits of the proposal or through bid process. For advertisement and publicity, financial assistance provided on actual cost basis, cost determined by following due procedure. Further, the goal is to contribute towards achieving the projected skilled human resources requirement as envisaged by

National Skill Development Corporation (NSDC) in food processing sector i.e., 17.8 million persons by the year 2022. Apart from implementation of the Skill component under PMKSY, a number of initiatives have been taken by GOI to address the skill gap in the food processing sector[66].

7.2.8 Operation Greens

In 2018-19, the government announced maximum limit of 50 crores under the Operations Greens scheme to promote integrated value chain development for crops[67].

Figure 5. Components of PMFME.

7.3 PM Formalization of Micro Food processing Enterprises

The Ministry of Food Processing Industries (MoFPI) has introduced PM-FME, a new government supported programme with a total outlay of 10,900 crore during the period of 2020–2025, as part of the ANB Mission. The different components of the scheme are shown in Figure 5. The ministry has authorised the One District One Product (ODOP) status for 137 distinct products in 710 districts throughout 35 States and UTs under the programme. This programme intends to assist tiny micro-units working in the food manufacturing sector that work closely with farmers including dry chilies, package spices, make pickles and papads. In recognition of their importance, these micro-units are eligible for a 35% subsidy on their project costs, up to a maximum of ₹10 lacs. a programme of Production-Related Incentives (PLI) for the food processing industry. This would help to create 2.5 lakh jobs by 2026-27, enhance exports and allow for the growth of food processing capacity to generate processed food worth Rs 33,494 crore[68].

7.4 Production Linked Incentive Scheme

This scheme aims to modernise and boost the competitiveness of the food processing sector by providing financial support for the production of a set of food products with a high potential for output expansion and value addition. The programme encompasses four categories of food goods, including mozzarella cheese, processed fruits and vegetables, processed millet products, and marine products. These SMEs' innovative/ organic products are also covered, including free-range eggs, poultry meat, and egg products[69].

8. Strategies for Bridging the Skill Gaps in Food Processing

We are all aware that India has witnessed the shift from major food importer to self-sufficient and then to major food exporter. The Indian food processing sector is a monolithic ecosystem that is becoming more open to technological and societal change. Due to the widespread spread of the novel corona virus, supply chains have been scrutinized for their robustness and effectiveness, and consumer behaviour has drastically changed to reflect new societal norms including lockdowns and social distance practices. The consumer's attention has shifted towards healthy and hygienic food products. The access to online food apps/stores, fast delivery of foods and groceries, availability of online food resources are further changing the food industry horizon drastically. Everyday novel food products are being introduced to the market

in every sub segment of the food processing. However, the question arises that whether the enough workforce is available to fulfill the demand of the sector? Whether the available workforce is equipped with the needed skillset for the fast-changing food processing industry? Whether the initiatives taken by the various stakeholders for skilling, upskilling and reskilling of the traditional workforce are enough; what skills set will be required and so on. The opportunities of Indian food processing sector are buried under these fundamental questions. The country has realized the significance of skill development over the years considering the demographic dividend, growing workforce and potential for greatly increasing sectoral productivity and growth. Systematic attempts have been made to provide skill training in the form of vocational education and training. In order to bridge the existing skill gaps, it is necessary to address the frequently encountered problems with skill development programmes with a different strategy based on better collaborations, institutions, and programme designs. Based on various policy documents, research findings and review of literature following strategies are suggested for bridging the skill gaps in food processing sector:

- Incorporate entrepreneurialism an inseparable part of skill development efforts. Broaden the prospects of skill development in the agriculture and food industry.
- Establish training facilities near industry clusters and food parks would give employers access to a broader talent pool while reducing the risks associated with attrition and migration.
- Launch innovative industry-focused courses tailored for the food processing sector. ITIs should create courses on how to operate and/or maintain food processing machinery.
- Create a nodal organisation that will offer industry-specific courses in food processing to help the nation's labour force become more skilled, like to MCI (medical) or AICTE (engineering).
- Government managed learning facilities must incorporate private stakeholders and operate on a PPP model to augment the potential of the existing training infrastructure.
- Develop a database/repository of all informal employees at the entry level, including their previous work experience, professional skills, and employer assessment, might begin. It will offer a platform for an organization to identify a person with a certain set of skills and experience for their business.
- Encourage women to work in the industry by offering them adequate training, financial incentives and flexible learning environment. The success of Shri MahilaGriha Udyog, a self-employment-based cooperative organisation, can be duplicated in other parts of the country. For this industry, the government can create employment guarantee programmes that are exclusively for women.
- Ensure that innovations have the institutional, intellectual, and financial backing they need to succeed and stand the test of time.
- Food control systems must address every level of food supply chain for maintaining quality and ensuring food safety and this can only happen if all chain sectors function cohesively.
- Emphasize transforming agriculture into agribusiness, diversifying foods in the direction of the food processing industry, and processing using food processing's byproducts.
- Involve all supply chain stakeholders and optimizing the supply chain.
- Create a virtual platform for connecting all public and private stakeholders.
- Introduce concept of farmer field schools.
- Enforcing safety and hygiene standards.
- Treat the sector as a major export-oriented industry.

9. Conclusion

The aim of Aatmanirbhar Bharat, Skill India Mission, National Education Policy (NEP-2020) and other highly ambitious programmes focuses towards the long-term viability of skill-development. The quality, outreach, assessment and monitoring design of skilling programmes must be customised as per the requirement of the industry and understanding level of the learner. The gap between what is expected by the industry and what is provided by the workforce will be bridged by implementing the effective training programmes developed via the collaboration of the food industry and academia. The Food Processing

Industry will attract fresh people who complete these specialised training programmes and acquire the necessary specialist certifications as well as complete industry expertise. The food professional will be able to keep up with technological advancements and increased worldwide competition. The workforce's updated qualifications and skills will optimize the production efficiency of the sector. The food processing sector is to face the significant challenge posed by the industrial revolution is having a skilled workforce that can handle the expanding technology. It can only be accomplished by addressing the current skill gaps between the workforce and industry demands, anticipating future skill needs for the industry, and offering the most practical training and educational programmes. The strategies for utilizing full potential of the food processing sector should make skill development an aspirational, inspiring, inventive and entrepreneurial or transforming skill development into a lifelong learning process.

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