

ENTREPRENEURSHIP DEVELOPMENT THROUGH FRUIT AND VEGETABLE PROCESSING

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1. INTRODUCTION

Agro-industries are those enterprises that process agricultural raw materials into edible or consumable form. In that process, agro-processing wastes may also be utilized for extraction of natural bioactive compounds so as to be used in pharmaceutical and other industries. An agro-processing plant can open up new opportunities to the farmers facilitating income and employment generation. However, the industries dealing with fruit or vegetable processing are characterized by seasonality, perishability and variability of raw materials. In such industries, the raw materials can only be procured in particular season while processing operations may continue for the off season. For the processing of raw materials by the agro-industries, greater speed in handling, storage and distribution is required. The raw materials obtained for processing vary in their quality as well and hence the emphasis must also be given towards post-processing management also. Such characteristics make the procurement rather restrictive and the industries are amenable and move viable to the locations nearer to the source of raw material.

India is known as fruit and vegetable basket of the world. It is the second largest producer of overall fruits and vegetables production in the world, after China and one of the centers of origin of fruits and vegetables with the total production of 81.285 million metric tonnes of fruits and 162.187

million tonnes of vegetables till the year end 2013 (NHB, 2013). It has the potential to be the world's largest food producer which is bestowed with one of the best natural resources in the world and several factors like Increasing urbanization, nuclear families, working women, disposable income and changing lifestyles are gearing up the Indian food supply chains for a better future. Organized retail and Private label penetration, demand for functional food, and increased spend on health food are major drivers for the growth of this sector (Viswanadham, 2007). As the population is increasing, the demand for such food is also increasing.

India has a strong raw material base for the food processing industry. India is one of the largest producers of certain fruits, vegetables, pulses, cereals and dairy products such as mangoes, papaya, potatoes, onions, ginger, chick peas, rice, wheat, groundnuts, milk and eggs among others. Over time, there has been a continuous increase in the production of food processing industry. The total value addition of the food processing sector as a share of GDP manufacturing was 9.8 percent in 2012-13. Yet in India the sector suffers from several bottlenecks leading to an estimated wastage of 25-30 percent of agriculture produce (Chari and Raghavan 2012). India lacks agricultural raw materials of processable quality. Only 7 percent of the total Indian perishable produce is processed, which is extremely low compared to countries such as the US (65 percent), Philippines (78 percent) and China (23 percent).

Food and grocery is the largest segment in India's retail sector, with a share of more than 60 percent in India's total retail market in 2014. The vast production base offers India tremendous opportunities for export. During 2015-16, India exported fruits and vegetables worth Rs. 8,391.41 crores which comprised of fruits worth Rs. 3,524.50 crores and vegetables worth Rs. 4,866.91 crores.

The food-processing sector employs about 13 million persons directly and about 35 million persons indirectly. India's agricultural production base is quite strong but at the same time wastage of agricultural produce is massive. Processing is very low at around 2.20% in fruits and vegetables, 35% in milk, 21% in meat and 6% in poultry. Value addition is only to the tune of 20% Food processing sector contributed about 14% of manufacturing Gross Domestic Product. India's share in world trade in respect of processed foods is only 1.6 percent and India was ranked 27th in 2006 in terms of trade performance of Processed Food Products. (APEDA, 2015)

2. RECENT TRENDS IN FOOD PROCESSING

In India, a substantial portion of net value added from agro industries is derived from unregistered and cottage small units and the contribution of registered units is very meagre. Generally in food processing industries, about 90% of total value added comes only from primary processing while secondary tertiary processing account for a small proportion.

In addition, by-product processing of major fruits and vegetables has huge potential for industrial growth in rural areas as well.

Organizational problems of fruit/vegetable based industries and the basic characteristics are as follows:

1. Industries based on fruit and vegetables depend upon the seasonality of the raw material. This factor compels such industries to procure most of their raw material requirements during the peak harvesting season and a little after that so that they can process them during and after the season. This enables the industries to market their processed products round the year as per the existing demand.
2. Owing to the perishable nature of F & V's, additional care in handling, transportation, storage and processing is required.
3. The location also acts as a key feature for establishment of such industries, as the raw materials are highly perishable and hence these units should be in a close proximity to the availability of raw materials. It also reduces the expenditure towards transportation cost.
4. Another technical feature of this industry is that unlike other industries, such unit's faces variability in the quality and quantity of their raw materials.
5. In addition, the price of raw material also does not remain steady throughout the year which makes difficult the task of fixing the prices of processed products.
6. The domestic demand for processed foods is very low as most of the Indians have a habit of consuming fresh F & V's and moreover the prices of processed products are beyond the reach of common man.
7. Such industries also face many hurdles in developing the domestic market due to lack of infrastructural facilities including cold storage, suitable transport facilities and adequate food testing laboratories.

8. Besides, the owners of such industries do not have strong information network for marketing of their products.
9. Another characteristic of this industry is that government play supplementary role in fruit processing by providing facilities to the people at certain agricultural centers at very nominal cost for consumers. However, such facilities are very limited and are confined to only one or two products. Such services rendered at subsidies price create competition for the private enterprises.
10. The raw material represents a large investment. It is therefore important that strict orderliness and method are employed to ensure accuracy in preservation and safety at all stages of raw materials movement and custody.
11. Owing to the perishable nature, the F & V's required to be preserved in cold storage to avoid wastage and decay. But the entrepreneurs of the local units with their limited capital neither could afford to have their own cold storage nor has the government come forward to help them in this regard. Moreover, though most of the units are started by the entrepreneurs at their own residential houses with sufficient space for production yet they are carried on in an unorganized way.
12. Since most of such processing units are being operated through household and hence are having a small scale of operation. And as the space available is very limited, the minimum space requirement as per FSSAI license/standards could not be fulfilled. As a result, their product though of good quality is deprived of getting FSSAI license.
13. In certain rare instance, there is also a capability of foreign uneatable particles found in the processed foods. This is because the items are often prepared in an unhygienic manner.

2.1 Production of an industry

For the success of any industry, production should be carried on in a smooth and uninterrupted way. It can be only possible when the purchasing of the raw materials, machines and other equipment required for production is done in an effective manner. In addition to this, the brought materials need to be stored in an adequate manner to avoid wastage and decay. Moreover, the production department has to see whether an efficient quality control process is adopted to test the quality of finished products. The production activities comprises of following:

- **Purchase:** The requirement of proper materials, machines and other accessories are must for any industry. Before going for large scale production, sufficient quantity and assurance of continuing supply to meet production needs and schedules must be managed. The material quality must be adequate for the intended purpose and suitable for the process and the equipment used. Procurement of raw materials at consistently lower cost with quality is desired. Efficient inventory management is also a contributory factor for economic and successful operation.
- **Storage:** It is the function of receiving, storing and issuing of materials. The raw material represents a very large investment and hence strict orderliness and method are employed to ensure accuracy in preservation and safety at all stages of material movement throughout the production line.
- **Quality control:** The quality awareness must begin at the very conception of a product and continue during the various stages of its manufacturing till consumption. The quality cycle begins and ends with the user. It starts when the users need is analyzed and ends when the final product is accepted for consumption.
- **Transportation:** It plays a vital role both in production and marketing of products. Bringing the raw materials from distant places and inadequate cold storage facility may become the reason of deterioration inevitably increasing the transportation cost.
- **Preservation:** Necessary steps need to be adopted for increasing the keeping life of processed products. It can be achieved using physical methods (heating, refrigeration, freezing, drying, dehydration, and concentration), chemical methods (sugar, salt, vinegar, potassium meta- bisulphate and sodium benzoate) and fermentation.
- **Finance:** It is the most essential criterion for initial establishment and further modernization of any business. Both the central as well as state government has many financial schemes for establishment of such processing ventures.
- **Personnel:** An industrial or commercial organization comes into existence when a number of persons come together and work in coordination. These people work together to achieve organizational objectives. Human resource is of paramount importance for the success of any organization. The management must deals with

maintaining a satisfactory workforce.

- Labour: It is always and everywhere the largest critical factor for any industry. It represents people employed or capable of being employed in a productive activity. The manpower can be divided into three main categories: skilled, semi-skilled and unskilled. However, most of the times, there is a dearth of skilled manpower in and around the established industry. In addition, there must be uniformity in the standard rate of wages and timely payment of wages must also be ensured.
- Training: It involves the transfer of defined and standard procedures to the workforce to cope up with the future challenges in the industry. The various institutes under Indian Council of Agricultural Research (ICAR), State Agricultural Universities (SAU's) and Krishi Vigyan Kendra's (KVK) must conduct training on processing and value addition of F & V's and train the manpower.
- Marketing: It is the aggregation of all those activities that are related to the free flow of goods from the points of production to the points of consumption. The pertinent marketing problem faced by the units seems to be the most vital one.
- Packaging and labeling: Ordinary and simple type of labeling is mostly preferred by the local units.
- Advertisement: The level of advertising the products must be rigorously increased in order to compare with the commercially available materials.
- Market research: It is among the most prominent step before initiation of any industrial setup. A survey/study must be carried out in order to understand the probable market behaviour before launching of the products. In addition, few persons must be employed for door to door sales and to bring feedback information regarding the acceptance/ limitations of the product for further improvement.

3. METHODOLOGY TO TAKE UP FOR DEVELOPMENT OF ENTREPRENEURSHIP

Indian agriculture is severely suffering with unacceptable level of wastages and failed to provide remunerative prices to farmers. This problem could be curtailed if appropriate strategies can be adopted for processing of agricultural commodities (especially fruits and vegetables) at their production catchments. In a study conducted by Nanda et al. (2012), the

estimated losses are 5.8 to 18% for fruits and 7.5 to 13% for vegetables, respectively. The food processing sector surrounds with plentiful opportunities for the entrepreneurs, nevertheless the industry is forced to revamp the overall value and speed of its innovations. Significant progress of entrepreneurship in food processing segment will create work opportunities for rural youth and thereby augmenting the living standard of the people across the country (Negi, 2013).

3.1 Role of government

The government must create conducive business environment and promote financial help via venture capitals, investors and business houses. The ideal role for the government to be the enabler and provide adequate infrastructure, ease in taxation, raising of fund, attract investments etc. The MSME sector has taken few initiatives in this regard,

- Udyog Aadhar Memorandum- to promote ease of doing business
- Employment exchange for industries
- ASPIRE (Promoting innovation and rural entrepreneurs)- setting up a network of technology to promote startups for innovation and entrepreneurship in rural and agriculture based industry

3.2 Agricultural and Processed Food Products Export Development Authority (APEDA)

This agency was established in December 1985 with its head quarter at New Delhi. The main objective of the organization is to promote and develop the exports of various processed products including the fruits and vegetables. It plays a very important role in promotions of agricultural commodities export from the country. APEDA has established cold storage facilities at metropolitan cities of the country. It has also developed standards of marketing for processed products. APEDA acts as a platform to take the products to various national and international fairs and exhibitions. It also arranges many seminars and conferences where experts are invited to address the entrepreneurs regarding the different aspects of processing of F & V's and their export (Choudhury and Barua, 2006).

3.3 Indian Institute of Entrepreneurship (IIE)

This was established in the year 1993 by the Ministry of Industry with its head quarter at Guwahati (Assam). The institute undertakes training, research and consultancy activities in the field of small scale industry and entrepreneurship. The institute also acts as catalyst for entrepreneurship

development by creating suitable environment in a way by organizing seminars and workshops for sharing experience on implementation of programs of self-employment. The institute conducts various training programs related to processing of fruit and vegetables which help them for developing their technology, marketing, quality improvement etc (Choudhury and Barua, 2006).

3.4 Ministry of skill development and entrepreneurship (MSDE)

The prime focus of this ministry is to focus on enhancing employability of the youth through skill development. The proposed schemes on Entrepreneurship Development by the government are:

1. Educate and equip potential and early stage entrepreneurs across India
2. Connect entrepreneurs to peers, mentors, incubators
3. Support entrepreneurs through Entrepreneurship Hubs (E-Hubs)
4. Catalyze a culture shift to encourage entrepreneurship
5. Encourage entrepreneurship among underrepresented groups
6. Promote Entrepreneurship amongst Women
7. Foster social entrepreneurship and grassroots innovations

3.5 National Horticultural Board (NHB)

It was set up by the Government of India in 1984 as an autonomous society with a mandate to promote integrated development of horticulture to help in coordinating, stimulating and sustaining the production and processing of F & V's and to establish a sound infrastructure in the field of production, processing and marketing with a focus on post-harvest losses. The HQ's is at *Gurugram* and total 33 offices are functioning throughout the country. Developing post-harvest management infrastructure, provide training and as well as education to farmers and processing industry personnel for improving agronomic practices and promote consumption of F & V's in fresh as well as processed form are among the major objectives of this board (Choudhury and Barua, 2006).

3.6 Small Industries Development Bank of India (SIDBI)

It was set up as an apex institution for promotion, financing and development of industries in the small scale sector.

4. FOCUS ON ENTREPRENEURIAL OPPORTUNITIES AND RESOURCES

According to GEDI (Global Entrepreneurship Development Index) 2018, India ranked 68th out of 137 countries in the world and ranked 14th out of 28 countries among Asia Pacific region a “middling” performance. India performed above its overall score and its strength areas where are in product and process innovation, start-up opportunities, risk acceptance, internationalization, opportunity perception and robust competition in the marketplace. Its accomplishment on human capital is broadly at par with its overall performance. The entrepreneurial potential in India is on rise as per the latest Global Entrepreneurship Monitor (GEM) Report on India for the financial year 2016-17. According to the report rate of entrepreneurial intention stood 14.9% compared to 9% in 2015-16. Whereas, the fear of failure rate has decreased from 44% in 2015-16 to 37.5% in subsequent year. It is also noted that India with its peers in BRICS economies suggests that perceived opportunity is the highest and perceived capability is the second highest among all. Thus, Entrepreneurship positive performance leads to development of a country in several ways, *viz.*, wealth creation and distribution, employment opportunities, balanced regional development, GDP and Per capita income, exports and community development at various levels. Education, entertainment, retails, transportation, manufacturing, e-commerce are some of the sectors in India which have been revolutionized by entrepreneurship.

Agriculture and allied sectors are known to be the mainstay of the Indian economy, which provides food and nutrition to 1.3 billion people and creates forward and backward opportunities to support 60% of Indian population contributing about 16% of Gross Domestic Product (GDP) of India. Every individual, communities, corporate industries, etc., are directly or indirectly dependent on agriculture either for raw material, farm labour, marketing etc. to run their business smoothly. But, Indian agriculture is still seen low in tech-industry with limiting the individual business towards quantity oriented business rather than quality oriented profit. Over the last decade, this situation has changed drastically due to economic liberalization, government policies, a reduced shelter of agricultural markets and fast changing, individual awareness and more decisiveness society.

Thus Agriculture and allied oriented entrepreneurship are moving progressively more to adapt to the vagaries of the market, changing consumer lifestyle, enhanced sustainable approach, improved ecological regulations, new requirement for product quality, chain management, food safety and

security so on. These changes have paved the way for new participator, innovation, and portfolio entrepreneurship in agriculture and its allied segments such as horticulture and its allied sectors (including fruits and vegetables, plantation crops, flowers, spices, aromatic and medicinal plants).


India bestowed with a varied agro-climate and is highly favorable for growing a large number of horticultural crops which includes fruits and vegetables. It is the second largest producer of fruits and vegetables. Entrepreneurial development through the fruits and vegetable mainly lies in the rural India, where development agencies look into rural entrepreneurship as an enormous employment potential, farmers take it as an instrument for improving farm earnings and women see it as an employment possibilities.


With respect to fruits and vegetables, there are plenty of opportunities in processing and value addition sector. Processing of commodities (F & V's) which are cheaper along with abundant availability, results in higher profit margin for entrepreneurs. A brief description of such fruits and vegetables with relevant information on number of valorized products that can be prepared is described below:

4.1 Aonla

Aonla is amid such category of fruits which is available at a very low price during its peak production season and a variety of value added products can also be prepared. It has been in use for jam, jelly, segments, pickle, preserve, *chavanprash*, candy, juice, squash, mouth freshner etc. There are established machineries for different unit operations of aonla processing with variable capacity and efficiency. The major unit operations include grading, pricking, shredding, juice extraction and drying. There are machineries available for each of the unit operation. Few tools/machineries were fabricated and few were procured and arranged sequentially under pilot plant facility at ICAR-CIPHET Abohar (Punjab). Description of the machineries is as follows:

Table 1: Machineries to be used for aonla processing

S	Machine	Specifications	Picture
1.	Aonla harvester	<ul style="list-style-type: none"> Consists of a stainless steel pipe with a hook type structure and a net structure composed in such a way that it surrounds the tree system The hook on the top of harvester is mired to the branch and shaken vigorously 	

	<ul style="list-style-type: none"> The fruits are collected by the surrounded net. Capacity: 5-6 trees/h or 6 kg/min aonla 	
2. Aonla size grader	<ul style="list-style-type: none"> Based on size grading of aonla fruits and has a capacity of around 350-400 kg/h It consists of 10 cylindrical rollers made of PVC plastic which are placed at an inclination of 3-10° from horizontal Machine grades Aonla into three sizes i.e. below 20 mm; 20-40 mm and 40-60 mm Grading efficiency was 75%. 	
3. Aonla pricking machine	<ul style="list-style-type: none"> The machine consists of a feed hopper, pricking part and outlet. About 50-70 holes are made on each fruit before it comes out of the machine Capacity to prick: 100 kg/h 	
4. Aonla shredding machine	<ul style="list-style-type: none"> Power operated machine is designed for extracting whole stone from Aonla Aonla gets scraped continuously by the rotating blades, against the concave and shreds are obtained Capacity: 250-300 kg/h 	
5. Aonla pulper	<ul style="list-style-type: none"> Fruits are first heated in water for about 10-15 min to separate the segments from the stone Pulp is extracted by addition of water equal to the weight of segments and passing through pulping machine. 	
6. Heating kettle	<ul style="list-style-type: none"> Can be used for concentration of fruit juice/pulp. Capacity: 100 kg 	

7. Tray dryer	<ul style="list-style-type: none"> • For dehydration of aonla shreds or stones to make value added products like mouth freshener and powder etc. 	
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Establishment of Aonla processing plant

Government institutes like ICAR, SAU's etc. have given consultancy to establish aonla processing plant in the production catchments of some progressive farmers/entrepreneurs. Such type of technical guidance was given to Mr. Kailash Chaudhary, by ICAR-CIPHET Ludhiana and the established firm is named as Chaudhary Agro Bio- Tech, Keeratpura, Kotputali, Dist. Jaipur (Rajasthan). At present, this industry is involved in making value added products from aonla like juice, powder, candy, squashes, pickles, sweets and exporting to countries like USA, UK, UAE and Japan under brand name of KS BIO FOODS besides the domestic sale.

4.2 Kinnow

Kinnow is a high yielding hybrid mandarin in Punjab (India) having 48182 ha area under this fruit with production about 1.11 million tonnes in 2014 -15. It is also grown to some extent in Rajasthan, Haryana, Himachal Pradesh, Jammu and Kashmir, Maharashtra, Tamil Nadu and Karnataka also. Kinnow is grown in all the districts of Punjab but Fazilka and Hoshiarpur are the main kinnow growing districts followed by Firozpur, Faridkot and Amritsar. In Punjab, Kinnow occupies 55% of the area under citrus. The overall post-harvest losses in kinnow were earlier about 25-30%, however, subsequent the establishment of waxing and grading plants in Punjab and Rajasthan, the losses are reduced to below 15%.

Harvesting and post-harvest handling operations of kinnow in pack houses.

With respect to Kinnow, the general pack house operations after fruit harvest include washing, waxing and grading. The sequential operations by means of a pictorial flowchart are shown below (Fig 1).

Machines used for kinnow waxing, grading and packaging

- Feeding cum sorting conveyer
- Washing, sponging and waxing machines
- Waxing unit
- Drying section

- Grader
 - Rotary cylinder Grader (Reel grader)
 - Roller Grader
- Packaging
 - Regular slotted corrugated board box:\
 - Telescopic corrugated board box
- Accessories:
 - Plastic crates: (18-20 kg capacity)
 - Labeling and sealing equipment
 - Quality inspection tables
 - Fork lift: used for lifting of crates, bags or packed kinnow boxes
 - Conveyors

Sponging

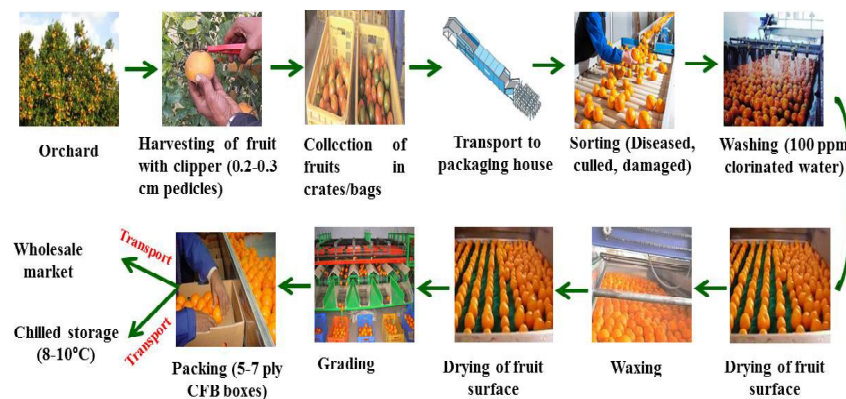


Fig. 1. Pictorial view of pack house operations of Kinnow fruit

Fruit and Vegetable pilot plant established at ICAR-CIPHET Abohar

A pilot plant for processing and value addition of Aonla has also been established at ICAR-CIPHET Abohar. This facility holds the purpose of demonstration and providing hands on training for the upcoming entrepreneurs who wish to have such type of facility at their vicinity for Aonla processing and product development. The fruit processing plant established at ICAR-CIPHET Abohar comprises of following machineries-

Table 2: Machineries available in fruit and vegetable processing pilot plant

S. No.	Machine	Capacity	Operation of machine
1.	Fruit washer	100-200 kg/h	Washing of fruits
2.	Fruit crusher	40-50 kg/h	Crushing of fruits into pulp
3.	Juice extractor	80-100 kg/h	Juice extraction from fruits
4.	Juice pasteurizer	100 l/h	Pasteurization of fruit juice
5.	Storage tank	100kg	Handling of product
6.	Steam jacketed kettle	100 liters	Concentration of product
7.	Vacuum bottle filling machine	0-1000 ml, Filling speed: 20-30 bottles/ min	Bottle filling of products
8.	Bottle Crowning Machine	100-150 bottles/h	Placing of crown over bottles
9.	Blancher Container	50kg	Blanching of fruits

Common utilities available in plant are listed below:

- a) Baby boiler
- b) Tray dryer
- c) Sealing or packaging machine
- d) Vacuum packaging machine
- e) Weighing machine
- f) Material handling devices and utilities
- g) Volume measuring devices

The facilities of established pilot plant are being used by the entrepreneurs for preparation of several value added products from fruits like Aonla, Mango, Guava, Kinnow, Sapota, Plum etc. Further the value added products that can be prepared using the established pilot plant from different fruits is given below:

Table 3: Value added products that can be prepared from listed fruits

Commodities	Value added products
Aonla	Whole aonla/ segment based products: Preserve (Murabba), aonla candy, aonla pickle Juice based products: Aonla juice, squash, Ready

	to Serve (RTS) beverage Aonla powder based products: Aonla shred powder, mouth freshner, churan Other products: Laddu, dry shreds, jam, sauce, chutney
Mango	Pulp based products: Slices/ amchur, leather/ aampapad/ slab/ amawat, jam, preserve chutney, toffee Segment based products: preserve (Murabba), candy, pickle Juice based products: juice, squash, nectar, Ready to Serve (RTS) beverage
Pomegranate	<i>Anardana</i> , frozen arils, seed oil, juice, squash, RTS, nectar, jam, jelly, peel powder
Guava	Pulp, squash, juice, RTS, nectar, jam, jelly, leather, cheese, toffee
Sapota	Pulp, squash, RTS, nectar, jam, jelly, leather, dried shreds, powder
Plum	Squash, jam, jelly, chutney, sauce
Kinnow	Juice, squash, syrup, marmalade, candied peels
Tomato	Puree, ketchup, sauce, soup, peel powder, dried slices, lycopene
Potato	Chips, shreds
Onion and Garlic	Dried flakes, powder, paste
Okra	Dried slices
Chilli	Paste, powder, puree, pickle, <i>chutney</i>

5. ENTREPRENERIAL OPPORTUNITIES IN FRUITS AND VEGETABLES AND THEIR RESOURCES

Overcoming challenges can be a game changer in augmenting opportunities to setup entrepreneurship in fruits and vegetable business. Some of the challenges and opportunities are been discussed here under

1. Post-harvest loss and their preventive measure

The fruit and vegetable segment has grown vigorously both in volume and in variety of outputs which are traded globally. Improved and precise technology, falling transportation costs, improved channelized marketing and evolving international markets, have all contributed towards robust growth. This increased level of fruit and vegetable output has, unfortunately, mismatched by processing, value addition, preservation and certainly developments in supply chain management. While minimal and traditional processing technologies present considerable opportunities for innovation and vertical diversification in the fruit and vegetable sector, relatively few small and medium enterprises (SMEs) are able to tap into and benefit from these opportunities.

Foreign Direct Investment (FDI) of 100% in food industry and streamlining the norms to set up business unit has increased the number of processing unit in India. Further, 100% FDI under Government route for retail trading through e-commerce, is permitted in respect of food products manufactured and/or produced in India. Establishment of 42 mega food parks, a primary processing center for grading, sorting, packing and collection center various producers. Agro-Processing Cluster (APC) enables to facilitate modern infrastructure, common facilities and encourages group of entrepreneurs to set up food processing units based on cluster approach by linking groups of processors with farmers/ producers and markets through well-equipped supply chain.

2. Challenges and avenues in cold chain

The estimated annual production of fruits and vegetables in the country is about 130 million tones. This accounts for 18% of our agricultural output. Due to diverse agro climatic conditions and better availability of package of practices, the production is gradually rising. Although, there is a vast scope for increasing the production, the lack of cold storage and cold chain facilities are becoming major bottlenecks in tapping the potential. The cold storage facilities now available are mostly for a single commodity like potato, orange, apple, grapes, pomegranates, flowers, etc. which results in poor capacity utilization.

As per National Centre for Cold-chain Development (NCCD), the Current gap in cold storage infrastructure estimated to be 40 million metric tons. The investment is expected to grow rapidly in India's cold chain in next 5 to 10 years. For instance, refrigerated transport, it is required 3 times the present infrastructure to handle full service in storage capacity i.e the current estimate of refrigerated transport shows that the available on road capacity is of 3.6 million MT only. The other opportunities lays in testing cum certification labs, research and framework development centers, training centers, IT network, handling and packaging equipment. Moreover, service tax has been exempted for various project erections pertaining to cold storage.

3. Fruits and vegetable exports

With production base of fruits and vegetable, India has tremendous opportunities for export. During 2017-18, India has exported fruits and vegetables worth Rs. 9,400 crores. But, India's share in the

global market is still nearly 1% only, but there is an increasing acceptance of fruits and vegetables from the country especially for Pomegranates, Mangoes, Grapes, Bananas, Walnuts in fruits and Onions, Mushrooms, Bitter Gourd, Okra, Chillies and Potatoes from vegetables. This may be due to concurrent developments in the post-harvest management such as quality assurance, packaging, strict regulation, standard operating procedures, cold chain infrastructure etc. Even large investment pumped in by public sector as well as initiatives of private sector with APEDA's assistance integrated post-harvest handling facilities and several centers for perishable cargoes and have been set up in the country. Initiatives to build capacity building at the farmers, processors and exporters' levels have also contributed towards this effort. These are some of the key factors have placed the food processing industry on a high growth track as reflected by the increase in food processing from 11 per cent in 2009 to 17 per cent in 2017.

4. **Technology delivery systems**

- a. **Farm level intervention:** Enabling farmers to cultivate multiple superior varieties with higher juice and brix content with distributed production. A distributed time for yielding varieties prevents glut and ensures stabilized prices, making lesser market risk for farmers. Development of clusters at different places for same agriculture commodity can create forward and backward linkage with better logistics and marketing channels. Consultancy on farm extension and sustainability are the fast and thrust area to grow entrepreneurs at full scale.
- b. **Industry level intervention:** Processor level interventions in citrus and apple fruits may get tax exemptions and financial subsidies for capacity expansion and improving the financial viability of existing units. The government is keen in looking at subsidizing the integrated units to setup for by-product processing.
- c. **Corporate level interventions:** Fragmented lands are often considered the biggest challenge for Indian agriculture; however, there has been success of a cooperative system in the fragmented dairy sector. There could be projects to address all aspects of fruit juice concentrate processing thus leading to a Fruit Circular Economy. These projects can be new venture in terms of developing new varieties, farm extension services and providing e-marketing, digital market linkage to the farmers.

6. RESOURCES FOR AUGMENTING HORTI-ENTREPRENEURIAL OPPORTUNITIES

- Agro processing clusters set up by Project Execution Agency (PEA)/ Organization such as Govt/PSUs/ Joint Ventures/ NGOs/ Cooperatives/ SHGs/ FPOs/ Private Sector/ individuals etc. and are eligible for financial assistance.
- Under central governments scheme SAMPADA, financial assistance in setting up integrated cold chain, preservation and value addition infrastructure facilities are provided with an objective to arrest post-harvest losses of horticulture produce by providing infrastructure from farm gate to the consumer
- Under PMKSY Scheme for Infrastructure for Agro Processing Clusters, which aims at development of modern infrastructure to encourage entrepreneurs to set up food processing units based on cluster approach
- Technical Agencies (TA) of Ministry of Food Processing Industry (MoFPI) will be organizing capacity building workshops, training for Board of Directors (BoDs), business planning and other key members of the FGs on entrepreneurship and management related to food processing.
- Scheme under APEDA which provides financial assistance for development of an adequate infrastructure for export of agricultural products. The scheme covers fresh produce and processed food products. Its primary role is on setting up of post-harvest handling facilities to entrepreneurs.
- Indian Institute of Horticultural Research (IIHR) provides on-site incubation facility in order to encourage start-ups in fruit and vegetable processing
- Food Processing Training centres (FPTC) established under various institutes recognized by MoFPI imparts training on various areas such as cluster creations, processing of fruits and vegetables, framework and export regulations, analysis procedure, startups to producers, entrepreneurs etc.

7. ECONOMICS INVOLVED TO TAKE UP THE VENTURE FOR ENTREPRENEURSHIP DEVELOPMENT

Indian Council of Agricultural Research (ICAR) in its Consortium

Research Platform (CRP) project scheme has directed the respective institutes for establishment of pilot plants with respect to processing and value addition of fruits, vegetables, spices, oilseeds, grains etc. These established are serving as training cum incubation center for the local farmers/entrepreneurs. They can process their raw material under the guidance of trained professionals of the institute. The operating cost is also very minimal so as to encourage the local community for processing of raw produce. Utilizing the incubation facilities will not only ease the whole process for the farmers but also the collaboration with institutes will help them in gaining authenticity of their processed produce. ICAR-CIPHET is actively engaged in conducting entrepreneurship development programs (EDP's) on different aspects of processing of cereals, oilseeds, horticultural produce etc. The duration of such trainings will vary from 3-5 days and the fee structure also varies with technology/product.

Suggestions for further improvement in EDP (Dixit et al. 2014)

- The nomination of participants to the training must be based on certain criteria based on need assessment, willingness, socio-economic status, occupation, resources availability and market accessibility etc.
- There must be a continuous monitoring system of trained entrepreneurs so as to keep them updated with changing technological and market environment.
- Awareness on marketing aspects and funding source are vital and guidance should be given to the participants.
- The basic information about the 'Food safety and standards' and procedural guidelines for acquiring license from Government or any other authorized body.
- The fees should be waived off so as to increase the number of interested participants.

8. CONCLUSION

India abides to its agro climatic condition is a place suitable for growing wide range of fruit and vegetables. The post-harvest losses while handling and marketing are substantial and processing of these horticultural produce into various kinds of value added products not only stabilizes the market, it also creates opportunity for employment of rural youth which in turn will help in increasing the farmers income. The role of entrepreneurship in agro-processing in developing countries like India is very significant.

Entrepreneurship development programs conducted by ICAR-CIPHET have impacted well in terms of motivation and adoption of post-harvest technology. The establishment of processing units has resulted into economic benefits to the intended beneficiaries besides generating direct and indirect employment to the society. Finally, need based EDP's considering the socio-economic conditions, willingness, resources availability, geographical dimensions and market for final product are to be promoted so as to encourage processing in production catchments.

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