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Skill Gaps Analysis in Food Processing Industry with Special Reference to Fruits and Vegetables

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Abstract **- India has gradually evolved as a knowledge-based economy due to the abundance of capable, flexible and qualified human capital. With the constantly rising influence of globalization, India has immense opportunities to establish its distinctive position in the world. However, there is a need to further developing and empowering the human capital to ensure the nation's global competiveness. Today's knowledge-driven economy demands that workers have skill sets that are both advanced and specialized. At the same time, job seekers must also meet a breadth of additional requirements that go beyond their specialized skills, including broader functional capabilities, industry expertise. Despite the emphatic stress laid on education and training in this country, there is still a shortage of skilled manpower to address the mounting needs and demands of the economy. This paper attempts to analyze the skills which are required by the food processing industry with a special reference to fruit and vegetable processing. For this a detailed study of skill requirement is done with the help of generic value chain involved in food processing. This paper also deals with the skill gaps at each step in value chain and provides few amicable solutions to address these gaps which can be beneficial for both the individuals as well as the companies.**
Keywords: **Food processing, skill gaps, value chain, manpower**

I.INTRODUCTION

Being backed by biggest food and agricultural sector, India is the world's second largest producer of food. The food processing industry is one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. The total food production in India is likely to double in the next 10 years with the country's domestic food market which is expected to reach US$ 258 billion by 2015. Agriculture, which provides employment to 52 per cent of the population, is estimated to account for 14 per cent of the country's gross domestic product (GDP). Further, technology and advancements in agricultural sciences and mechanization of farm operations has helped transform Indian agriculture and increased output considerably. Presently, the Indian food processing industry accounts for 32 per cent of the country's total food market. The Government of India has nominated two agencies, Agricultural & Processed food products Export Development Authority (APEDA) and Marine Products Export Development Authority (MPEDA), for promoting exports from India. Owing to them and the seemingly lucrative opportunities in this sector, the food industry in India has been attracting a lot of attention from foreign investors as the country is close to the markets of Middle East, Africa and South East Asia.

Food processing can be defined as transformation of raw ingredients into food, or of food into other forms. Food processing typically takes clean, harvested crops or butchered animal products and uses these to produce attractive, marketable and often long shelf-life food products. The processed food industry is divided into the following broad segments:

Primary Processed Food - which includes products such as fruits and vegetables, packed milk, unbranded edible oil, milled rice, flour, tea, coffee, pulses, spices, and salt, sold in packed or non-packed forms.

Value-Added Processed Food - which includes products such as processed fruits and vegetables, juices, jams, pickles, squashes, processed dairy products (ghee, paneer, cheese, and butter), processed poultry, and processed marine products, confectionary, chocolates, and alcoholic beverages**.**

Food-processing is considered to be an emerging sector across the world, because of its large potential for growth and socio economic impact. It not only leads to income generation but also helps in reduction of wastage, value addition, and foreign exchange earnings and enhancing manufacturing competitiveness. In today's global market, quality and food safety have become competitive edge for the investment in food processing, technical innovation and infrastructure for agriculture sector, India could well become the food basket of the world". Food processing accounts for about 14% of manufacturing GDP, i.e. Rs. 2,80,000 crore, and employs about 13 million people directly and 35 million people indirectly. Indian food processing industry stands fifth in terms of production, consumption, export and expected growth across the world. However, level of processing and the extent of value addition are very low as compared to other developing countries. Food processing sector is emerging as critical

area of focus & its significance can be understood by the fact that it that it can create 18 direct jobs and 64 indirect jobs for every 1 million invested, in organized food processing industry alone .

Food processing sector is the most suitable sector for creating jobs for rural poor, and thereby reducing the burden on agricultural sector for creation of their livelihood. Familiarity with the agricultural sector makes it easier to train and place people in food processing enterprises. Further, investment in food processing industry has multiplier effect on employment generation, which is much higher than any other sector. Therefore, for the overall progress of economy it is important that the farmers and backward communities working in rural food-processing units are treated at the top of the growth process. Rapid and sustained poverty reduction requires economic growth which is inclusive and the one that allows people to contribute to and benefit from it.

II.OVERVIEW OF INDIAN FOOD PROCESSING INDUSTRY

Food processing sector is an important segment of the economy, constituting a share of around 9–10 per cent of gross domestic product (GDP) in agriculture and manufacturing sector. Currently growing at more than 10 per cent per annum, it is expected to touch US$ 194 billion by 2015 from a value of US$ 121 billion in 2012, according to Mr Swapan Dutta, Deputy Director General, Indian Council of Agricultural Research (ICAR).

Packaged food industry is the fifth largest sector in India. The industry is currently pegged at US$ 39.7 billion in India and is expected to reach US$ 65.41 billion by 2020, owing to the rise in middle class income, changing urban lifestyle and modern retail trade. Residents in urban areas are the largest consumers of processed food, consuming 78 per cent of all packaged food in 2011.

Indian agricultural and processed food exports during April–December 2013 stood at US$ 16,578.91 million as compared to US$ 15,206.22 million during the same period last year, according to data released by the Agricultural and Processed Food Products Export Development Authority (APEDA). The share of food processing export in total exports from India is around 12 per cent.

Food processing industries in India attracted foreign direct investments (FDI) worth US$ 5,360.89 million during the period April 2000–January 2014, according to the latest data published by Department of Industrial Policy and Promotion (DIPP).

The major segments in the Food Processing sector comprise of Fruits and Vegetables, Dairy, Edible Oils, Meat and Poultry, Non-alcoholic beverages, Grain-based products, Marine products, Sugar and sugar-based products, Alcoholic beverages, Pulses, Aerated beverages, Malted beverages, Spices, and Salt. Out of these segments, dairy (16%), Grain-based Products (34%), Baker-based products (20%), and fish and meat products (14%) contribute to a major portion of industry revenues, apart from the manufacture of beverages.

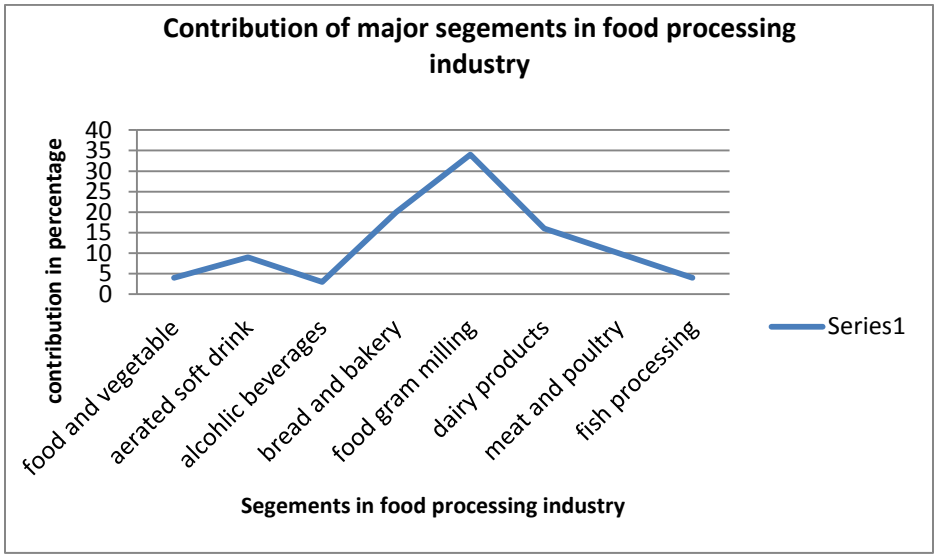

Fig. 1 Contribution of major segements in food processing industry

As far as state wise contribution is concerned with respect to food processing industry it has been found that major contributors are Andhra Pradesh, Gujarat, Maharashtra and Uttar Pradesh. The chart below represents the state wise contribution towards food processing industry.

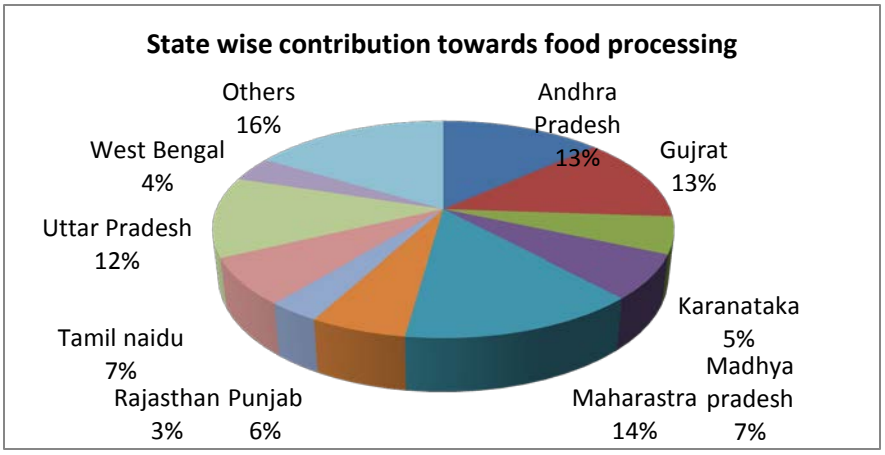

Fig.2 State wise contribution towards food processing

III.RESEARCH METHODOLOGY

The Main objectives of study are as discussed below.

a) To study the key demand drivers, success and risk factors associated with food processing industry.
b) To study the value chain of food processing industry along with specific value chain of fruit and vegetable industry.
c) To identify the human resource and skill required at each level and find out the skill gap, if any
d) To suggest necessary methods to overcome this gaps

Source of Data: An annual report, websites, previous research studies has been used for source of secondary data. Key demand drivers, success and risk factors associated with food processing industry. Food Processing Industry is driven by growth in consumption of food. The major growth segments are likely to be:

a. Fruits & Vegetable , growing at 13
b. Dairy, growing at 11.5%
c. Meat and Poultry, growing at 16.3
d. Marine Products, growing at 14.8%
e. Beverages growing at 14.1%.

There are several factors which are responsible for this fast growth of this industry. Some of them are rising incomes, changing lifestyles, and a growing middle class, gradual acceptance of processed food

Incomes have risen at a brisk pace in India and will continue rising given the country's strong economic growth prospects. Nominal per capita income is estimated (IMF) to have recorded a CAGR of 9.0 per cent over 2000–13. This has resulted in rise in consumerism which resulted in willingness to try new products, increased consumption of value added processed food, movement to convenience food & RTE food, shopping at a organized retail chain and increasing brand consciousness.

All this is expected to lead to increasing consumption on food. While the proportion of food in the 'share of wallet' is likely to come done, the overall size would continue to increase due to increasing income levels.

The following are some of the demand drivers unique to certain segments:

A.Fruits and Vegetables:

a. With the expanding middle income group as a proportion of total population and increasing disposable income in all sections, the expenses on food are increasing. More Indians are becoming health conscious, but due to paucity of time, they prefer processed fruit and vegetables which will be fuelling the demand of these products in India in years to come.

b. Export-led demand growth, demand for fresh F&V at homes, rising preference for organic produce, consumer acceptance of processed food, demand for sauces, concentrates, sauces with changing lifestyles and preference for convenience and readymade produce.

B.Dairy products: Domestic and Export-led demand growth for curd and yoghurt, as well as milk proteins.

C.Meat and Poultry: Increasing consumption levels are expected to drive demand for processed meat and poultry. Vegetarianism in India is actually low, as compared to perception (only 20% of population are strictly vegetarian), implying that people will experiment with poultry and move to meat as incomes rise. Further, preference for fresh meat in the domestic market and demand for high-value frozen foods in the export markets will drive growth. Also with the emergence of big players such as Suguna, there will be much more scope of fulfilling the demand supported by their state of art processing infrastructure and increased capacity.

D.Beverages: Changing perception of alcoholic beverages in India from 'taboo' to 'socially acceptable' has led to immense internal demand growth, wide range of product offerings, the opening up and increasing 'organization' of distribution channels will drive growth of alcohols in the beverages segment, supported by soft drinks, etc.

In India, the technology used in processing is not abreast with international trends in all sectors – this is a significant risk factor for the industry across segments. Significant success factors and risk factors for the Food Processing Industry are discussed below. The discussion tries to sum up the factor in two separate group's viz. those which are common to industry & few sector specific factors which consider the high growth segments.

Key Success Factors and Risk Factors which are common to Food Processing Industry

Success Factors:

a. Product innovation – packaging, look and feel – especially in snacks and RT
b. Competitive pricing.
c. Strong branding (along similar lines of an FMCG play).

Risk Factors:

a. Poor supply chain facilities and cold storage
b. Continuing preference for fresh food among consumers
c. Poor yield of crops and milch animals.

TABLE I SECTOR SPECIFIC SUCCESS FACTORS AND RISK FACTORS

Sectors / segments	Key Success Factors	Key Risk Factors
Dairy Products	✓ Ability to increasing scale of output ✓ Wide product portfolio of high-value products such as yoghurt, sweets ✓ Ability to tap into export markets ✓ Developing a portfolio of milk-based products	✓ Low productivity in milch animals despite the largest bovine population (250 million) ✓ Lack of scale in the industry despite of success stories such as AMUL**.**
Fruits and Vegetables	✓ Ability to establish forward and backward linkages through contract farming, cold chains, and a strong distribution network. ✓ Use of modern technology in F&V processing rather than manual methods. ✓ Using hybrid seeds to improve yield. ✓ Large number of innovative products and branding.	✓ About 35% of agricultural produce is wasted due to poor cold chain linkages during storage and transportation ✓ International trade rules and increasing protectionism in export markets. ✓ Poor performance of the agricultural/primary sector.
Meat and Poultry	✓ Ensuring quality and sustained branding ✓ Ability to tap into export growth in the value-added segment	✓ Quality and hygiene is low in street-side wet markets ✓ Imperfect slaughtering ✓ High supply chain costs as feed constitutes 60% of total broiler costs ✓ Relatively unregulated slaughter facilities to the extent of 50%. The country hasonly 3,600 slaughterhouses, 9 modern abattoirs and 171 meat processing units, and a limited number of pork-processing units ✓ Primitive rearing techniques

Value chain in food Processing Industry

The value chain in food processing industry generally beign from farm inputs and ends at food retail and food service. The ***first stage*** of value chain includes delivery of agro-inputs, i.e. seeds, agro-chemicals, fertilizers etc. along with the production of crop, and insurance of crop against any sort of natural or man-made calamity. It also involves procurement of agro-produce for value addition. The ***second stage*** involves storage and trading of produce and where, generally wastages occur due to lack of proper cold storage facilities . This problem is one of the biggest challenge in food processing industry, as stated in a survey conducted by FICCI . The trade and distribution facilities also include transportation for export, and shifting of produce from one place to another and trading of sourced agro-produce. Then, comes the processing part which involves grading, sorting and waxing in case of fruit and vegetable segment, milling, grading in case of grains (for example paddy-rice, wheat-flour). Then value addition of wheat into noodles, wheat into bakery items, processed fruit and vegetables, extruded snacks etc. In the next stage there is wholesale trading of value-added produce, export of produce and branding of products. The final stage food retail and food services, implies retailing of value-added foods by means of hotels, restaurants, eat-outs and retail stores (for packed items, grains, Ready to Eat foods etc.). There is increase in valueaddition in every segment of food processing industry with increase in demand for processed food.

Value chain in the Fruit and Vegetable Processing Segment

The following figure illustrates the composition of the value chain in the Fruit and Vegetable
Processing Segment:

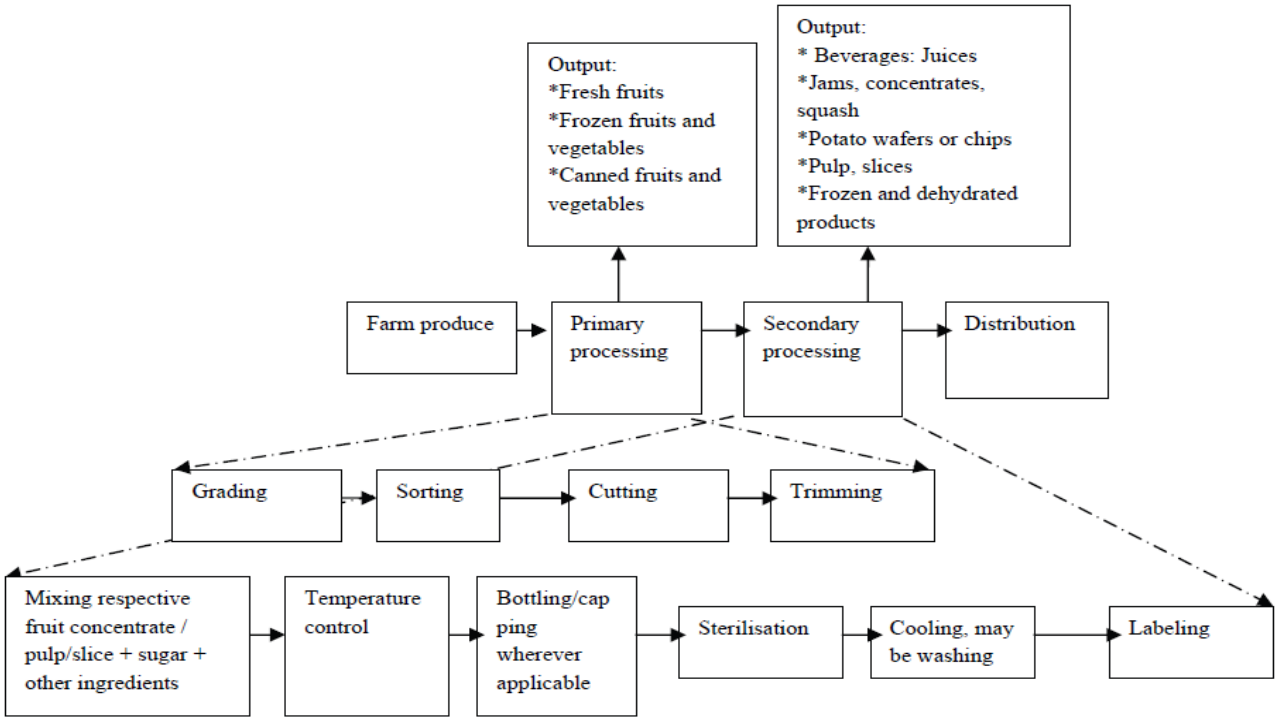

Fig. 3 Value chain in the Fruit and Vegetable Processing Segment

The handling of the product before and during processing is very important in the Fruit and Vegetable Processing Segment. Uniform temperature control is enforced at all stages from the storage of the raw product, through the processing stage and finally at the warehousing of the finished product either in storage or on the shelf for maintaining the quality.

Various processing levels possible are as below:

A.Minimal Processing: Minimally processed products increase the functionality of a food without changing its fresh-like appearance and properties. This process involves washing, cleaning and chilling followed by peeling, slicing and trimming.

B.Primary Processing: The focus is to retain freshness, flavour, texture and appearance of the crop. This is accomplished through efficient harvesting, cleaning, chilling and storage of the product. There is very little change from what is harvested to what the consumer purchases. Cleaning is done to remove foreign particles which tend to enter the produce at farm or in transportation.

C.***Secondary Processing:*** This encompasses several methodologies such as heat preservation, refrigerated "ready to eat", freezing, dehydration, extraction, preserves and fermentation. The most common on-farm heat preservation methods are pasteurisation and blanching. Refrigerated Production, Ready to Eat, Heat and Serve involve cleaning and preparing the food item, packaging appropriately, labelling with storage instructions, dates of expiry.

IV. DISCUSSION

The value addition in different stages in food processing industry requires different skill sets; the basic functional distribution of human resource across segments in food processing industry is given in Table below.

TABLE II BASIC FUNCTIONAL DISTRIBUTION OF HUMAN RESOURCES ACROSS SEGMENTS IN FOODPROCESSING INDUSTRY

Function	Percentage of employees
Procurement	10
Testing and Quality	10
Production	55
R&D	1-2
Storage	2-3
Other(Sales and other support functions)	10

It is clear from the table that around 55% of the human resource in food processing industry is involved in production work, or in processing stage. After having an overview of functional distribution of human resources across segments in food processing industry, we will observe the educational profile of the employees involved in food processing industry.

TABLE III DISTRIBUTION OF HUMAN RESOURCES BY EDUCATION LEVEL IN FOOD PROCESSING INDUSTRY

Education level of employees	**Percentage of employees**
Employees with management education	1-2%
Proportion of food technologists	20%
Post-Graduates	0.5-1%
Graduates	10%
Diploma holders	2-5%
Certificate holders	2-5%
10th Standard or below	80%

Table above shows that maximum percentage of workers in food processing industry has low level of education, and therefore their skill level is also low. Low level of skills highlights a very dark picture of Indian food processing industry; here workers can't contribute from their side in the development of the industry, thus leading to stagnation of the industry.

Skill gaps in food processing industry

The skill gaps present in various segments of the food processingindustry will be analyzed in next section. This section tries to focus on the projected growth rate in respective sectors along with the human resource requirement .Further a close analysis of the demand and supply of avialable human resource with specific skills is done. In the end this section also present the profile of the people who are working in fruits and vegetable segement , skills required to accomplish the task and respective skill gaps.

Projected size of food processing industry & human resource requirement in future

The Food Processing Industry is expected to grow from Rs. 3,600 billion in 2008 to over Rs. 15,600 billion by 2022, a CAGR of about 11%. Table below shows projected growth in food processing industry over a period of time from 2008 to 2012 upto a period of 2022.It is clear that composite growth of 11.0 % is expected for food processing industry. Further it expected that the share of Food Grain segment would decline, Meat and Poultry Processing, and Bread and Bakery products would gain maximum in the overall processed food market.

TABLE IV PROJECTED SIZE OF FOOD PROCESSING INDUSTRY TILL 2022 – RS. BILLION

Sector	**2008**	**2012**	**2018**	**2022**	**CAGR**
Fruit and Vegetable Processing	159	259	543	887	13.1%
Food Grain Milling	1,230	1,663	2,613	3,532	7.8%
Dairy Products	572	881	1,686	2,597	11.4%
Meat and Poultry Processing	369	675	1,673	3,063	16.3%
Fish Processing	139	180	265	343	6.6%
Bread and bakery	714	1,137	2,288	3,646	12.4%
Alcoholic beverages	101	171	380	645	14.2%
Aerated water/soft drinks	338	451	693	923	7.4%
Total	3,622	5,419	10,140	15,638	11.0%

Source: ASI, NSSO, MOFPI Vision 2015, IAMR study on Food Processing Sector, and IMaCS analysis

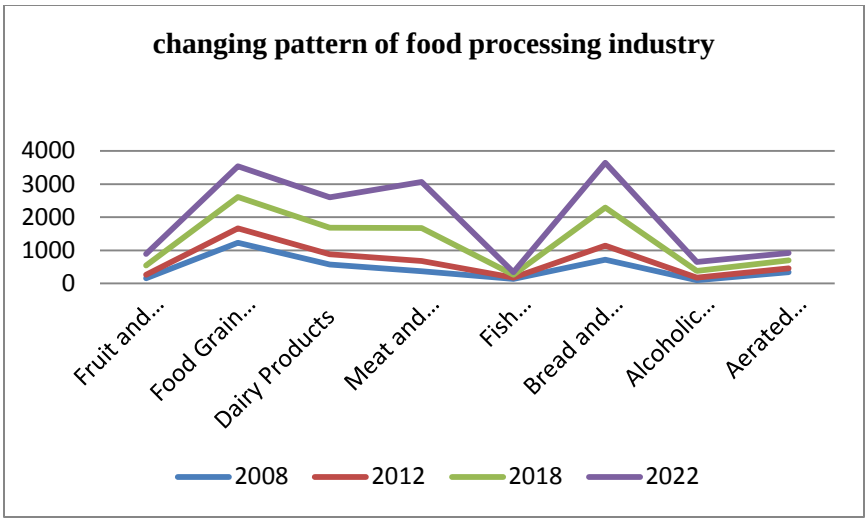

Fig. 4 Changing structure of the Food Processing Industr

Projected Human Resource Requirement

For the projected growth in the Food Processing Industry, it is expected that the requirement of human resource would increase from about 8.5 million in 2008 to about 17.8 million in 2022, an incremental human resource requirement of about 9.3 million persons till 2022.

TABLE V PROJECTED HUMAN RESOURCE REQUIREMENT FOR THE FOOD PROCESSING INDUSTRY (IN '000 PERSONS) TILL 2022

Sector	2008	2012	2018	2022	Incremental (in '000 persons)
Fruit and Vegetable Processing	140	183	273	357	216
Food Grain Milling	2,427	2,618	2,932	3,162	735
Dairy Products	1,126	1,385	1,887	2,320	1,194
Meat and Poultry Processing	658	961	1,697	2,479	1,821
Fish Processing	216	223	234	242	25
Bread and bakery	3,420	4,348	6,235	7,928	4,508
Alcoholic beverages	390	528	834	1,131	741
Aerated water/soft drinks	153	163	178	190	36
Total	**8,531**	**10,409**	**14,271**	**17,808**	**9,278**

Source: ASI, NSSO, MOFPI Vision 2015, IAMR study on Food Processing Sector, and IMaCS analysis

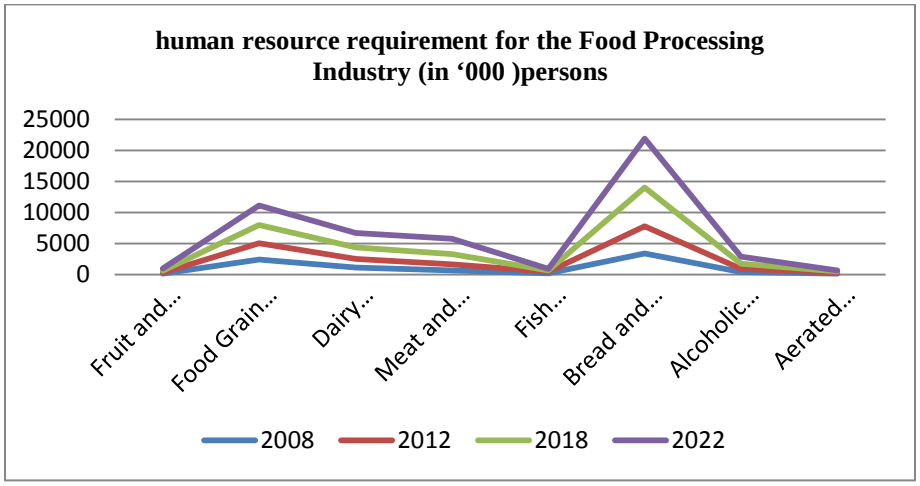

Fig. 5 Human resource requirement for the Food Processing Industry (in '000)persons

It is expected that Organized Sector would contribute to about 20% to 25% of employment, while a large portion of the employment would be generated in the Unorganized Sector in the Food Processing industry. A large portion of the incremental requirement would be in the Bread and Bakery sector, followed by Meat and Poultry Processing and Diary Products.

Available supply of human resource and demand-supply gap

According to a study on 'Assessment of Requirement of Food Technologists, Managers and Entrepreneurs for the Food Processing Industries' conducted by IAMR. Following available skills under 10th plan and during period of 2008 to 2014 is shown along with the required annual demand in each specialized category of human resource. The table below indicates the skill requirement in organized food processing industry. However, if unorganized sector is also to be considered then this required annual demand is likely to increase.

TABLE VI HUMAN RESOURCES SUPPLY GAP

Category	10th Plan Period (available human resource)	2008 to 2014 (available human resource)	Required Annual Demand
Food Technologists – PG	1,000	1,700	2,384
Graduates in Food Science/Technology / Food Science and Quality Control	1,500	2,550	5,363
Diploma	600	1,020	4,768
Certificate (ITI/ITC)	2,500	4,250	4,768
Short-term course trained personnel with education below 10th/12th standard	6,400	10,880	95,351
Total	12,000	20,400	112,633

Source: Assessment of Requirement of Food Technologists, Managers and Entrepreneurs for the Food Processing Industries', IAMR & IMaCS analysis

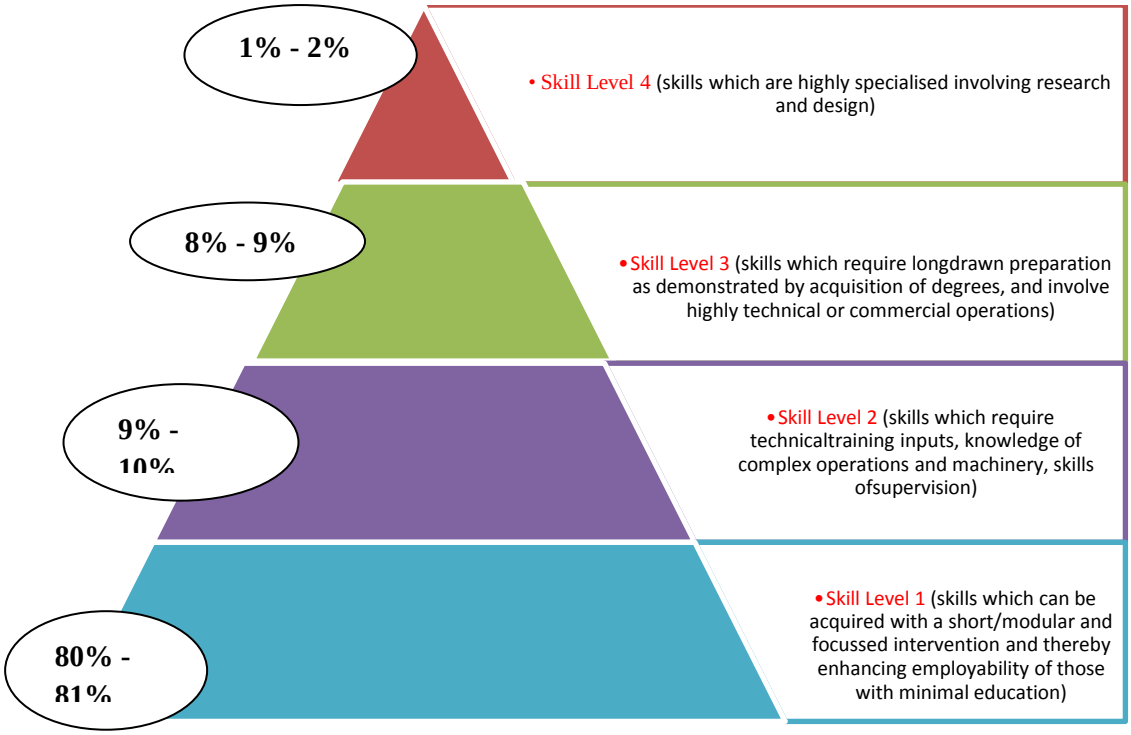

Fig. 6 Skill Pyramid for the Food Processing Industry

While there are gaps in terms of excess of demand over supply in the organized sector at all levels, the gap is maximum when considering the demand for 'those trained by short-term courses' with low educational qualification (below 10th/12th standard) where there is a required demand for about 1 lakh trained persons annually against a supply of over 10,000 persons. This requirement will increase to over 5.3 lakh if the unorganized sector is also taken into account.

Skill Pyramid

The profile of human resource in the Food Processing Industry can be viewed in the form of the Skill Pyramid.

It is to be noted that a large proportion of the workforce falls in the lower portion of the pyramid which would be the source of employment generation in a large scale.

On similar pattern of skill pyramid a represantative profile of the people who are employed in fruit and vegetable segment can also be drawn which can be helpful in indentifing the required skills & key skill gaps.

TABLE VII SKILL REQUIREMENTS AND SKILL GAPS IN THE FRUIT AND VEGETABLE PROCESSING SEGMENT

Function / level	**Skills required**	**Skill gaps**
Operations a) Supervisor	• Good reporting/documentation skills so as to be able to report the status of production, challenges faced and recommendations to top level management. • Excellent communication skills so as to effectively interact with workers on daily targets, production techniques, quality issues, etc. • Ability to manage labor issues and keep workmen motivated. • Ability to handle crisis and take corrective actions in case of quality issues such as mishandling of goods in plant and output not conforming with requirements	Inadequate / restrictive motivational skills Inadequate documentation skills / not conversant with e-reporting / working on computers
b) Floor level	• Ability to visually examine fruits / vegetables and separate rotten fruits / vegetables • Basic reading/writing skills for understanding the standard operating procedures • Ability to be conversant with basic measurements so as to understand customer requirements as given in company documents • In the case of manual operations, the ability to appropriately size/dice as well as the ability to make end produce visually appealing is critical. • Knowledge of procedures, sequence of steps / machines and the ability to adhere to the same at all times. • Ability to operate machines and set parameters such as temperature, running time of machines specific to process requirement.	Inadequate knowledge of operations resulting in wastage. Inadequate ability to undertake dicing / slicing at the entry level. Lack of interest and knowledge in tracking the productivity and improve the same over a period of time
Procurement	• Excellent communication skills to be able to interacts with farmers and conduct training/educate them about the produce handling methods, preprocessing techniques, the demand driven choice of fruits/ vegetables to be grown etc. for them • Ability to coordinate with sales teams and farmers equally well so as to close the communication loop and help attain the required production levels.	Inadequate knowledge and ability to educate farmers on demand, advice on farming and wastage reduction. Inadequate communication skills to be able to motivate farmers for better quality and higher productivity
Sales & marketing	• Good communication, documentation and coordination skills, especially important for personnel working in companies that have export operations. • As products in this segment (such as juices, ketchup) differ with ingredient and proportion of mix, it is important to have adequate knowledge of such parameters. • Ability to gauge the customer's requirement and design different SKUs and innovative packaging for fulfillment of varied customer needs depending on income, consumption level, etc.	Inadequate ability to articulate views. Inadequate ability to understand changing customer preferences, and understand demand for new products.

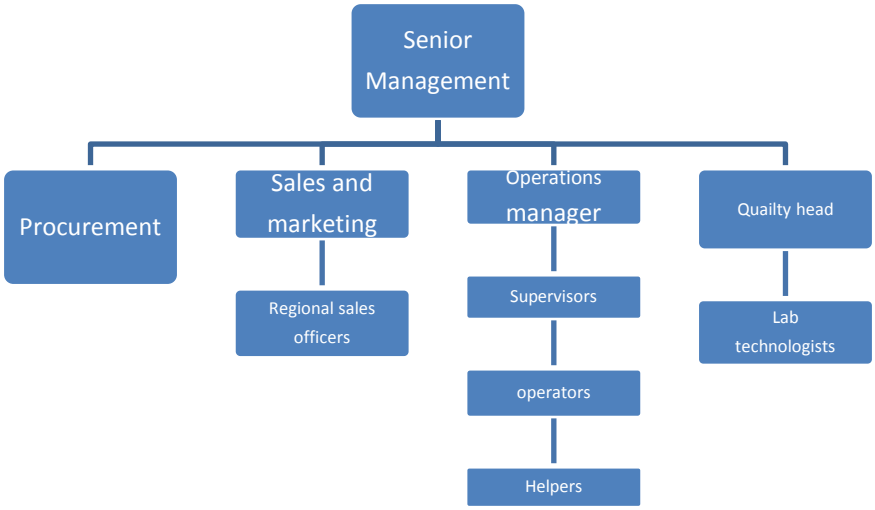

Fig.7 Organizational chrat

The remaining section of paper presents the profile of the people working in fruits and vegetable segment of food processing industry along with the educational qualification required at each level. Later on key skills and probable skills gaps are discussed which are need to be addressed , so that the efficiency could be enhanced in production & quality of product / processed food can be increased.

Skill requirements and skill gaps in the Fruit and Vegetable Processing Segment

The abovetable presents the skill requirements and gaps across various functions and hierarchical/reporting 'levels' in the Fruit and Vegetable Processing Segment:

V.CONCLUSION

Earlier sections of the paper indicate that there is a need for additional capacity and skill building at all levels, such as Food Technologists, Quality Control, Techno-Managerial, etc., a vast majority of the requirement would arise from the need to build skills at the lower portion of the workforce – operators/workers/packaging and assembly line workers.
As far as segment specific skill building is considered it should be created through short-term/modular/vocational courses. For fruit & vegetable segment some of the specific suggestions can be summed as below:

- Correct methods of sun-drying, or methods of artificial/ radiation preservation.
- Mixing in right proportions.
- Preparation of concentrates, juices, squash.
- Edible oil manufacture.
- Preparation of sauces, jelly, marmalades.

Further, similar kind of skill gap analysis should be done for other segments also .Apart for the specific skill development ***generic skills building*** should also be the focused in the Food Processing sector which involves Packaging (in Cans, Poly-packs), Labeling, Working in hygienic conditions, Operation of food processing equipment, Good Manufacturing Practices, Compliance to quality and safety, Compliance to ISO, FAO, HACCP, Basic maintenance of equipment, Soft skills – ability to read simple manuals, standard procedures, communicate with supervisors and team, basic behavioral skills (timeliness, etc.).

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