BRIDGING THE SKILL GAP IN THE INDIAN FOOD PROCESSING SECTOR: A REVIEW

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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 food processing sector witnessed a growth of 11.8% CAGR during 2015-16 to 2018-19. This growth is being driven by automation and mechanization, making the industry more efficient and creating demand for skilled workforce. The food processing sector currently employs approximately 70.44 lakhs of the workforce in registered and unregistered food processing units (MOFPI, 2022), of which majority of workers have not gone under any formal or informal skill training (Ganguly et al., 2019).To fully capitalize on India's demographic advantages, it is critical to educate and develop both the nation's existing workforce as well as fresh talent. In this review, we offer an overview of the food processing industry, its 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*

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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. 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. Secondary food processing involves further processing of food ingredients which are primary processed. 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 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 (Singh et al., 2012).

India has the potential to become the world's food basket with adequate investment in food processing, technological innovation, and agricultural infrastructure (Punjabi, 2007).India is one of the world's largest producers of rice, wheat, milk, pulses and a variety of other fruits and vegetables. However, in spite of having a higher agricultural production, India's food processing industry is still under-developed when compared to that of other developing countries. The highest share of the processed food is in the dairy sector, where 35% of the total produce is processed, of which only 15% is processed by the organized sector(Merchant, 2008).The processing level is around 2.2% in the 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 (Ministry of Food Processing Industries, 2022).

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 (Rais et al., 2013).It is generally acknowledged that the food processing industry is the best sector for giving rural poor the 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. Food processing industry of India is one of the most fragmented segments and dominated by unorganized sector. Around 42% of the food processing is done by the unorganized sector, 25% by the organized sector, and the remaining 35% by local and small businesses shareholders. Although the unorganized component varies among categories, it still makes up about 75% of the market. In comparison to the primary processing segment, the organized sector is significantly larger in the secondary processing segment. India's consumption patterns are changing as a result of rising urbanization, an increased focus on nutrition growth of working women, single students and professionals, and nuclear families. The development of organized retails makes processed food easily accessible (Shelly & Kaur, 2015).

In the light of the above-mentioned facts, the purpose of this paper is to examine the current scenario of food processing industry in India. The paper presents an overview of the Indian food processing industry, employment generation opportunities, and highlights the skill gaps in Indian food processing industry. The major challenges and underlying opportunities in the food processing sector along 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.

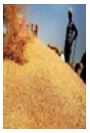
2. Overview of the Indian Food Processing Industry

India experienced rapid growth in the food processing sector following independence, particularly during the 1980s. It came after the first phase of the Green Revolution, which saw an increased agricultural output and the need for post-harvest management (Kachru, 2010). The manufacturers recognized the economic potential of the food processing sector, which led to a shift from grain trading to grain processing. The Indian food processing industry started expanding its area from only rice processing to other sectors such as wheat milling, milk and milk products processing industry, sugarcane processing and oil extraction. Key achievements of the Indian food processing and production industry are shown in Figure 1.

Figure 1: Key Achievements of Indian Food Processing Industry

World's largest milk-producing nation.

World's largest producer and exporter of spices.



World's second-largest producer of food grains.

World's second-largest producer of fruits & vegetables.

World's second-largest producer of fish & 4th largest sea food exporter.

India is the world's second-largest sugar producer after Brazil.

India ranks 3rd in global egg production.

India is the 5th largest exporter of millets globally.

India ranks 8th in meat production in the world.

The white revolution transformed the country from a milk deficient nation to the world's largest milk producer country. The dairy-farming became the largest self-sustaining industry and largest rural employment provider industry of India. The dairy sector employs more 80 million people and this has largely been accomplished as a result of favorable policies and an institutional network that has assisted millions of rural households in pursuing their livelihoods through small-scale dairy farming. 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. Small, marginal farmers and landless labourers generate most of the nation's milk. The organized dairy sector collects and processes about one-fifth of all milk produced (Department of Animal Husbandry and Dairying, 2022).

However, the Indian milk herd's full potential has yet to be realized, and there is room for diversification and growth. As of 2021, India was the world's leading milk producer, accounting for 23% of the global market share. In 2020-21, India's total milk production was 209.96 MT. During the fiscal year 2021-22, India exported 108,711.27 Metric Tonnes (MT)of dairy products to the world, valued at USD 391.59 million (Mn). Between financial year (FY) 2018 and FY 2023, the milk processing industry is expected to grow at a 14.8% annual rate, reaching USD 32.57 billion(Bn) in FY 2023(Gandhi et al., 2020).

Foodgrain production has increased from 308.65 MT in January 2022 to 315.72 MT in December 2022 which is the highest ever food grain production in the country. India is now the second largest producer of fruits and vegetables after China and accounts for about 15% of the world's total fruits and vegetables production. The nation is the second-biggest producer of potatoes, onions, brinjal, cauliflower, and cabbage, and the largest producer of ginger and okra (Singh et al., 2021). Horticulture production during 2020-21 was 331.05 million metric tons (MMT) which has increased to 342.33 MMT during 2021-22. It is the highest ever production for Indian horticulture (PIB[1], Ministry of Agriculture & Farmers Welfare, 2022). Vegetable output totaled at 196.27 MMT with an average productivity of 17.11 MT/hectare (ha), while fruit production totaled at 102.76 MMT with a productivity of 14.51 MT/ha (Bhatia et al., 2020).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 fruits and vegetables sector in India exported goods worth USD 1,469.33 Mn(FICCI, 2021; Economic Survey of India, 2022).

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, being the main contributors of 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. Despite the COVID-19 Pandemic, spices export from India has continued its upward trend during 2020-21 and has attained an all-time high of USD 4.0 billion mark for the first time in the history of spices export(Indian Spice Board, 2021).

India is a leading player in egg production with a production of 122.11 billion eggs in 2020-21 with per capita availability at 91 eggs per annum (Dhanya et al., 2020). India's exports of Animal Products in 2021-22 was USD 4.15 billion. In India, the market for food and beverage packaging was valued at USD 26.28 billion in 2019 and is expected to increase to USD 22.78 billion by 2025, growing at a projected CAGR of 29.88% (Hamid, 2021).

The COVID-19 pandemic accelerated a significant shift in food habits including consumer buying preferences, consumption pattern and overall behavior which instigated tremendous development in the food services sector.

2.1 Past Projection vs. Current Situation of Food Processing Industry

The food processing sector witnessed a growth of 11.8% CAGR during 2015-16 to 2018-19. In 2018-19, the sector was estimated at USD 56.11 billion and was projected to reach USD 79.40 billion at a CAGR of 9% by 2022-23 (Rais

et al., 2013). The value of agri-food exports including processed food exports during 2020-21 was of the order of USD 38.32 billion accounting for about 13.2% of India's total exports (USD 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 agri-food imports in the world was 1.31% in 2020 (Rais et al., 2013). In another report (Confederation of Indian Industry, 2019) the food processing market was projected to reach USD 544 billion by 2020-21, whereas the food industry output was expected to reach USD 535 billion in 2025-26. Similarly, another report (Ramaswamy et al., 2020) projected the industry to grow at an annual average rate of 10.4%, reaching to USD 482 billion by 2020. We had reviewed extensive data and reports to see whether the projections made in the past are in agreement with the current situation and found that the estimated target in terms of the market value of the industry is still not achieved and further shifted to be achieved by 2025. The latest data show that food processing sector was valued at USD 143.51 billion in 2020, it further reached to USD 275.93 billion in 2021. The industry valued at USD 307.66 billion at the end of the year 2022. The Indian food industry is poised for exponential growth, currently growing at a CAGR of 11% validating the earlier predictions of growing at a CAGR of 9.49% till the year 2021 (Rais et al., 2013 and Navadhi, 2021). Futuristic projections estimate that India's food processing market may touch USD 470 billion by 2025 and its output is expected to reach USD 535 billion dollars by 2025-26, exhibiting a growth rate (CAGR) of 9.5% during 2023-2028. Similarly, India's consumer spending may also grow to USD 6 trillion by 2030. The set target seems too bigger and unrealistic for such a shorter span of time and reason behind not hitting the target may be many including restrictions on manufacturing sector due to pandemic situation, ignored perishables loss across various food categories, and lack of highly skilled manpower, innovation in raw material sourcing and marketing, investments in technology and research and development (R&D) and, of course, new product development on a continuous basis. To reach the estimated projection for upcoming years it is mandatory to have skilled professionals in the industry, automation, mandatory quality standards, reduction in wastage and increase in processing percentage, which is still very low in comparison to other major economies of the world. We have a very low processing level in India when compared to our global counterparts – while we have a processing level of 4-6% here in India, it's 80% in USA and 70% in France. Even if we compare ourselves with developing nations, we lag behind many of them, for example, 80% in Malaysia and 30% in Thailand. Further, small and medium-sized enterprises (SMEs) have to be supported to become major players of the industry.

3. Employment Generation Opportunities in Food Processing Sector of India

In terms of gross domestic product (GDP), employment, and investment, the food processing sector has also emerged as an important segment of the Indian economy. The food processing industry employs roughly 13 million people directly and 35 million people indirectly and contributes to about 14% of the manufacturing GDP i.e., 43.75 billion USD. Its employment intensity is demonstrated by the fact that, for every 1 million INR spent, the organized food processing industry alone generates 18 direct jobs and 64 indirect jobs (Annual Survey of Industries, 2018-19).The total output in India's registered manufacturing sector was 176.07 billion USD, accounting for 12.83% of the total output. In 2019-20, the food processing sector generated 30.06 billion USD in gross value addition (GVA), accounting for 1.69% of the total GVA in the country. The (GVA) share of food processing sector has increased from 7.96% in 2014-15 to 9.87% in 2020-21 (Ministry of Food Processing Industries, 2022).

The food processing sector engages maximum number of people with 20.05 million accounting for 12.32% of the total employment share in the country (Annual Survey of Industries, 2018-19). The unregistered food processing sector employs 51.11 million people and accounts for 14.18% of employment in the unregistered manufacturing sector (NSSO 73rd round, 2015-16), as shown below in Table 1. By 2022, the food processing industry was projected to generate about 4.43 million new jobs, primarily at entry-level and at supervisory profiles (Ramaswamy et al., 2020).

Table 1: Employment in Food Processing Industry

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

Source: MOFPI, Annual Report, 2021-22

*: Includes food products and beverages segments;

#: Source: Annual Survey of Industries 2018-19;

**Source: NSSO Report No.582 (73/2.34/2) on Economic Characteristics of Unincorporated Non-Agricultural Enterprises (Excluding Construction) in India; NSS 73rd Round (July 2015 - June 2016)

The demand for processed food items is significantly increasing with the increase in population and thus more food processing industries (FPI) are needed to meet the demand. As per the Annual survey of Industries (ASI) and the data presented by the Ministry of Food Processing, there are around 40,579 registered food processing industries across India. Creating FPIs in rural India

offers a large number of resources in one location as well as at affordable labour. Thus, to promote the food processing industries and food parks, the Government of India allocated a fund totaling 267 USD million through National Bank for Agriculture and Rural Development(NABARD) in 2014 and 2015 (Limbad, 2022). 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 the 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 2022 is attributed to packaged foods, grains, and oilseeds. Lower labour elasticity of 0.3-0.4% between 2013 and 2022 is anticipated as a result of technological advancements in processing sector categories including meat and beverages. In terms of National Skills Qualification Framework (NSQF) categorization, levels 4, 5, and 6 supervisory and technician occupations are predicted to see a significant surge in requirement of labour from 2013 to 2022. Due to the increasing adoption of technology and automation, enforcement of quality standards and emphasis on exports, techno-quality is another area that will need attention.

4. Skill Gaps in Indian Food Processing Industry

Skills and knowledge are the fundamentals on which the financial growth and economic development of a country is built and India is no exception to that. India's workforce is the second largest in the world after China's. Being one of the largest pools of "young population" and a fast-emerging economy, India has immense potential to be the skill capital of the world. Every year India adds 12 million to its workforce (Majumdar, 2008). However, presently only 3.05% of the total workforce in India has undergone formal skills training (Srija & Sanghi, 2019). By 2025, the country is predicted to have a higher demand-supply mismatch in the important sectors of the economy. 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 challenges in the value chain further tend to increase and lead to gaps within the sector. There also exists a lack of platform and communication channel to enable the skill community to make informed decisions. Since the country's training needs for the Indian food sector are quite considerable, policymakers have given skill development a high priority with the goal of making the programmes aspirational for young people and helping them understand the importance of experience and knowledge (Ganguly et al., 2019). MoSDE provided the human resource requirement and the incremental training needs for the period 2017-2022 as summarized in Table 2. The human resource requirement in the agriculture and food processing sectors is estimated to be about 37 percent of the total requirement in 2022 as compared to 47 percent in 2017. The incremental human resource and training

needs are estimated to be 6 percent of the total requirement (Ministry of Skill Development and Entrepreneurship, 2018). Based on the finding of the above data, discussions were held across the sectors with the Ministries to identify the sectoral training needs up to 2022 and develop a Skill Action Plan. The Skill Action Plan projected that 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 respectively (Ministry of Skill Development and Entrepreneurship (MOSDE, 2022). The incremental human resource and training needs are estimated to be 6% of the total requirement (Lambert, 2001). If we see the trend, it is quite evident that the number of persons engaged in the registered food processing sector increased from 1.73 million in 2014-15 to 2.05 million in 2018-19.

Table 2: Human Resource requirement and incremental training needs

Sector	Human Resource Requirement (million)		Incremental Human Resources and Training need (million)
	2017	2022	(2017- 2022)
Agriculture	229	215.5	-13.5
Food Processing	8.8	11.6	2.8
Total (Human resource requirement across the 24 sectors)	510.8	614.2	103.4

Source: Ramaswamy et al., 2020; MoFPI, 2020.

According to the latest skill gap analysis study by MFPI (2022) in which the food processing industry has been majorly distributed into 11 sub-sectors viz.,(i) Bread and Bakery products (ii) Cold Chain (including logistics) (iii) Dairy Products (iv) Fish and Seafood processing (v) Fruits & Vegetables processing (vi) Meat & Poultry processing (vii) Milling (Grains & Oilseeds) (viii) Beverages (Tea & Coffee) (ix) Ready-to-eat & Ready-to-cook products (x) Soya processing, and (xi) Spices. It is estimated that the total current overall market of all these sub-sectors is approximately 96 MMT in FY 2020. The overall processing volume is likely to increase at a CAGR of 7.5% to reach approximately 198 MMT by FY2030, and employment in the registered units from 1.46 million in 2020 will grow to 2.8 million employees by 2030 (FICSI & MoFPI, 2022). Thus, the net expected skilled human resource requirement in these 11 sub-sectors during 2021-30 would be around 1.34 million. Employment in different sub-sectors of food processing industry according to the study conducted by (FICSI & MoFPI, 2022) as feedback estimates in FY 2020 are shown below in Table 3.

Table 3: Employment in different Sub-sectors of Food Processing Industry

Sub-sectors	ASI Estimates (2017-18)		Feedback Estimates (FY'20)		
	No. of Registered FPI Units	No. of employees (FY'18)	No. of Registered FPI Units	No. of employees (FY'20)	No. of employees (FY'30)
Bread and Bakery products	1,758	1,19,730	1,996	1,35,233	321,983
Dairy Products	2,064	1,76,956	2,374	2,02,240	475,811
Fish and seafood processing	538	87,614	591	94,835	354,036
Fruits & Vegetables processing	1,256	77,989	1,426	88,258	180,821
Meat & Poultry processing	180	26,936	210	31,296	92,651
Milling (Grains & Oilseeds)	22,104	4,49,463	23,792	4,82,418	605,753
Ready-to-eat & Ready-to-cook products	482	34,208	716	51,085	159,785
Cold Chain (incl. logistics)	Not published in ASI		7,600	2,24,300	296,038
Beverages (Tea & Coffee)			1,075	1,05,100	169,870
Spices			1,063	40,750	134,844
Soya processing			165	6,075	11,256
Overall Total*	28,382	972,896	41,008	14,61,590	28,028,48

*Overall universe of around 41,000 units present in the sectors of interest which currently employs 1.46 million people (FY'20)

Sample survey does not report small unregistered units across sectors especially in segments like Milling and home institutions, retail bakeries and meat sellers.

Source: FICSI &MoFPI, (2022)

Some of the key challenges identified in acquiring skilling in the 11 sub-sectors of food processing include lack of knowledge of the basic Food and Hygiene practices, limited awareness and availability of finishing school/informal training institutes offering relevant programmes, inadequate infrastructure facilities vis-à-vis the demand for a skilled labour force, lack of continuous learning programmes among the existing employees, higher hiring cost, employee attrition across all levels, etc. Some of the other critical skill gaps

which exist in various stages of the Indian food processing value chain that need to be addressed are as follows:

4.1 Technical knowhow: 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 knowhow in basic hygiene and sanitary practices, storage of raw ingredients, food safety, product development, operational skills etc. The food processing industry is in the need of skilled personnel acquainted and trained in basic concepts implemented in the sector. Maintaining food quality and food safety is another critical domain, which demands 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 skill gaps between the present workforce and what the industry requires. In the recent years, 3D printing, edible packaging and many other emerging technologies are entering the market which requires well trained and skilled professionals in the field. Similarly, the industry has felt the growing need of technical specialists who are capable of working on imported machines in specific sub-segments.

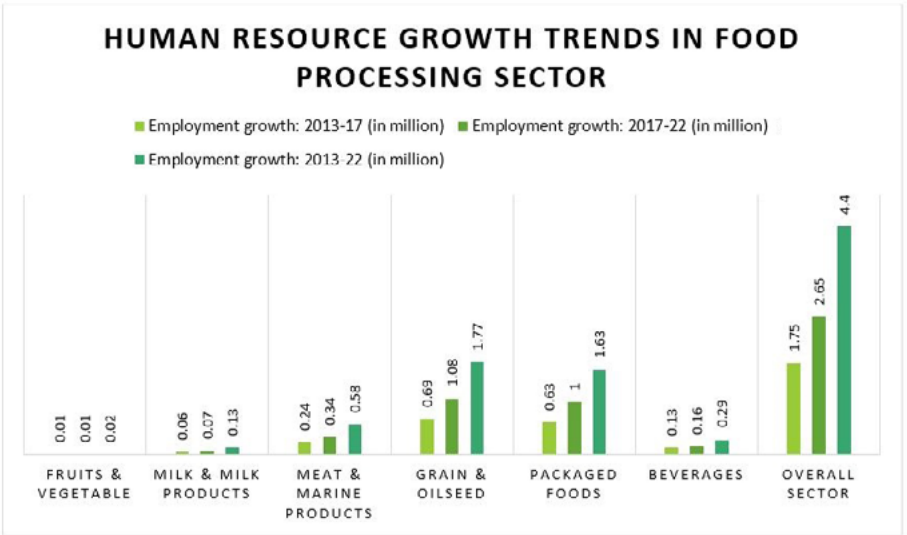
4.3Interpersonal and green skills: Skills such as decision making, critical thinking and independent problem solving are crucial components for any food processing unit specially during production, monitoring and quality control(Deming, 2017). Moreover, the demands for managerial, communication and organizational skills have increased significantly (Grundke et al., 2017). As industrial processes become more automated and digitalized in the next few years, the workforce will be accountable for more complex duties. Numeracy, strong literacy, problem-solving abilities, information and communication technology (ICT) skills as well as soft skills of autonomy, teamwork, and coordination will be needed to complete those jobs (Tomé and Goyal, 2015). 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 hence they need to streamline their raw materials' supply to meet the rising demand. At the farm level, the growers are poorly equipped and lack awareness

of implementing the best practices for growing. This is where the presence for procurement staff to be proactively engaged in crop/production advisory is missing.

Majority of the workforce engaged in food processing industry have low level of education and poor skills set, which pose a big challenge in harnessing the full potential of workers thus causing stagnation of the industry. Human resource growth trends in food processing sector presented in Figure 2 reveals the employment growth in various sub-sectors of the food processing industry. The overall sector has shown a growing trend of human resources involved in the food processing sector from 1.75 million during 2013-2017 to 4.4 million in 2022. This human resource growth trend can only be realized through training of personnel in all the sectors, particularly of individuals with short-term course training and education levels below 10th/12th standard.

Figure 2: Human Resource Growth Trends in Food Processing Sector



Source: Ramaswamy et al., 2020, (MOFPI, 2020)

5. Challenges in Food Processing Industry

Major challenges in food processing industry across the country include lack of raw materials, poor quality delivery, lack of a consistent supply of seasonal raw materials, inadequately trained labour force, expensive imported packing material, infrastructure, and operational inadequacies. The key challenges in food processing sector include inadequate infrastructural facilities, lack of comprehensive national level policy on FPI, ambiguous food safety laws, unavailability of trained manpower, inconsistency in central and state government policies (FICCI, 2010). MOFPI has identified six key challenges in the food processing industry which is discussed as follows:

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). Raw material availability is the most important factor for sustaining food processing activities in an agro-industrial system. 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 major challenges facing the large food processing enterprises.

5.2 Inadequate linkages between production and processing

Effective backward, forward and sideways linkages among the groups of producers/farmers, food processors and consumer/markets through well-equipped supply chain is absent in the Indian food processing industry (Arora, 2017). This is one of the major causes for post-harvest losses at several stages of food processing. Storage capacity linking consumption centers, farmers 'and customers' interactive platforms needs to be established to harness the full potential of the agri-food industry (Lambert, 2001).

5.3 Seasonality of operations and low-capacity utilizations

The raw materials used in the food manufacturing industry are seasonal and labor-intensive. Agricultural seasonality causes substantial changes in the food processing industry (Singh et al., 2022). Limited food supply from distant rural locations, and seasonality of operations causes a rise in food prices and undesirable alterations in foods. Under-utilization of human and other resources is another factor that results in low productivity and slowdown in the industrial growth (FAO, 2003).

5.4 Institutional gaps in supply chain, viz., dependence on APMC markets

The Agricultural Produce & Livestock Market Committees (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 minimum support price (MSP), farmers are required to sell their agricultural products only to licensed members of APMCs. As a result, the free flow of agricultural products is hampered, and markets and the supply chain are fragmented. There are numerous further obstacles including difficult inter-state 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. Food safety practices with implementation of ISO certification Hazard Analysis and Critical Control Points (HACCP), Total Quality Management (TQM), Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Food Safety and Standards Authority of India (FSSAI) etc. are existing in Indian food industry. However, the major portion of the industry being in the unorganized sector, focus on food safety and quality is lacking on a vast 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 processing industry include rising consumer expectations, different lifestyles, shifting preferences and more informed consumers in the internet age who want to learn about new products in the market. The industry is not able to matchup with the consumers' expectations for novel and innovative food products. This is due to strong price competition, lack of infrastructure, monopoly of established brands, 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 (Rani and Mittal, 2021).

6. Opportunities in Food Processing Industry

The Indian food processing industry has enormous growth potential to enhance the socio-economic situations of the rural population. Food processing industry provides plenty of opportunities because of its collaborative structure consisting agriculture and industry.

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 (Anonymous, 2015).

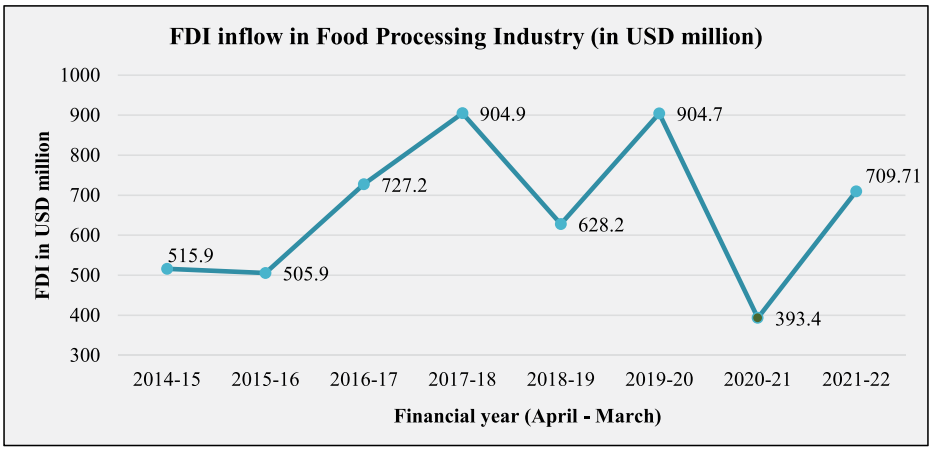
6.2 Demographic Favorability

India is home to a fifth of the world's youth population (Ministry of External Affairs, GOI, 2021), may benefit from its demographic dividend if it trains its ready-to-recruit cohort in skills. There are several technical and specialized skills that food processing sector requires. The higher is the quality of human resources, the better the performance. Educated, trained, and competent human resources play key roles in the success of an organization. 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. The nation's growing middle class, the altering dietary habits of the vigilant young people, etc. all point to the country's processed food industry's expansion (Anonymous, 2015).

6.3 FDI in Food Processing Sector

Foreign direct investment (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 urbanization and consumerism have been rising over time. The government has implemented a liberal and transparent strategy for attracting 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. From the year 2000 to 2015 the estimated FDI was around USD 7.5 billion and this was equal to the share of India (2.3%) at global level (Rani and Mittal, 2021). From the year 2000 to 2020 highest amount of investment was made in the year 2013-14 i.e., 3982 USD million. The details of year-wise FDI inflow for the period of 2014-15 to 2021-22 is presented in Figure 3indicate a non-synchronized movement of the FDI inflow. The sector was able to receive a total of FDI equity inflow of USD 4.99 billion from April 2014 to September 2021.In the FY 2021-22 the food processing sector has attracted FDI equity inflow of USD 709.71 billion in comparison to USD 393.4 million during the previous FY 2020-2021(Press Information Bureau[2], 2022).

Figure 3: FDI Inflow in Food Processing Industry



Source: Press Information Bureau[2], GOI, (2022)

6.4 Rapid 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 liberalization. Rapid urbanization, 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 (Cohen & Garrett, 2010).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 (Choudhury, 2022).

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. The annual number of deaths from CVD in India was projected to rise from 2.26 million in 1990) to 4.77 million in 2020 (Murray et al., 1997).According to data on "Accidental Deaths & Suicides in India" (ADSI) compiled by the National Crime Records Bureau (NCRB, 2021), the number of deaths due to heart attacks in India has remained consistently over 28,000 during the last three year ranging from 2019 to 2021. 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. 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. With global market share of only 2%, India has a lot of scope to grow on global platform. By 2023, India is expected to hold at least a 3.5% market share of the global market. India's nutraceutical market valued to USD 4 billion in 2020 and further projected to reach USD 11 billion by 2023, increasing at a CAGR of 21%. The Indian nutraceutical market exports valued USD 1.5 billion and imports valued USD 2.7 billion reflecting towards a higher import than export (Investor portal, Nivesh Bandhu, MOFPI, 2023). Nutritional and herbal supplements are predicted to have comparable market sales in the future, accounting for half of the total market revenue.

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

Recognizing the role that food processing industry can play in promoting employment and income in the rural sector, the Government of India has identified it as a priority sector under the 'Make in India' programme. 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 to increase the supply of skilled workers in the labour market. The following are some of the main actions that Indian government has taken 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 called the National Mission on Food Processing (NMFP), which was funded by the federal government and will be implemented by the states and union territories (UTs). The programme aimed to expand India's food processing industries while also overseeing 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 important role in policy creation. The NMFP ensures decentralization of food processing-related programme implementation for significant state government/UT participation.

The Indian government established a USD1.2 billion 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. The Food Safety and Standards Authority of India (FSSAI) plans to invest around USD 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 fertilizer sector, which will enable farmers to get good quality fertilizers at affordable rates and thereby achieve food security for the common man (MOFPI, 2022).

7.2 Pradhan Mantri Kisan Sampada Yojana (PMKSY)

The PMKSYojana 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. In most states, the scheme offers grants equal to 35% of qualifying project costs, while in the states in North-East and Himalayan regions, grants equal to 50% of eligible project costs. Investors, business owners, farmers, farmer organizations, and agriculture cooperatives are to gain from the development of agricultural facilities under this 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 maximize 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 6.82 USD million crore for 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.

7.2.2 Integrated Cold Chain and Value Addition Infrastructure

This system provides continuous integrated cold chain, value addition, and preservation infrastructure facilities from the farm gate to the consumer. It includes building infrastructure along the entire supply chain, including pre-cooling, weighing, sorting, grading, waxing facilities at the farm level, multi-product/multi-temperature cold storage, packing facility, individually quick frozen(IQF), blast freezing in the distribution hub, and reefer vans, mobile

cooling units to facilitate distribution of non-horticulture, horticulture, fish/ marine (except shrimp), dairy, meat, and poultry. Grant-in-aid for storage infrastructure includes ripening chamber, pack houses, pre-cooling units – at 35% for general areas and at 50% for northeastern states, Himalayan states, Integrated Tribal Development Project (ITDP) areas and islands. Grant-in-aid for value addition and processing infrastructures include frozen storage – at 50% for general areas and at 75% for North-eastern states, Himalayan states, ITDP areas and islands. Grant-in-aid for irradiation facilities include – at 50% of eligible project cost in general areas and at 75% of eligible project cost in the northeastern region like Sikkim and difficult areas like J&K, Himachal Pradesh, and Uttarakhand.

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 to enhance efficiencies as well as improving the quality of the end product. Grant-in-aid includes – 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&K, Himachal Pradesh, and Uttarakhand (Mishra, 2020)).

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 INR 25 crore. Basic Enabling Infrastructure includes roads, water supply, power supply, drainage, and electronic transit pass (ETP). The construction of shared infrastructure happens concurrently with the installation of the units.

7.2.5 Creation of Backward and Forward Linkages

The programme'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 availability of raw material 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 organizations, the Ministry has hired Technical Agencies (TAs). Grant-in-aid in general includes– 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 the current APMC *mandis* to create a unified national market for agricultural goods.

7.2.6 Food Safety and Quality Assurance Infrastructure

Quality and food safety have become a 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 organizations/ Government universities (including deemed universities) are eligible for Grant-in-aid at 100% of the cost of equipment. Other implementing agencies/private sector organizations/ universities (including deemed universities) are eligible for grant-in-aid at 50% of the cost of equipment in general areas and at 70% of the cost of equipment in North East and difficult areas. Grant-in-aid is 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.

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 such as organizing all India level seminars, workshops, fair for food processing sector, grant-in-aid at 50% of cost of event or maximum 0.5 million rupees are provided. For studies/surveys, grant-in-aid is decided on merits of the proposal or through bid process. For advertisement and publicity, financial assistance is 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 PMKVY, a number of initiatives has been taken by Government of India to address the skill gap in the food processing sector.

7.2.8 Operation Greens

In the budget 2018-19, the government announced the Operation Greens scheme to promote integrated value chain development for crops such as tomato, potato,

onion. Post-harvest processing facilities will be eligible for a grant-in-aid of up to 50% of the project cost. For this scheme, Rs. 5 billion has been allotted by the GOI in its annual budget.

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 Rs.109billion during the period of 2020-2025, as part of the ANB Mission. The different components of the scheme are shown in Figure4. The ministry has authorized the One District One Product (ODOP) status for 137 distinct products in 710 districts throughout the 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, making pickles and *papad*. In recognition of their importance, these micro-units are eligible for a 35% subsidy on their project costs, up to a maximum of Rs.10 lakh a programme of production-related incentives (PLI) for the food processing industry. This would help 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.3.3494 billion.

Fig. 4: Components of PMFME

7.4 Production linked Incentive Scheme

This scheme aims to modernize 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.

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 nation and then to a 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 spread of novel coronavirus, 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 in the market in every sub-segment of the food processing. However, the question arises as to whether enough workforce is available to fulfil the demand of the sector? Whether the available workforce is equipped with the needed skill set 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 (Dixit and Ravichandran, 2022). 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:

1. Incorporate entrepreneurship as an inseparable part of skill development efforts. Broaden the prospects of skill development in the agriculture and food industry.

2. Establish training facilities near industry clusters and food parks. This would give employers access to a broader talent pool while reducing the risks associated with attrition and migration.

3. 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.

4. Create a nodal organization that will offer industry-specific courses in food processing to help the nation's labour force become more skilled, like Medical Council of India(MCI) or All India Council for Technical Education(AICTE).

5. Government managed learning facilities must incorporate private stakeholders and operate on a Public-Private Partnership (PPP) model to augment the potential of the existing training infrastructure.

6. Develop a database/repository of all informal employees at the entry level, including their previous work experience, professional skills, and employer

assessment. It will offer a platform for an organization to identify a person with a certain set of skills and experience for their business.

7. Encourage women to work in the industry by offering them adequate training, financial incentives, and flexible learning environment. For this industry, the government can create employment guarantee programmes that are exclusively meant for women.
8. Ensure that innovations have the institutional, intellectual, and financial backing that they need to succeed and stand the test of time.
9. 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.
10. Emphasize transforming agriculture into agribusiness, diversifying foods in the direction of the food processing industry, and processing using food processing' byproducts.
11. Involve all supply-chain stakeholders and optimize the supply chain from beginning to end, resulting in a win-win outcome for all parties involved. The Stakeholder should be trained exhaustively for reducing food losses, improving productivity, and increasing the shelf-life of their products.
12. Create a virtual platform for connecting all public and private stakeholders. Introduction of incubation and accelerator programmes can be useful in sharing best practices, implementable solutions that can be replicated to create a unified community supporting innovation and entrepreneurship with certain standard objectives, approaches, and targets thereby amplifying the impact.
13. Introduce the concept of farmer-field schools to build a partnership between lead farmers, village level entrepreneurs and public extension system to offer skilling and demonstrate adoptable practices at grassroots levels.
14. Enforcing safety and hygiene standards to bring in more certified professionals to this sector.
15. Treat the sector as a major export-oriented industry and create favourable policies/incentives for exports.

9. Conclusion

The *Aatmanirbhar Bharat*, Skill India Mission, National Education Policy (NEP-2020) and other highly ambitious programmes focus towards the long-term viability of skill-development. The quality, outreach, assessment, and monitoring design of skilling programmes must be customized 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 specialized 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 going face the significant challenge due to the industrial revolution. The core challenge will be to have skilled workforce which can handle the expanding and everyday changing technology. This challenge can only be addressed by filling 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 techniques for leveraging the full potential of the food processing industry should change skill development into a lifetime learning process or make it an aspirational, motivating, imaginative, and entrepreneurial activity.

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