National Level

Collaborative Online Refresher Training Programme

on

"Value Addition Opportunities in Fruits"

for

Established Agripreneurs under Agriclinic and Agribusiness Centre Scheme

December 29 - 31, 2021

COMPENDIUM

ASPEE Agribusiness Management Institute (AABMI), NAU, Navsari

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Acknowledgement

India is ranked second in fruits and vegetables production in the world. Despite abounding with great horticultural produce, India lags behind when it comes to value addition and processing of fruits and vegetables.India, being a leading producer of fruits and vegetables, has immense potentialto leverage this agricultural bounty by adding value to its produce and making the produce more remunerative.In this regard value addition to horticultural products has numerous advantages for all stakeholders. As besides enhancing the shelf life of the product and reducing food wastage, value addition leads to higher monetary return for the food and beverage industry. In this context ASPEE Agribusiness Management Institute, Navsari Agricultural University, Navsari in collaboration with National Institute of Agricultural Extension Management (MANAGE), an apex level autonomous organization under Ministry of Agriculture and Farmers Welfare, Govt. of India organized **National Level Collaborative Online Three Days Refresher Training Program** on **"Value Addition Opportunities in Fruits"** under **Agriclinics &Agribusiness Centre Scheme** during **29-31 December, 2021.** This Refresher training program wasorganized for the successfully established Agri-ventures under Agri clinics and Agribusiness Center Schemefrom all over India.

Weextend our sincere gratitude to Dr. Z.P. Patel, Vice Chancellor, Navsari Agricultural University, Navsari for his guidance, leadership and motivation for organizing Collaborative Online Three Days National Level Refresher Training Programme for established agripreneurs. We are grateful to Dr. P. Chandra Shekara, Director General National Institute of Agricultural Extension Management (MANAGE), Hyderabad for providing us the opportunity and financial support for organizing this refresher training programme. We express our sincere thanks to Dr. S. R. Chaudhary, Director of Research and Dean PG Studies, Navsari Agricultural University, Navsari for his support and encouragement. We are thankful to Dr. Shahaji Sambhaji Phand, Principal Coordinator (AC&ABC), MANAGE, Hyderabad for his guidance and support in this endeavor. We are thankful to Mr. Vinay Patidar, Consultant, MANAGE and whole MANAGE Teamfor all the necessary support.

We are very much thankful to all the distinguished experts for

sharing their expertise and providing valuable insights to the established Agripreneurs by delivering lectures and for making this Refresher Training Programme successful. We would like to express sincere thanks to Dr. Ruchira Shukla, Principal, AABMI and Training Director forconceptualizing this Three Days Refresher Training Programme and providing everlasting support and encouragement to the team. It is our pleasure to thank all the training coordinators, event organizing panel, IT department for providing all the assistance and help required for conducting Three Days Refresher Training Programme. We are highly grateful to all the participants who actively participated in the Three Days Refresher Training Programmefrom 11 states of the country and made this event a great success.

This Compendium is an effort to showcase the vision and outlook of our eminent experts on the theme “Value Addition Opportunities in Fruits” in form of lecture note. The compendium represents a wide variety of topics beneficial for the budding agripreneurs for enhancing their knowledge on the emerging areas. We are thankful to all the authors of the compendium for their valuable contribution. We are sure that readers shall get immense ideas and knowledge from this compendium.

Editorial Team

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Fruit Production and Consumption Trends in Indian Markets

Timur R. Ahlawat
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Introduction:

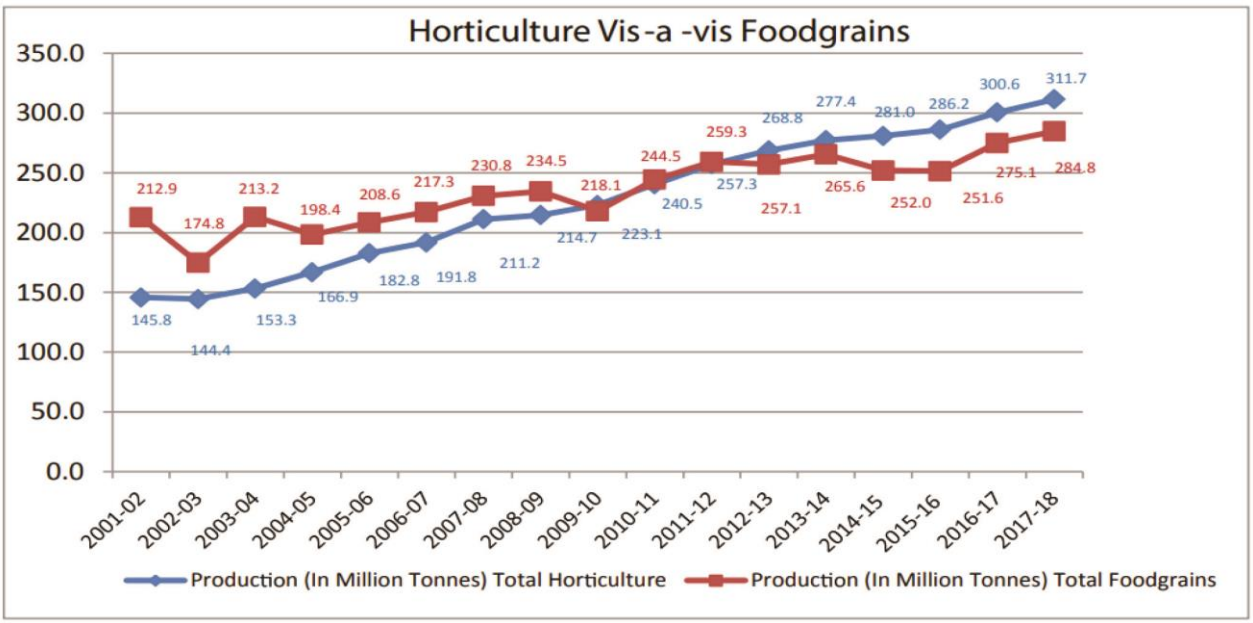
India's diverse climate ensures availability of all varieties of fresh fruits & vegetables. It ranks second in fruits and vegetables production in the world, after China. As per National Horticulture Database (Second Advance Estimates) published by National Horticulture Board, during 2019-20, India produced 99.07 million metric tonnes of fruits and 191.77 million metric tonnes of vegetables. The area under cultivation of fruits stood at 6.66 million hectares while vegetables were cultivated at 10.35 million hectares.According to FAO (2019), India is the largest producer of ginger and okra amongst vegetables and ranks second in production of potatoes, onions, cauliflowers, brinjal, cabbages, etc. Amongst fruits, the country ranks first in production of Bananas (26.08%), Papayas (44.05%) and Mangoes (including mangosteens and guavas) (45.89%).The vast production base offers India tremendous opportunities for export. During 2020-21, India exported fruits and vegetables worth Rs. 9,940.95 crores/ 1,342.14 USD Millions which comprised of fruits worth Rs. 4,971.22 crores/ 674.53 USD Millions and vegetables worth Rs. 4,969.73 crores/ 667.61 USD Millions.Grapes, Pomegranates, Mangoes, Bananas, Oranges account for larger portion of fruits exported from the country while Onions, Mixed Vegetables, Potatoes, Tomatoes, and Green Chilly contribute largely to the vegetable export basket.

The major destinations for Indian fruits and vegetables are Bangladesh, UAE, Netherland, Nepal, Malaysia, UK, Sri Lanka, Oman and Qatar.Though India's share in the global market is still nearly 1% only, there is increasing acceptance of horticulture produce from the country. This has occurred due to concurrent developments in the areas of state-of-the-art cold chain infrastructure and quality assurance measures. Apart from large investment pumped in by the private sector, public sector has also taken initiatives and with APEDA's assistance several Centers for Perishable Cargoes and integrated post harvest handling facilities have been set up in the country. Capacity building initiatives at the farmers, processors and exporters' levels has also contributed towards this effort.

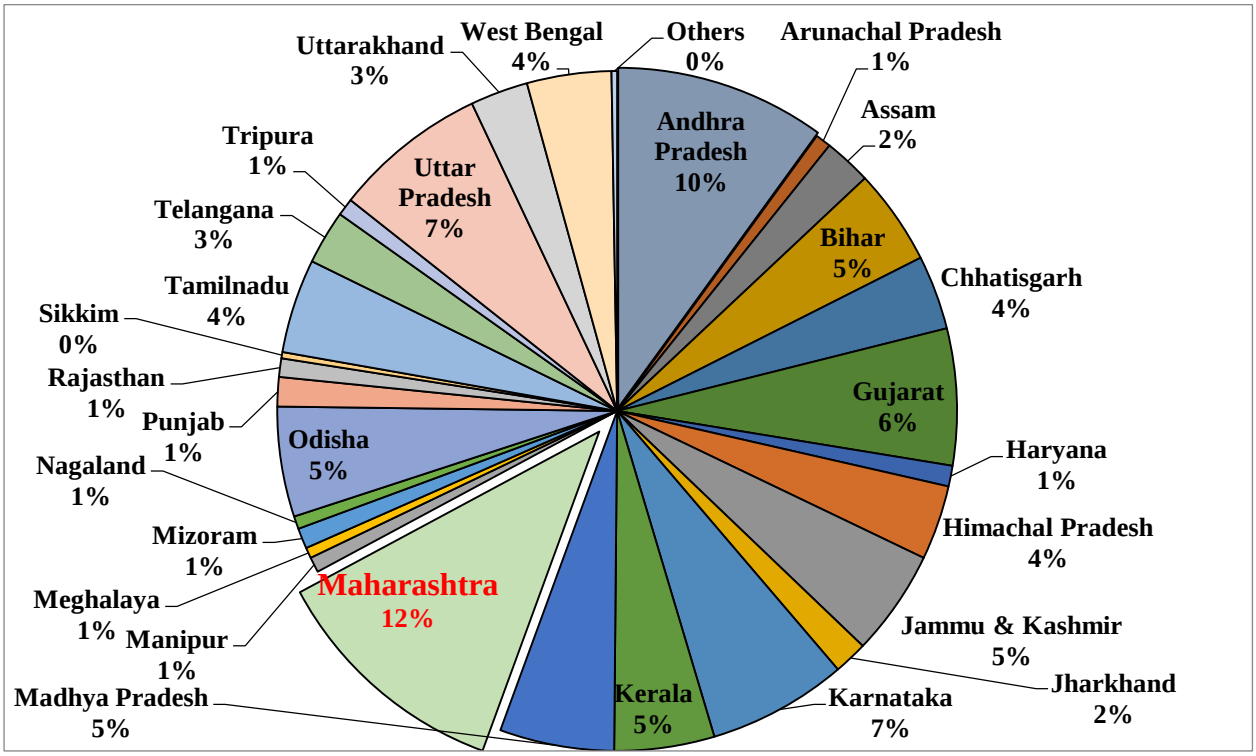
Overview of Horticulture Sector:

Resultantly, horticulture has moved from rural confines to commercial venture. T he Department of Agriculture, Co-operation & Farmers Welfare (DAC&FW) of the Ministry of Agriculture & Farmers Welfare is the nodal department for over viewing horticulture development in the country. It implements different programmes through Departments of Horticulture/Agriculture in all the States and provides the leadership to coordinate activities for the promotion of horticulture. However, efficient implementation of programme and policies call for robust information in time. In this backdrop, this book presents the overall information on horticulture focusing area, production and yield estimates apart from the information about crops price, market arrivals and export. The scenario of horticulture crops in India has become very encouraging. The percentage share of horticulture output in Agriculture has become 33%. Under the purview of Agriculture & allied activities, the share of plan outlay for Horticulture which was 3.9% during IX Plan, has increased to 4.6% during the XII Plan.

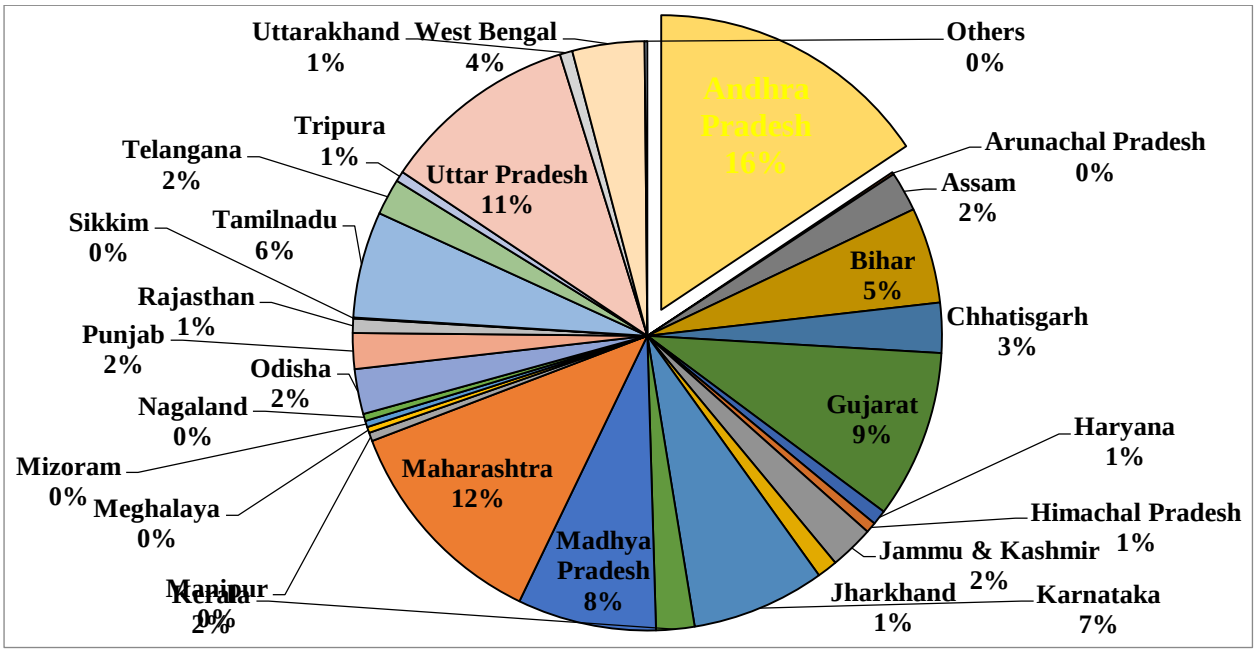
Horticulture Production in India: India has witnessed increase in horticulture production over the last few years. Significant progress has been made in area expansion resulting in higher production. Over the last decade, the area under horticulture grew by 2.6% per annum and annual production increased by 4.8%. During 2017-18, the 2 Horticultural Statistics at a Glance 2018 production of horticulture crops was 311.71 Million Tonnes from an area of 25.43 Million Hectares.



State-wise Area of fruit Crops of the year 2017-18

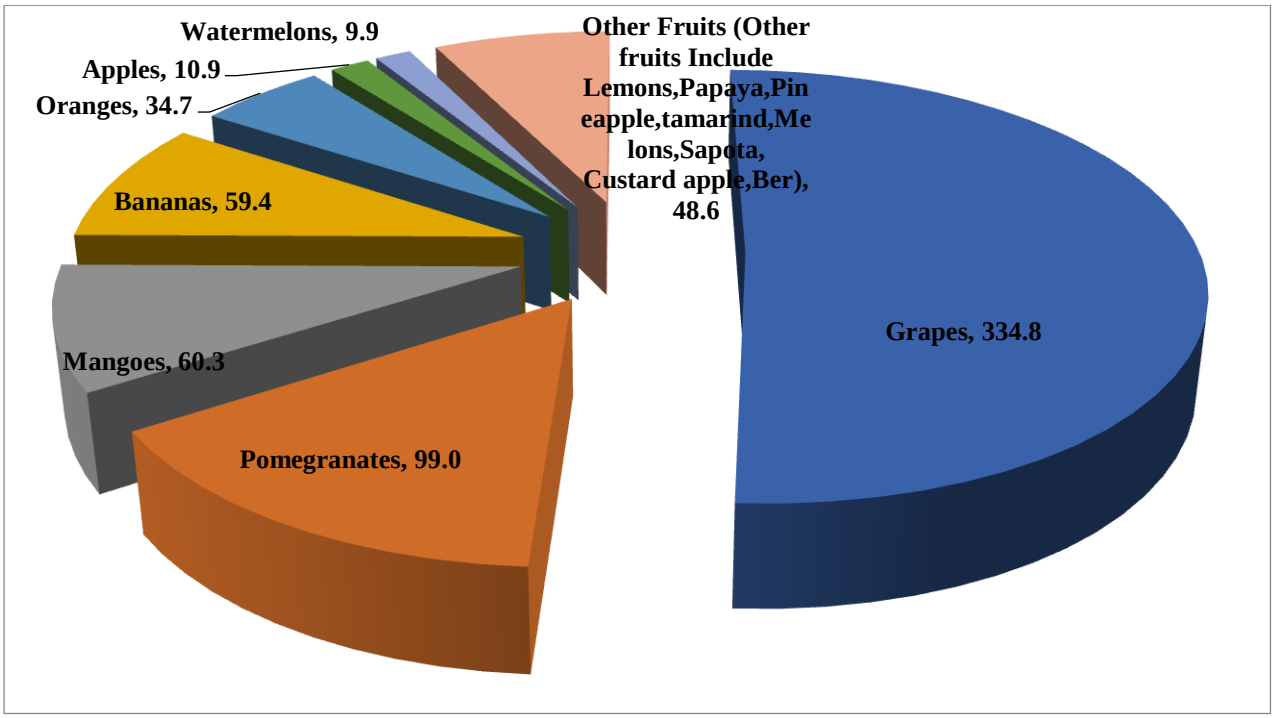


State-wise Production of Fruit Crops of the year 2017-18

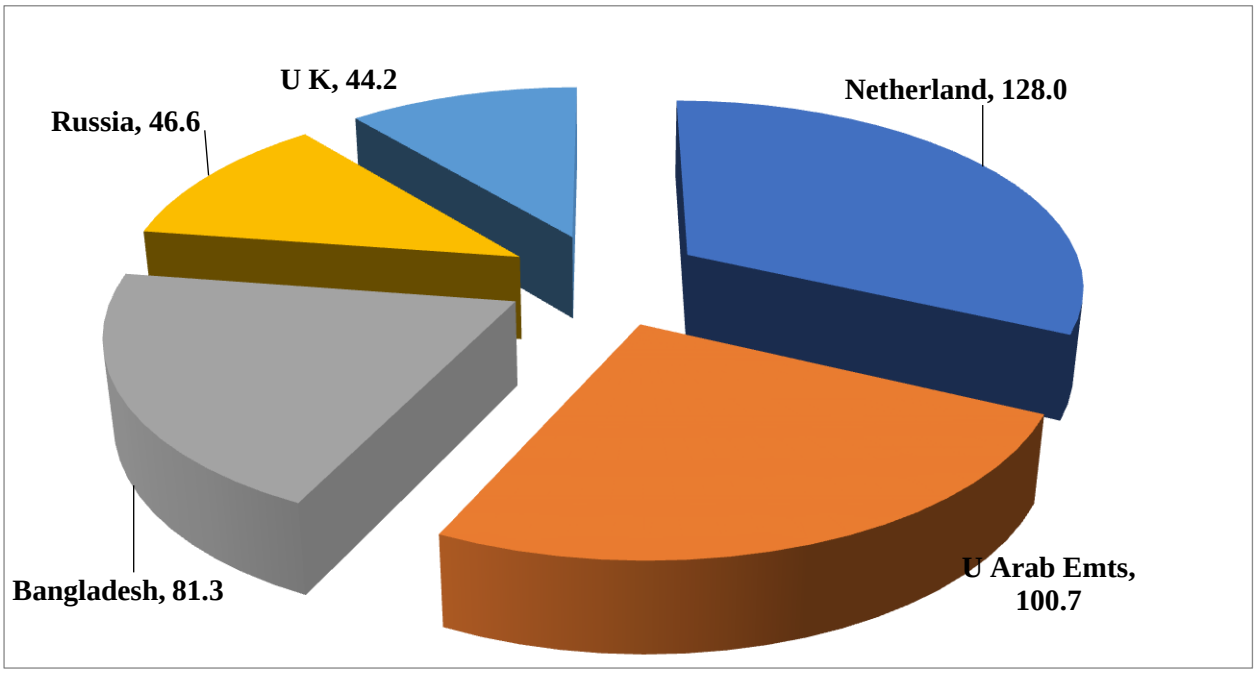


Source: Horticulture Statistics Division, Department of Agriculture, Coop. & Farmers Welfare

Export of Fruits during 2018-19 (US$ Mill):



Major Export Destinations of Fruits 2018-19 (US$ Mill):



Source: Horticulture Statistics Division, Department of Agriculture, Coop. & Farmers Welfare

Critical Issues in Promotion of Horticulture Exports:

- Post harvest infrastructure gaps in the states
- Requirement of pest/Disease free zones for Horticulture
- Absence of new plant varieties is affecting the export oriented production
- Infrastructure gap at various airports/ Sea Ports/ Supply Chain
- Need for sea protocol in respect of certain products

Developments in consumer demand:

Although the Indian economy faces a downturn, demand for (premium) fresh produce is stable and focusing more on health aspects and in-home cooking while food delivery and ecommerce are on the rise – and are probably here to stay. This means different market approaches may be needed.

The Indian market is characterized by rising incomes as well as high income inequality (top 20% of consumers receive 45% of income). There is explosive growth in digital penetration and usage (560 million internet subscribers, 354 million mobile users). Cities like Bangalore, Hyderabad and Chennai are rapidly urbanizing. At the same time, social structures and norms are changing, leading to a growing demand for services that make life easier, premium products, and shortcuts to simplify buying decisions. Consumers increasingly use online and neighbourhood stores interchangeably. At the same time, fast-paced lives increase demand for nostalgia, 'Made in India' and simple choices.

As consumers increasingly eat outside of their home (post-Covid), they are expected to pay more attention to healthy choices. The impact of India's lockdown on fresh produce trade varies from city to city. India's largest ports are facing congestion as their container freight stations get clogged because importers and customs house agents are unable to take their consignment. Also, getting products from cold storage to end consumers can be challenging. India's apple market is slower than in previous years but is expected to improve in June/July as trade issues are resolved and the mango season ends. Demand is up for specific products such as citrus due to expected immune system benefits.

In the long-term strong growth is expected for the sector. The top 20 percent of India's population are mainly located in big cities, and are least impacted by the downturn. They are not expected to cut expenditures on food items by much.

Conclusion:

The need for diversification to horticulture sector was acknowledged by the Government of India in mid-eighties by focusing its attention on investment in this sector. Presently horticulture has established its credibility in improving income through increased productivity, generating employment and in enhancing exports.The development achieved in the horticulture sector is indicative of the fact that there is growing demand for horticulture produce. The past experiences have been rewarding for enhanced output from the investment. Availability of timely robust information in this sector will certainly improve the socio-economic conditions of Indian citizens by providing self-reliance besides environmental protection.

Entrepreneurship Opportunities through Fruits Processing and Value Addition

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Introduction

Food processing sector is considered as sunrise sector in India. India's food ecosystem offers huge opportunities for investments with stimulating growth in the food retail sector, favourable economic policies, and attractive fiscal incentives. Through the Ministry of Food Processing Industries (MoFPI), the Government of India is taking all necessary steps to boost investments in the food processing industry in India. The government has sanctioned 41 food parks funded under the Mega Food Parks Scheme of which 38 have final approval. As of 1 August, 2021 there are 22 Mega Food Parks functioning in the country. As per the Investindia portal [10], the key highlights of Indian food processing sector are mentioned below:

- The FDI in the food processing industry has increased 86 per cent during April-September in 2022 touching $410.62 mn compared to $220.42 mn in the corresponding period of the previous year.
- By 2025, India's food processing industry is expected to be worth over half a trillion dollars.
- By 2030, Indian annual household consumption to treble, making India 5th largest consumer.
- The major destination of Ready to eat export as per 2020-21 data are U.S.A (18.73%), U.A.E (8.64%), Nepal (5%), Canada (4.77%), Sri Lanka (4.47%), Australia (4.2%), Sudan (2.95%), U.K (2.88%), Nigeria (2.38%), Singapore (2.01%).
- 100% FDI is permitted under the automatic route in food processing industries in India.
- 100% FDI is allowed through the government approval route for trading, including through e-commerce in respect of food products manufactured or produced in India.

India is the second largest producer of Fruits & vegetables in the world. According to APEDA, India is the largest producer of vegetables such as ginger and okra and second largest producer of vegetables such as potatoes, onions, cauliflowers, brinjal, and cabbages. India is the largest producers of fruits such as Bananas, Papayas, and Mangoes. There is a huge opportunity in harnessing the potential of fruits and vegetables processing in India in the form of frozen (IQF), canned, pulp, puree, paste, sauces, snacks, dressings, flakes, dices, dehydration, pickles, juices, slices, chips, jams and jelly. Maharashtra, Andhra Pradesh, Uttar Pradesh, Gujarat, and Madhya Pradesh are the leading producers of fruits in India, having a combined share of around 56 per cent in the total fruits production. On the other hand, West

Bengal, Uttar Pradesh, Bihar, Madhya Pradesh, and Gujarat are leading vegetable producers in India, together accounting for around 56 per cent of the national production. As per the Investindia portal [11], the Government of India through the Ministry of Food Processing Industries (MoFPI) is also taking all necessary steps to boost investments in the food processing industry. The government has sanctioned 41 Mega Food Parks (MFPs) to be set up in the country under the Mega Food Park Scheme. Currently, 22 Mega Food Parks are operational in India.

Understanding the Entrepreneur and Entrepreneurship

The term 'entrepreneur' [8] does not appear often in the prehistory of economics. It is a word of French origin that enjoyed common, though imprecise, usage in the eighteenth century, as corroborated by Savary's Dictionnaire. Universel de Commerce (1723) defines an entrepreneur as one who undertakes a project; a manufacturer; a master builder. An earlier form of the word, entrepreneur, appears as early as the fourteenth century (Hoselitz 1960). Throughout the sixteenth and seventeenth centuries the most frequent usage of the term connoted a government contractor, usually of military fortifications or public works.

The Cantillon theory looks Entrepreneurs as Economic Agents. The crucial role of the entrepreneur in economic theory was first and foremost recognized by Richard Cantillon (1680-1734), whose Essai sur la Nature du Commerce enGénéral was published posthumously in 1755.

Cantillon recognized three classes of economic agents:

- landowners, who are financially independent
- entrepreneurs, who engage in market exchanges at their own risk in order to make a profit; and
- hirelings, who forego active decision-making in order to secure contractual guaranties of stable income (i.e., fixed wage contracts).

In general, the entrepreneurship is largely associated finding the gap in existing processes and innovating the product or process which solves an existing programme or concern at large. Ease of process and efficiency in resource, time and cost are important aspect of entrepreneurship. Some of the salient factors deriving opportunities for entrepreneurship in fruit and vegetable sector are:

- Increase in single person households
- Increase in middle-income populations
- Preference for less time for meal preparation
- Increased demand for convenience food items
- Increased sales of ready-to-eat meals and
- Increases in restaurant and fast food operations.

Entrepreneurship Opportunities through Food Processing

Fruits and vegetables are among theimportant sources of essential nutrients like Vitamin C, carotene, etc. Fruits and vegetables are more prone to spoilage than serious due to the nature

and composition. In India, fruits and vegetables are available throughout the year due to varying climatic conditions however a lot of produce is lost because of post-harvest losses and inferior quality or cut fruits and vegetables which are not suitable for table purpose. The surplus and marketable produce can be a good source of vital nutritional components in our food and feed and can help in bringing down the cost of production of processed foods. There is a need to consume or utilize it when is available in the bulk during peak season by converting them into the value-added nutritionally enriched processed products. This also gives rise for identifying the technological gaps and evolving low cost- low energy requiring efficient processing technologies.

Salient direct opportunities in Fruit and vegetable processing are:

- Farm management
- Fresh fruit and vegetable primary processing facilities development
- Establishment of pre-cooling and storage facilities
- Strengthening supply chain and market linkage infrastructure

Salient indirect opportunities in Fruits and vegetable processing are:

- Establish of processing and value addition facilities
- Skill trainings for employability
- Development of support systems required to strengthen linkages like machinery, packaging material, linkage with solar energy, etc

Practically any fruit and vegetable can be processed, but some important factors which determine whether it is worthwhile are:

1. the demand for a particular fruit or vegetable in the processed form
2. the quality of the raw material, i.e. whether it can withstand processing
3. regular supplies of the raw material

For example, a particular variety of fruit which may be excellent to eat fresh is not necessarily good for processing. Processing requires frequent handling, high temperature and pressure. Many of the ordinary table varieties of tomatoes, for instance, are not suitable for making paste or other processed products. A particular mango or pineapple may be very tasty eaten fresh, but when it goes to the processing centre it may fail to stand up to the processing requirements due to variations in its quality, size, maturity, variety and so on.Even when a variety can be processed, it is not suitable unless large and regular supplies are made available. An important processing centre or a factory cannot be planned just to rely on seasonal gluts; although it can take care of the gluts it will not run economically unless regular supplies are guaranteed.To operate a fruit and vegetable processing centre efficiently it is of utmost importance to pre-organize growth, collection and transport of suitable raw material, either on the nucleus farm basis or using out growers.The major sectors of food processing in fruits and vegetables offering entrepreneurship opportunities are beverages, juices, concentrates, pulps, slices, frozen and dehydrated products, potato wafers, chips etc.

Categorization of Food Processing

FAO [5] has categorized food processing into three broad sectors

1. **Primary Processing**- This type of processing involves basic processing of the natural produce which results in operations like cleaning grading sorting washing. This type of processing does not include major conversion of forms and primarily the non-destructive kind of processing. Processing also supports the maintenance of good quality of produce specially for the fresh market for table purpose utilization of fruits and vegetables.
2. **Secondary Processing**- This type of processing includes elementary modifications of natural foods which include packing, waxing, pulping, juice extraction, preparation and preservation of semi-finished products for later use, etc. This type of processing includes a kind of form reduction from high volume to low volume and also results in high value produce. This type of processing is the intermediary processing stage and, in the end,, product of this process act as a raw material for most of the tertiary processing which are high value added high quality and long shelf life products. For example: Pulp of mango which becomes the raw material for various other products like nectar, squash, jam etc.
3. **Tertiary processing**-This type of processing involves high level of modification and we alter the natural produce and make it ready for consumption. It is the final stage of volume reduction and value enhancement. This type of processing requires more technological interventions and results in standardized products for or market and consumers. Such type of products are with long shelf life and high quality products.

Categorization of Food Processing Systems

FAO [5] on the basis of scale of processing also categorize processing systems as mentioned below:

1. **Small-Scale Processing**-This is done by small-scale farmers for personal subsistence or for sale in nearby markets. In this system, processing requires little investment: however, it is time consuming and tedious. Small-scale processing satisfied the needs of rural and urban populations.
2. **Intermediate-Scale Processing**-In this scale of processing, a group of small-scale processors pool their resources. This can also be done by individuals. Processing is based on the technology used by small-scale processors with differences in the type and capacity of equipment used. The raw materials are usually grown by the processors themselves or are purchased on contract from other farmers. These operations are usually located on the production site of in order to assure raw materials availability and reduce cost of transport. This system of processing can provide quantities of processed products to urban areas.
3. **Large-Scale Processing**-Processing in this system is highly mechanized and requires a substantial supply of raw materials for economical operation. This system requires a large capital investment and high technical and managerial skills. Because of the high demand for foods in recent years many large-scale factories were established in developing countries. Some challenges to large scale processing units were related to high labour

inputs and relatively high cost, lack of managerial skills, high cost and supply instability of raw materials, changing governmental policies, lack of adequate quantity and regularity of raw material supply to factories.

Value Addition Opportunities in Fruits

The value addition of fruits and vegetables [9, 17] can be taken up by various forms of processing which includes:

A) Fruit pulp preparation-Fruits like apples, pears, peach, apricot, plum was washed with acetic acid water or 0.1% HCL to remove dust and dirt and after removing leaves, stalks and other undesirable portions from fruits like strawberries are crushed with rollers. Plums, apricots and peaches are heated with water till they become soft and a pass-through wide mesh to separate the stone and skin. Cherries are also treated in the similar way. The stalks and stones of mangoes are and then passed through pulp crusher. Pineapple slices after coring are passed through the screw type of cancer to get fairly course pulp. In the case of loss skin oranges, the segments are separated and then passed through screw type of extractor to get pulpy juice. The pulp of fruits like banana, papaya, guava tomato, is also extracted and later used for making processed products like jam jellies, concentrates, nectors, etc. [13,18].

B) Juice preparation-Juice preparation is another important exercise through which the value added products of fruits and vegetables can be prepared. Processing technology employed for various fruits and vegetables required different set of equipment's for various unit operations in fruit juice processing. Fruits and vegetables are washed and thereafter passed through equipments for extracting juice, boiler/ concentrator, syrup mixer. Products like nectar, squash, concentrate, sharbat and syrups are prepared.

C. Dried and dehydrated products-Drying and dehydration are one of the most widely used method for preservation it is usually accomplished by removal of water from fruits and vegetables. The presence of enough moisture facilitates the action of enzymes and growth of microorganisms. Hence, by removing water content below a certain level at which the enzyme activity and growth of microorganisms is affected adversely, the fruits and vegetables can be preserved for a fairly long period of time. The dried and concentrated fruits and vegetable products are also called as high sugar high acid foods or high value low volume foods. These dried or concentrated products save energy, money and space in shipping, packaging, storage and transportation.

E. Steeped products-Fruit and vegetable processing is important agro based industry the main purpose of protection of food against spoilage and to help retain their valuable nutrients the preservation of fruits and vegetables in a steeping solution involving permissible chemical preservatives and other food additives. It is one of a non-thermal alternate processing technology which is cheap and easy to operate having considerable scope for adoption in developing countries. This intermediate technology is easy to follow economical and save valuable nutrients.

Key Opportunities in The Fruit And Vegetable Sector in India

A. Opportunities in fruit and vegetable supply chain

A large set of activities besides purchasing is part of supply chain management. Each of these seemingly diverse activities is part of a network that will define how efficiently and effectively goods and information flow across a supply chain [14, 20]. The activities include:

- **Purchasing:** Most organizations include purchasing as a major supply chain activity since purchasing is the central focus.
- **Quality control:** Almost all organizations recognize the importance of supplier quality and the need to prevent rather than simply detect quality problems. Progressive organizations work directly with suppliers to develop proper quality control procedures and processes.
- **Demand and supply planning:** Demand planning identifies forecasts of anticipated demand, inventory adjustments, orders taken but not filled and spare part and after-market requirements. Supply planning is the process of taking demand data and developing a supply, production, and logistics network capable of satisfying demand requirements.
- **Material or inventory control:** The material group is often responsible for determining the inventory level of finished goods required to support customer requirements, which emphasizes the physical distribution (i.e., outbound or downstream) side of the supply chain. The inventory control group is often responsible for determining the inventory level of finished goods required to support customer requirements, which emphasizes the physical distribution (i.e., outbound or downstream) side of the supply chain.
- **Order processing:** Order processing helps ensure that customer receive material when and where they require it. It represents a link between the producer and the external customer.
- **Production planning, scheduling and control:** Production planning, scheduling and control involve determining a time-phased schedule or production, developing short-term production schedules, and controlling work-in-process production. vii. Warehousing / distribution: Warehousing / distribution is particularly important for companies that produce according to a forecast in anticipation of future sales. viii. Customer service: Customer service includes a wide set of activities that attempt to keep a customer satisfied with a product or service.

  The initiative of Tamil Nadu Agricultural University and Michigan State University, worked together on a project "Building university capacity to improve fruit and vegetable supply chain development in India" funded by USAID through Association of Liason office, USA. The project lead to some key success stories like:

  i. Federation formed for the 'King of fruits': "Tamil Nadu Mango Growers' Federation" (TAMAFED)
  ii. Trading of mangoes goes online - a 'One India-One Market concept': Safal National Exchange (SNX), for Tothapuri mangoes in Krishnagiri district.
  iii. Tamil Nadu Growers go for EurepGAP certification
  iv. A unique 'Farmer owned Post-harvest Complex for banana'

v. "Farmer owned producer company" incorporated under Company Act and Wholesale Farmers'-Sandy

The other opportunities related to supply chain of fruits and vegetables are related with food safety services in implementation of HACCP systems/ consultant and auditing. The pre-requisites for such services would require that one must be professionally certified and trained to carry out such services [12].

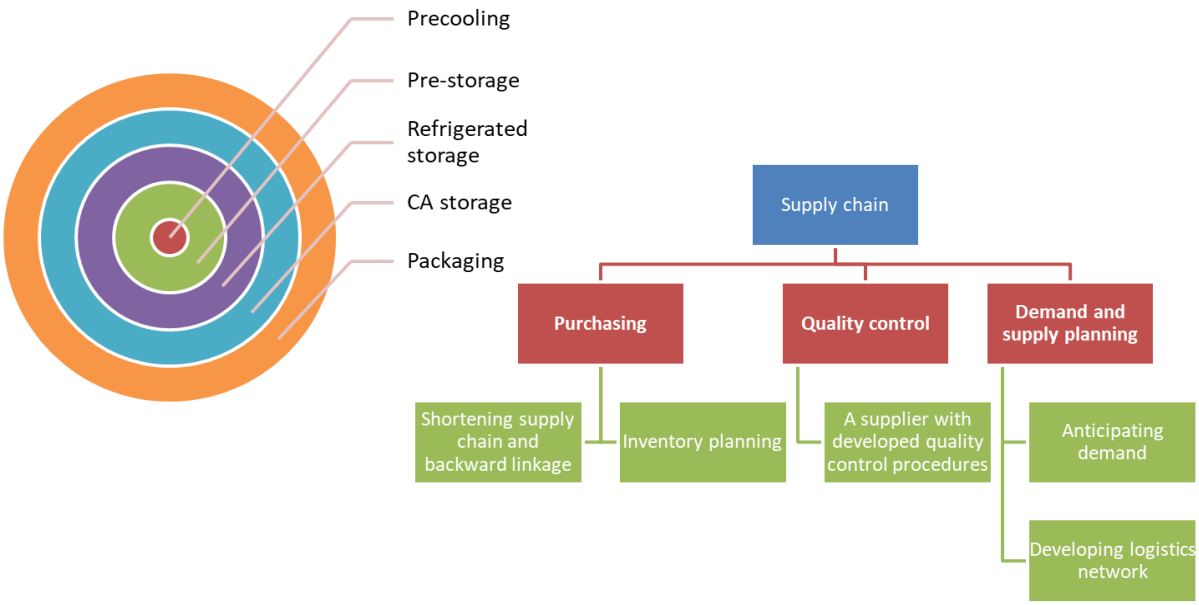

Fig: The key opportunities in supply chain of fresh fruits and vegetables

B. Opportunities of value addition through primary processing

One major opportunity while handling fresh fruits and vegetables lies in primary processing of harvested produce which mainly includes cleaning, washing, sizing and grading of horticulture produce followed by operations like waxing and packaging [21]. The sizing and grading can be done on physical characteristics like shape, size, weight, color, specific gravity, etc. The opportunities could be explored through various graders and sorting machines. This helps to fetch better prices for the produce and offers good quality to consumers. This operation also helps to remove unwanted and poor quality produce from the bulk and in turn results in better shelf life during storage.

Fig: Different types of roller and sizers

C. Opportunities with ripening of fruits

One of the upcoming opportunities with fruits is use or ripening chambers to obtain uniform and safe ripening of fruits [16]. Fruits like mango, banana, papaya, guava, melons, pears, etc are widely subjected to such ripening process. The de-greening operation for oranges and selected citrus fruits can also be accomplished using such facility. A ripening chamber comprises of following components:

- Air tight room with insulation
- Temperature control for cooling and heating
- Air circulation and ventilation system
- Humidity control system
- Electric control system
- Ethylene gas injection system

The major benefits of this technology are:

- Controlled ripening
- Safe than conventional method
- Uniform color
- Better market acceptance of produce
- Better shelf life

D. Opportunities with drying and dehydration of fruits and vegetables

Drying or dehydration is a simple, low cost way to preserve food that might otherwise be spoiled. Drying is the removal of moisture from food to a certain level at which microorganisms cannot grow. Dehydration is the removal of moisture under controlled temperature and humidity condition without impairing the inherent quality of the products. Traditionally, the fruits and vegetables were exposed to direct sunlight for drying. In modern times, it is being done using specialized machines. Dried and dehydrated fruits and vegetables can be used successfully for different food preparations and for preparation of instant soups, baking, dairy and confectionery products.

Some salient examples of dried and dehydrated products [3, 4] are mentioned below:

Sl. No	Name of the crop	Dried and dehydrated products
1	Mango	Mango powder, mango lather
2	Banana	Banana chips, dried banana
3	Grape	Raisin
4	Date palm	Dried date palm
5	Apple	Dried apple
6	Pear	Dried pear
7	Peach	Dried peach
8	Anola	Dried shred of anola
9	Pomegranate	Anardana (dried pomegranate)
10	Fig	Dried fig
11	Potato	Potato chips, potato flour, papad
12	Tomato	Dried tomato, tomato powder
13	Chilli	Dried chilli, chilli powder
14	Cauliflower	Dried cauliflower
15	Cabbage	Dried cabbage
16	Garden pea	Dried pea
17	Turnip	Dried turnip
18	Onion	Dehydrated onion, onion powder
19	Garlic	Dehydrated garlic, garlic powder
20	Pumpkin	Pumpkin lather

E. Opportunities with frozen fruits and vegetable products

Frozen foods are part of niche segment and supports year round supply nutritious food. Foods which are with appreciable amount of water are only subjected to freezing preservation (80% or more). Freezing process entails two major parts:

- Lowering of temperature of food
- Change of water phase from liquid to solid

The freezing of water gives rise to formation of ice crystals. If freezing rate is high, a large number of small ice crystals are formed which help in protection of structural integrity, textural and rheological properties of food (-80- to -100 degreecel.) At -15 degreecel. more than 80 percent of total water in food gets transformed into ice. In the particular case of fruits and vegetables, dehydro-freezing has been successfully used, since part of the water is removed before freezing, thus being an advantage for plant texture preservation. Fruits and vegetables needs special treatments like blanching / Osmo blanching in sugar or salt before freezing. There are reports indicating that vegetables like spinach, green peas, cauliflower can be kept up to 187 days; 305 days and 295 days respectively under -18 degree cel..

In 2018, the Indian frozen foods market reached a value of around Rs 74 billion. The market is further projected to reach a value of Rs 188 billion by 2024, expanding at a CAGR of around 17% during 2019-2024. McCain Foods, Venky's, Mother Dairy, Godrej Tyson Ltd, Hyfun Foods, AlKabeer Group and Innovative Foods (Sumeru) are some of the key players in the Indian frozen foods market. The freezing technique employed in fruits and vegetables assists in retaining the colour, flavour and nutritive value of these products. The residual moisture is converted into ice by freezing, which prevents the growth of bacteria and hence slows down the decomposition. The spoilage of fruits and vegetables during transportation and exposure to light, heat and dust is also reduced by employing freezing technology. Frozen fruits and vegetables offer numerous benefits which include low cost, easy preparation and availability during the off-season [2]. Frozen peas, corn, cauliflower, spinach, beans are some very popular products [6, 7].

F. Opportunities with minimal processing of fruits and vegetables

Minimally processed fresh fruit and vegetables (MPFVs) are commonly defined as any fruit and vegetable that has been subjected to different processing steps (e.g., peeling, trimming, cutting, washing, disinfection, rinsing, etc.) to obtain a fully edible product while providing convenience and functionality to consumers and ensuring food safety. These commodities contain exclusively natural ingredients, and are bagged or prepacked in polymeric films able to generate optimal modified atmosphere packaging (MAP) conditions, and they are kept under chilling until consumption. MPFVs have similar characteristics to the whole original fruit or vegetable, and they usually need no further processing before use, offering advantages for consumers because, in addition to convenience, they have high quality and they produce little waste at a reasonable price [1]. This requires high level of hygiene in the processing area and cold chain. Since the operations like cutting and trimming create wounds on the surface of the produce and opens up the internal environment of fruit and vegetables, Toslow down deterioration, storage temperature is the single most important factor affecting the spoilage of MPFVs. However, there are many other preservation techniques used by the MPFV or fresh-cut industry, such as antioxidants, sanitizers, and MAP, as well as good manufacturing and handling practices in well-designed factories.

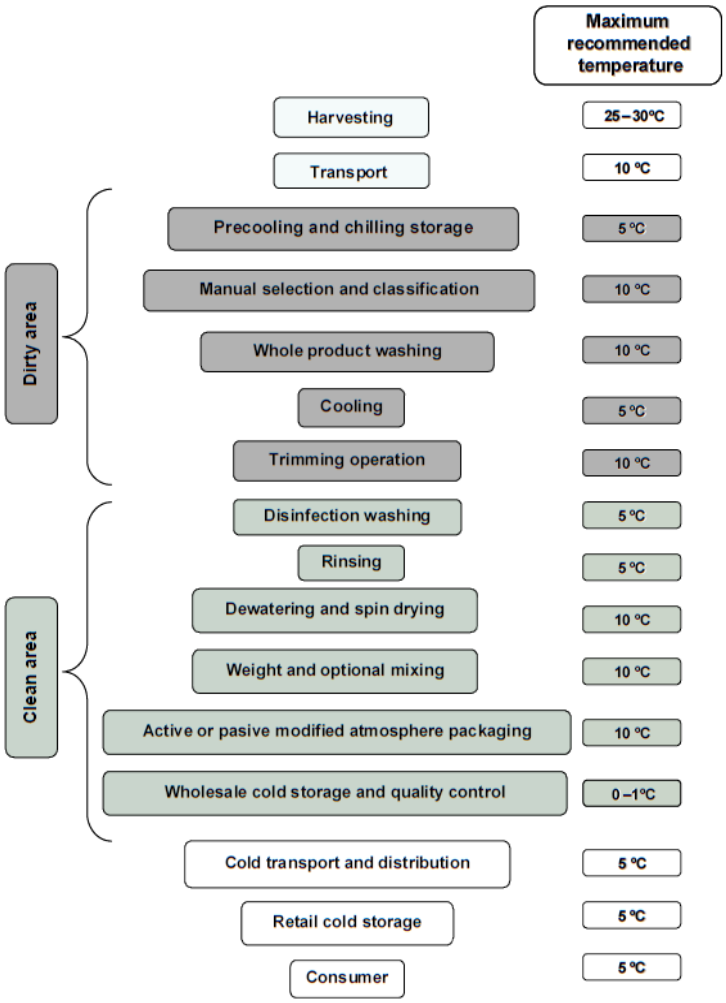

Fig: General unit operations in a processing plant of MPFVs and the maximum recommended temperatures for each processing step [1].

G. Opportunity through MoFPI to Promote Entrepreneurship (PM FME Scheme)

PM Formalisation of Micro food processing Enterprises (PMFME) Scheme, an initiative under AatmaNirbhar Bharat Abhiyan, is being implemented by Ministry of Food Processing Industries (MoFPI) with an outlay of 10,000 Crore over a period of 5 years from 2020-21 to 2024-25 [15]. The Scheme aims to augment the existing individual micro-enterprises in the unorganized segment of the food processing industry and formalize two lakh micro food processing enterprises with special focus on supporting groups such as Farmer Producer Organizations (FPOs), Self-Help Groups (SHGs) engaged in Agri-food processing sector, inter-alia, by providing:

a. Seed capital @ Rs. 40,000/- per SHG member for working capital and purchase of small tools

b. Support to food processing enterprises through credit-linked capital subsidy@35% of the eligible project cost with a maximum ceiling of Rs.10 lakh per unit
c. Credit linked grant of 35% for capital investment to FPOs/ SHGs/ producer cooperatives.
d. Support for marketing & branding to micro units
e. Training and capacity building

Further, MoFPI has identified products for each district under "One District One Product (ODOP)" and priority would be given to SHG manufacturing products mentioned under ODOP. The list of ODOP products selected by States is available on http://odop.mofpi.gov.in/odop.

The scheme lays focus on the ODOP approach and following are the eligibility on various components under the scheme:

a. Support to existing individual micro units for capital investment, preference would be given to those producing ODOP products. However, existing units producing other products would also be supported. In case of capital investment by groups, predominately those involved in ODOP products would be supported.
b. Support to groups processing other products in such districts would only be for those already processing those products and with adequate technical, financial and entrepreneurial strength.
c. New units, whether for individuals or groups would only be supported for ODOP products.
d. Support for common infrastructure and marketing & branding would only be for ODOP products.
e. In case of support for marketing & branding at State or regional level, same products of districts not having that product as ODOP could also be included.

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Igniting a Spark Within for Sustainable Agribusiness Enterprises

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The image on the left-hand side is a very famous and the most celebrated quote in Sanskrit which has been inspiring me and serving as a guiding force in my career and life from the day when I entered in the Department of HRD at Veer Narmad South Gujarat University (VNSGU), Surat (Gujarat) for pursuing my PG in HRD way back in 2001. This worthy quote; appreciating and depicting the fundamental philosophy of Human Resource Development; is well placed at the entrance of this Dept. of HRD. Based on its far-reaching positive effects on my mind, thoughts, intellect and progress; I have printed it on my visiting card verbatim in toto. Guided by this philosophy of HRD, I have been striving hard to help people to transform themselves for better in their career and life for the last 21+ years and the image on the right-hand side indicates the personal logo for the same, voicing out my work and domain everywhere.

Let's understand what this thought-provoking quote, as given below, is trying to tell us:

अमंत्रमक्षरं नास्ति नास्ति मूलमनौषधम् ।
अयोग्यः पुरुषो नास्ति योजकस्तत्र दुर्लभः॥

amantramaksharamnasti, nastimoolamanaushdham |
ayogyahpurushonasti, yojakastatradurlabhah ||

there is no sound that is not a mantra, no plant that is not medicinal |
there is no person unworthy, what is lacking is an 'enabler' ||

Each and every sound can be a mantram, to be meditated upon. But for that one needs to understand the acoustics of the mouth, vibrations of sounds, meaning of the letters of the language, especially in Sanskrit each letter sound has a meaning. e.g. the first consonants

- क (ka) means - brahmm, vishnu, kamadeva, agni (fire), vayu (wind), surya (sun) etc.
- ख (kha) means - sky (khaga = those that move in the sky = birds), heaven, senses of perception, field (farm), void
- ग (ga) means - gandharva (celestial singers, dancers), adjective for ganesha (ganganapatayenamah)

Every plant has some medicinal use; even the poisonous ones have use in fighting venom. A pharmaceutical company would be better testimony of it even for modern medicines, what to say of Ayurvedic medicines which were prepared from plants directly, and were heavily plant based. And remember what was that old adage – *"you are never totally useless; you can always be used as a bad example!"*

Everyone has some qualities that they can contribute to the society. We are all born with some innate nature and acquire skills. We all are doing some karma all the time! Even the so-called bad karma doers can be used positively. Police uses ex-criminals to help them find new ones. A master lock-picker may help a security company to make better locks. Then one may wonder why are so many of us dissatisfied with our job, career, business or life? Here, it might be good to remember what Steve Jobs of Apple, Inc. said – 'for the past 33 years, I have looked in the mirror every morning and asked myself: *"If today were the last day of my life, would I want to do what I am about to do today?"* And whenever the answer has been "No" for too many days in a row, I know I need to change something.'

The reason for most of the unhappy individuals is that they have not matched their INTEREST and SKILL with the job/career/business, but only matched the SALARY/RETURNS/PROFITS with their EXPECTED lifestyle.

Considering all these, one must ponder:

What is missing?

What is lacking?

One who could see the worth in the sound, the plant or the person. This also means that a mantra to have full impact (vibration, meaning), a knowledgeable person is needed. Similarly, an Ayurvedic Vaidya (Doctor) could find use of any plant and a good manager is one who knows the strength and weakness of his team members and assigns them duties according to their skills and interest. A Yojaka is one who manages, connects, enables, and organizes. One who properly 'connects' the 'parts' to make the 'whole' functional at its best. We all are lucky enough as ICAR-MANAGE is proudly serving as the hard to find "YOJAKA" for enabling you to fight with adversities in managing your business or entrepreneurial ventures.

As we are aware that in this nail-biting competitive business landscape, which is highly turbulent and surrounded by VUCA meaning

V – Volatility

U – Uncertainty

C – Complexity

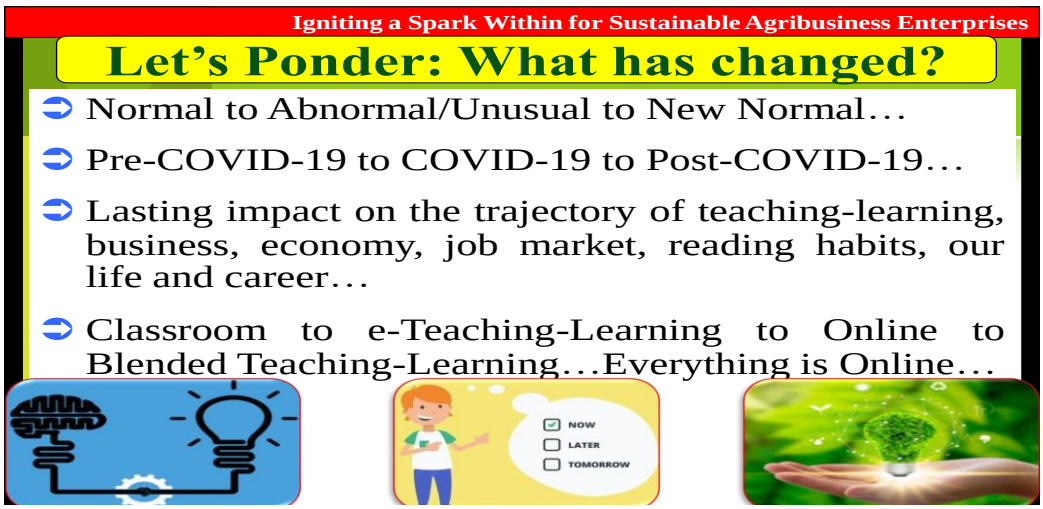
A – Ambiguity

We as a business owner or entrepreneur are always under threat of getting wiped out by stiff competition if we don't respond to the changing needs of the hour and change the way we have been managing our business. Look at the famous quote of the legendary Jack Welch – Charismatic CEO of the world-renowned company General Electric (GE). He used to say that *"If the rate of change inside is not more than the rate of change outside, then our end is insight."* If we don't change the way we have been doing and managing our existing enterprises, howsoever small or big it may be, we may soon become extinct from the market. This is what happened to many giants like NOKIA, SONY and many others.

So, change is the only permanent thing in our life and business. Whether we like it or not, change is bound to happen; as it is the most enduring thing. What is required from our end is to be equipped for the forthcoming changes and embrace the change by responding favorably. This requires proactive orientation instead of becoming a fire fighter. As the famous saying in Medical Science voice out that *"Prevention is always better than cure."* Same holds true even in business. And remember that motivation to change has to come from within and not from outside, as change always happen 'inside-out'. So, let's understand how to ignite a spark within for sustainable agribusiness enterprises.

Introduction

Let's first ponder what has changed in the last couple of months, or a year.



Due to COVID-19 pandemic, there has been a lasting impact on our economy, jobs, business and so many other sectors. Remember, we have already entered into Industry 4.0. Technical advancements have changed the entire business landscape. Let's briefly have a look at the First Industrial Revolution to Industry 4.0.

1st Industrial Revolution

The First Industrial Revolution began in the 18th century through the use of steam power and mechanisation of production. What before produced threads on simple spinning wheels, the mechanised version achieved eight times the volume in the same time. Steam power was already known. The use of it for industrial purposes was the greatest breakthrough

for increasing human productivity. Instead of weaving looms powered by muscle, steam-engines could be used for power. Developments such as the steamship or (some 100 years later) the steam-powered locomotive brought about further massive changes because humans and goods could move great distances in fewer hours.

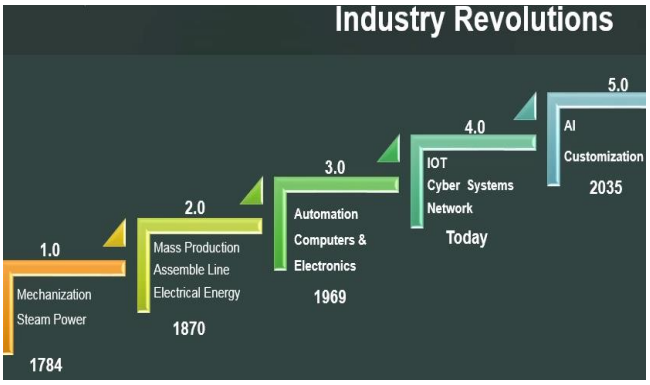
2nd Industrial Revolution

The Second Industrial Revolution began in the 19th century through the discovery of electricity and assembly line production. Henry Ford (1863-1947) took the idea of mass production from a slaughterhouse in Chicago: The pigs hung from conveyor belts and each butcher performed only a part of the task of butchering the animal. Henry Ford carried over these principles into automobile production and drastically altered it in the process. While before one station assembled an entire automobile, now the vehicles were produced in partial steps on the conveyor belt - significantly faster and at lower cost.

3rd Industrial Revolution

The Third Industrial Revolution began in the ’70s in the 20th century through partial automation using memory-programmable controls and computers. Since the introduction of these technologies, we are now able to automate an entire production process - without human assistance. Known examples of this are robots that perform programmed sequences without human intervention.

4th Industry Revolution



We are currently implementing the Fourth Industrial Revolution. This is characterised by the application of information and communication technologies to industry and is also known as "Industry 4.0". It builds on the developments of the Third Industrial Revolution. Production systems that already have computer technology are expanded by a network connection and have a digital twin on the Internet so to speak. These allow communication with other facilities and the output of information about themselves. This is the next step in production automation. The networking of all systems leads to "cyber-physical production systems" and therefore smart factories, in which production systems, components and people communicate via a network and production is nearly autonomous. When these enablers come together, Industry 4.0 has the potential to deliver some incredible advances in factory environments. Examples include machines which can predict failures and trigger maintenance processes autonomously or self-organized logistics which react to unexpected changes in production. And it has the power to change the way that people work. Industry 4.0 can pull individuals into smarter networks, with the potential of more efficient working. The digitalization of the manufacturing and marketing environment allows for more flexible methods of getting the right information to the right person at the right time. The increasing use of digital devices inside factories and out in the field means maintenance professionals can be provided with equipment documentation and service history in a timelier manner, and at the point of use. Maintenance professionals want to be solving problems, not wasting time trying to source the technical information that they need.

In short, Industry 4.0 is a game-changer, across industrial settings. The digitalization of manufacturing will change the way that goods are made and distributed, and how products/services are offered, sold, serviced and refined. On that basis, it can truly lay claim to represent the beginning of the fourth industrial revolution.

People are predicting that by 2035, we would be in Industry 5.0 phase also.

Despite these unprecedented changes, one thing hasn't changes and that is, the significance of sustainability in whatever we do. That's why thinking and getting trained about igniting a spark within for sustainable agribusiness enterprises make every sense for all of us, as you are proud managing your own entrepreneurial venture after getting rigorously trained and supported under the ACABC Scheme.

Indian Economy, Business and Sustainability of Agribusiness Enterprises

- ✓ India will be the third largest economy in the world by 2030-2032 with estimated GDP of ten trillion dollars.
- ✓ Will certainly be driven by knowledge resources and not only by the natural resources.
- ✓ Agribusiness is the Sunrise Industry of India; and Agriculture Sector is a dominant contributor to our GDP even in tough times.
- ✓ Improving Ranking in *"Ease of Doing Business"*, MUDRA *and* other Loans, GST, Rising Economy, Single Window System, LL Reforms…

Despite being badly hit by the COVID-19 pandemic, as the strongest pillar of our economy since times immemorial, our Agriculture sector has done fairly well. In fact, Agriculture and Allied sectors have emerged as the major contributor to the GDP of our Agrarian Economy. Glad to see that with the passage of time, from the infancy stage of merely subsistence farming; the agriculture sector has matured in the form of business venture. This emerging landscape of "Agribusiness" can certainly serve as an essential pathway to revitalize Indian Agriculture. As the ideal building block of our country's economy, the agriculture in general and agribusiness sector in particular, needs to be managed by those, who are professionally and technologically sound, dynamic and creative; and above all filled with a missionary zeal to do something for uplifting the standards of living of the "real fathers of world – the farmers". This makes the agribusiness sector one of the most challenging and exciting sectors to be in. The process of fuelling this growth engine of our economy has picked up momentum; and with proper planning, India can certainly transcend new heights in terms of becoming the proud food basket of the world. Given the promising position of Indian economy coupled with business reforms, Agribusiness ventures are going to be the 'Game Changer' and can certainly look forward to sustainability.

Framework for Sustainable Enterprises

Achieving sustainability in business enterprise starts with having a clear vision and mission. Every organization should/must have its own carefully designed *"Vision" and "Mission"* statements.

Mission means the basic purpose of existence of an organization. A mission statement is a statement of the purpose of a company, organization or person; its reason for existing; a written declaration of an organization's core purpose and focus that normally remains unchanged over time.

- ✓ It reflects an organization's priorities. What the organization wants to do, whom it serves as the stakeholders, why the organization has come into existence – such questions are answered by Mission statement of an organization.
- ✓ In just a few sentences, a mission statement needs to communicate the essence of your organization to your stakeholders and to the public. A mission statement should be clear, concise statement that says who the company is *(the name, that it is a nonprofit, and what type of agency it is)*, what it does, for whom and where.
- ✓ Properly crafted mission statements: *(1) serve as filters to separate what is important from what is not, (2) clearly state which markets will be served and how, and (3) communicate a sense of intended direction to the entire organization.*
- ✓ The mission statement should guide the actions of the organization, spell out its overall goal, provide a path, and guide decision-making. It provides *"the framework or context within which the company's strategies are formulated."* It is like a goal for what the company wants to do for the world.

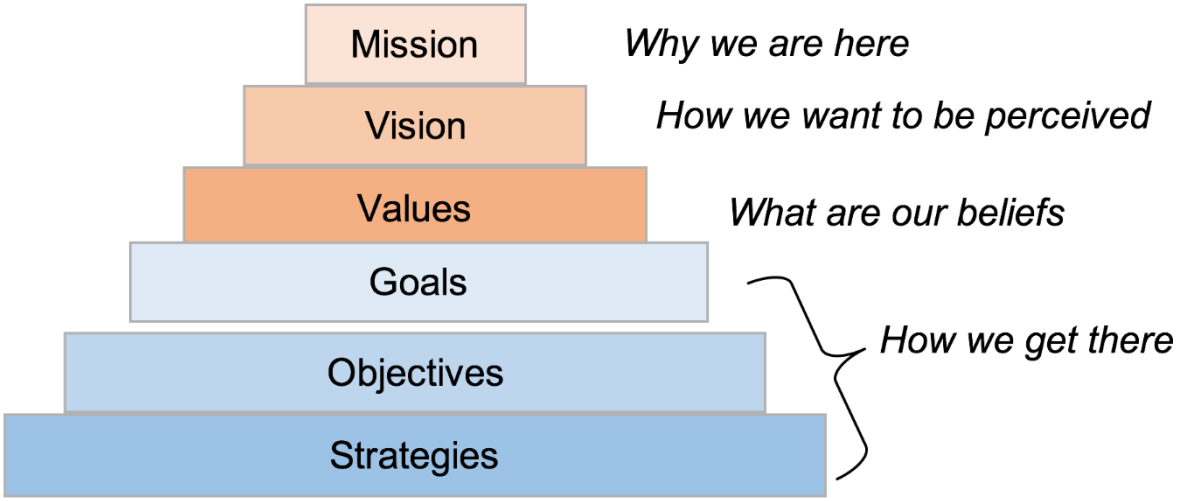
A personal mission statement is developed in much the same way that an organizational mission statement is created. A personal mission statement is a brief description of what an individual wants to focus on, wants to accomplish and wants to become. It is a way to focus energy, actions, behaviors and decisions towards the things that are most important to the individual.

Vision means the long-term goal of an organization. Where you want to reach after a span of time is manifested by the vision statement of an organization.

- ✓ It is a *powerful binder – a glue – a sort of fevicol* – for channelizing the efforts and energies of all the employees in single direction of achieving organizational goals.
- ✓ A vision statement is a company's road map, indicating both what the company wants to become and guiding transformational initiatives by setting a defined direction for the company's growth. Vision statements undergo minimal revisions during the life of a business, unlike operational goals which may be updated from year-to-year.
- ✓ Commonly cited traits about "Good Vision Statement" include the following:
  - ✓ ***concise:*** *able to be easily remembered and repeated*
  - ✓ ***clear:*** *defines a prime goal*
  - ✓ ***future-oriented:*** *describes where the company is going rather than the current state*

- ✓ ***stable:*** *offers a long-term perspective and is unlikely to be impacted by market or technology changes*
- ✓ ***challenging:*** *not something that can be easily met and discarded*
- ✓ ***abstract:*** *general enough to encompass all of the organization's interests and strategic direction*
- ✓ ***inspiring:*** *motivates employees and is something that employees view as desireable*

Vision and mission statements together should articulate the essence of your business enterprise's beliefs and values and define its place in the world. They establish the long-term direction that guides every aspect of an organization's daily operations. Along with powerful mission and vision statements, every business organization should/must have clarity regarding its Fundamental Values that it follows in business, Goals (Short Term & Long Term), Objectives and Strategies.



To achieve/realize/fulfill the mission and vision of an organization, the 4 key elements of an organization must be in tune with each other. So, let us understand the 4 fundamental/key elements of an organization.

Key Elements of Organization:

Every organization has 4 fundamental/key elements as follows:

(1) **People (Employees):** People create the soul of any organization. They are the only source of long-term competitive advantage for any organization. Every organization needs to have competent (able), motivated (willing) and committed (loyal) people at all levels of any organization, to achieve organizational goals effectively and efficiently.

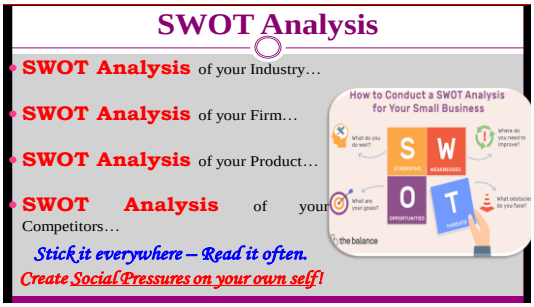
(2) Structure: It is a complex web of formal official and informal social relationships among people at the workplace. It is not opposing to organizational processes/functioning, but it facilitates smooth working of the organization. Structure decided who reports to whom and who is responsible for what. It gives an idea of "Hierarchy" of an organization, as it is diagrammatic representation of reporting relationships from top to bottom in the organizational setup.

(3) Technology: Whatever helps you to do your work in a quicker, simpler and easier way can be termed as technology. But technology has its own limitations, as it makes the people (employee) dependent on it. Further, it may create "technophobia" among people, if they are not trained about the "know-how" of the technology. So, technology helps an organization to excel only when its people (employees) know how to use it.

(4) Environment: No organization operates in isolation. It operates within the boundaries of Internal and External environment. Internal environment consists of organizational climate, organizational culture, the total knowledge, skills, creative abilities & talents and aptitudes of an organization's workforce as well as the values, attitudes & beliefs of the individuals involved. It also includes their working style (habits). Together all these determine the Strengths (S) and Weaknesses (W) of an organization. The External environment consists of Competitors, Suppliers, Customers, Legal Environment, Socio-Cultural Environment, Political Environment, technological Environment, Economic Environment, etc. Together all these determine the Opportunities (O) and Threats (T)for an organization.

Every industry, firm or even an individual is unique and has unique set of SWOT. Knowledge of SWOT analysis of the industry and your own enterprise enables a businessman to have accurate picture of his/her business and its prospects, challenges, risks associated with it and so on. Accordingly, he/she can behave proactively to initiate such measures which will facilitate the enterprise to achieve its goals effectively and efficiently.

As a business enterprise owner, you must have sound knowledge and understanding of the following:



For an example, let's have a look at the Mission and Vision statement of a leading food processing company founded by an alumnus of a State Agricultural University of Gujarat, who is closely associated with our Navsari Agricultural University, Navsari also. The name of the company is Patson Foods India Pvt. Ltd. located at Navsari and exporting its products to more than 20 countries. This vision and mission statements given below have

been developed during our consultancy assignment and meeting with stakeholders of the company.

Our Vision…

VISION MISSION

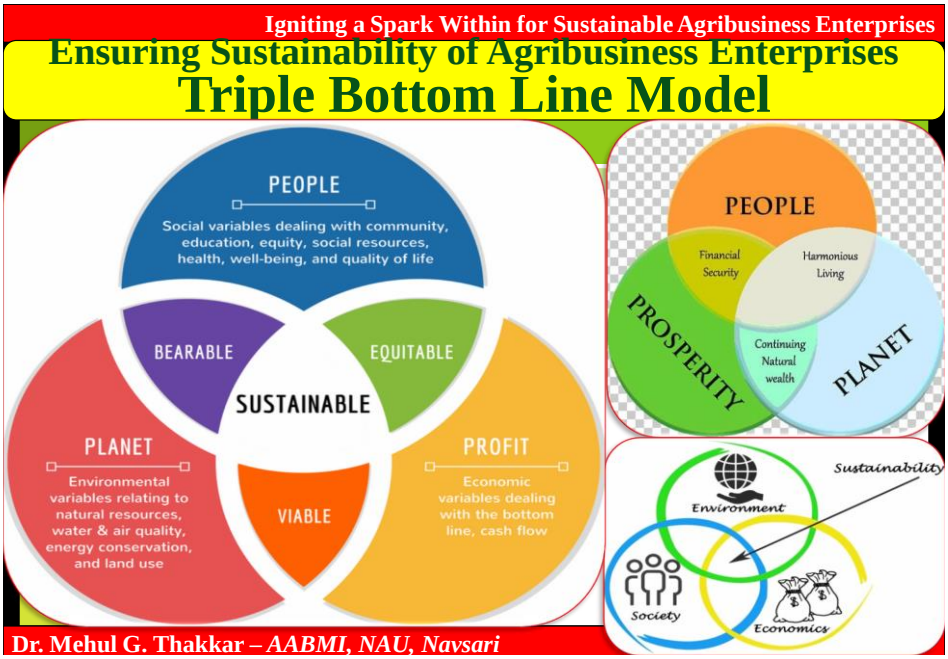
- ***To become the most preferred and trusted eco-friendly, socially responsible Producer and Supplier of Processed Foods across the globe.***
- ***To be recognized as the foremost innovator and a leading, distinctive, reliable brand of ever-fresh processed products across the globe.***

Our Mission…

VISION MISSION

- ***To play prominent role in ushering the Green Industrial Revolution and bring prosperity for the "Sons of the Soil – the Farmers" by increasing harvest and returns from the land.***
- ***To produce and supply ever-fresh processed products of the benchmark quality at a reasonable and affordable price; for a Tastier, Healthier, Happier and Refreshing feel.***

Triple Bottom Line Model for ensuring Sustainability of Agribusiness Enterprises



To be viable and sustainable business enterprise, as the figure above suggests, one needs to win on three frontiers – People, Planet and Profit. The Planet frontier basically talks about factors related to natural resources - water & air quality, energy conservation, land use, etc. For our agribusiness enterprises, it talks about complying to all the standards, norms and legal framework for business enterprises, doing business in the most ethical way and ensuring to avoid conflict with the society at large. Let's elaborate on the other two important frontiers namely the People and Profit.

Winning on the PEOPLE front through People

Akio Morita – the Founder of SONY Corporation once said, *"there is no magic in the success of Japanese Companies in general & Sony in particular. The secret of success is simply the way they treat their people".* This clearly shows how importantly people are treated in Japanese organizations.

Peter Brabeck – the CEO of world's leading Food Company - NESTLE once said, *"any organization can succeed only when every person in the organization ask him/herself every evening – Is there anything I can still do to add a little more value to our company?"*

This clearly shows the importance of having competent (able), motivated (willing), dedicated (involved) and committed (loyal) people at all levels of any organization, and more specifically a business enterprise.

Today you may be a small business entity, but as you grow, you need to ensure to have competent, motivated, dedicated and committed people who can serve your customers like anything. This may include your Teammates, Employees, Dealers, Retailers, etc. This is because people can only "make or mar" your enterprise. They can either "Make the company A Fortune 500 Company" or "Mar it to be closed down". So, be aware in choosing your people.

Processing and Value Addition of Fruits for Entrepreneurship Development

Dev Raj
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Navsari Agricultural University, Navsari

Introduction

India has attained important position with respect to production of forest-based fruits and medicinal crops-based forest products. Despite such a huge production, there is 25-33% post-harvest loss of take place owing to highly perishable nature and possess very short shelf-life.The major cause of post-harvest loss is availability of poor infrastructure for post-harvest management (PHM) and processing of commodities. These losses can only be minimized by proper handling, marketing and processing of the agricultural commodities. According to national level study conducted under AICRP on PHT, the post-harvest losses during different farm handling operations like harvesting, sorting, grading and packing accounts for about 13%, during farm storage about 6% and during storage at godown, wholesale and retail level about 12% of the produce goes waste. Thus, on an average, about one third of produce never reaches the ultimate consumer. Insufficient knowledge of pre- and post-harvest operations and lack of proper facilities for handling like pre-cooling, grading, packaging, transport, storage, processing and marketing altogether compound the post-harvest losses for more than Rs 65,000 crores. The food processing industry ranks fifth in size in the country and employs 16 lakh workers which is 19% of the country's industrial labour. It accounts for 14% of the total industrial output with 18% of industrial GDP and 6.3% of countries GDP. Despite such good rank, there is only <2.4% processing in India as compared advanced countries (60-70%). So, food processing can play a vital role in India's prosperity. The Ffood processing industry sector in India is one of the largest sectors in terms of production, consumption, export and growth prospects. According to ASSOCHAM-Grant Thort on research paper, food processing sector possess potential to generate employment of 9 million persons by 2024 in India and expected to generate about 8,000 direct and 80,000 indirect jobs. India exported 12.70 Lakh tones of processed foods comprising of mango pulp, juices, concentrates, dried and processed vegetables, pickle and chutney, alcoholic and non-alcoholic beverages worth Rs 10583.41crores (APEDA, 2017). The food processing export share is around 12% to the total export in India. The foreign direct investment (FDI) in the food processing sector is expected to rise by 38%. For accelerating the growth of the food processing industries, GOI has implemented a number of schemes and doubled the allocated amount of Rs 715 crore during 2017-18 to Rs 1400 crore in 2018-19.

Processing and value addition

The food processing industry ranks fifth in size in the country and employs 16 lakh workers which is 19% of the country's industrial labour. It accounts for 14% of the total

industrial output with 18% of industrial GDP and 6.3% of countries GDP. So, food processing plays a vital role in India's prosperity. The Food Processing Industry sector in India is one of the largest sectors in terms of production, consumption, export and growth prospects. Food processing industry broadly comprises primary processing category and the other categories embracing the secondary, tertiary and further stages of downstream processing.

In India, majority of the produce is sent to the market for fresh trade and whatever is left as marketable surplus in the form of small and pittoo size, non-uniform and cull is utilized for processing for conversion into value added products. The processing capacity in our country from more than 36871 licensed Food Processing Units is less than 2.4% of total fruit and vegetable production against 60-70% in many advanced countries. Further, the actual production of processed products stood at only 1.33 million tones with a less than 35% capacity utilization of the installed processing units. There are 70% units in home/cottage/ small scale sector and 30% units in large scale sector with capacity of 250 tonnes per annum and 30 tonnes/hr, respectively. Large scale contributes 70% of the production. Despite such a huge production of horticultural commodities there is only <2.4% processing and India's share in the world trade is around 1%. However, processing in advanced countries is too high as compared to India (Fig 1). Consumer food comprises of group of products like chocolates, confectionery, cocoa products, soya-based products, RTE foods, mineral waters, soft drinks etc. Among these, soft drinks enjoy the biggest share. Confectionery output is growing at the rate of 6-7 % and chocolate production at the rate of 10-15%. Similarly, India exported 9.53 Lakh tones of processed foods comprising of mango pulp, juices, concentrates, dried and processed vegetables, pickle and chutney, alcoholic and non-alcoholic beverages worth Rs 10583.41crores (APEDA, 2007).

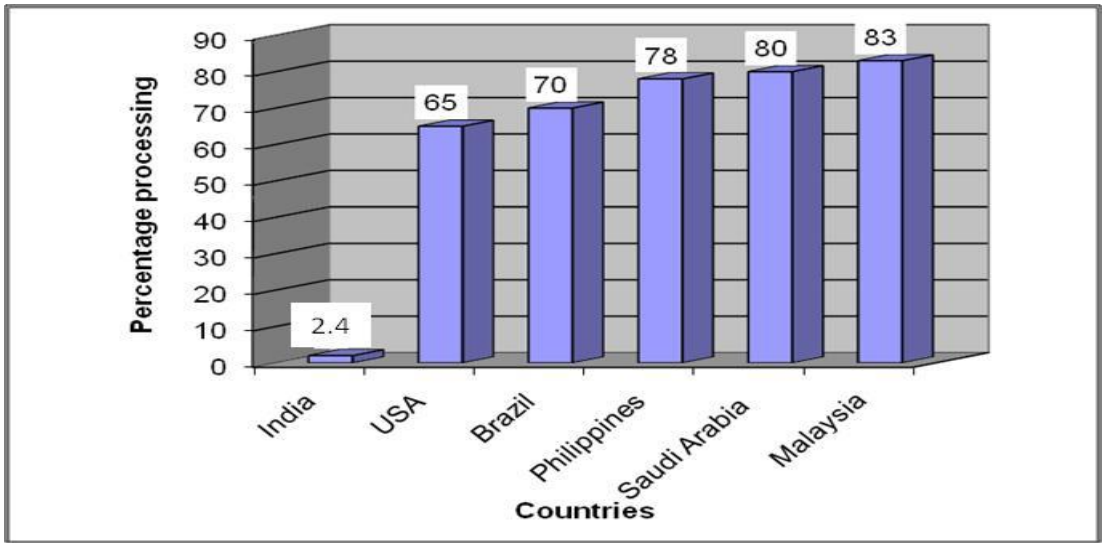

Fig. 1. Status of fruits and vegetable processing in India in comparison to advanced counties

Problems and constraints

The fortune of the food industry is largely depending upon the caprices of the monsoon. The problems of the agro-industries, agri-businesses or any other economic activity related to or depends upon agriculture are therefore compounded. It is therefore imperative to

know and understand the problems, risk and constraints associated with such food processing industries. The main constraints and problems of the food processing industry are given as under:

1. Food commodities are biological in nature and inherently subjected to variation in their physico-chemical composition and sensory characteristics as influenced by various factors.
2. Low productivity of the agricultural produce and non-availability of good quality food commodities for processing purposes.
3. Food commodities are mostly perishable or semi-perishable, leading to high degree of wastage of the produce.
4. Wide and violent fluctuations in the supplies, quality and price of the food as commodities may be location/region-specific or season specific.
5. Low level of developed technology and management inputs.
6. Poor post-harvest management infrastructure and lack of awareness about procedures and technologies to improve shelf life.
7. Inadequate infrastructure for storage, distribution and marketing.
8. Weak linkages in the supply chain
9. Lack of integration with upstream (food production) and downstream (marketing and export) agencies.
10. Very less value addition and processing

Other problems associated with basic constraints

1. High cost and high vulnerability due to wide variation in the prices of the agro-derived inputs.
2. Inadequate trained manpower and quality testing laboratories.
3. High investment cost is needed to establish an industry.
4. High investment cost is needed for publicity and promotion of the consumer products.
5. High cost of packaging.
6. Incidence of unduly high and irrational taxation.
7. Lack of suitable processing technologies.
8. Lack of regular and consistent supply of processing grade raw material at factory gate.
9. Lack of awareness regarding quality of food desired in international markets.
10. Lack of awareness regarding International Quality Standards and Measures.
11. Wastage of produce during transportation, storage and processing.

Importance of food processing

Food processing industry is recognized as sun-rise industry. Food supply has to keep pace with the needs of the population. There is always a shortage of food in developing countries like India meet this, storage results in wastage due to inadequate facilities available for storage and preservation. It is therefore, imperative to expand facilities for the storage and preservation of food. Food processing is important because it helps in

1. Increasing the shelf life of food, thus increasing supply

2. Making the seasonal food available throughout the year and to such area where this
3. Saving time by reducing preparation time and energy
4. Stabilizing prices throughout the year.
5. To meet food requirement during natural calamity foods wars famines
6. Reduces wastage and losses.
7. Handles gluts.
8. Generate employment.
9. Stabilizes farm prices and income
10. Earn foreign exchange.
11. Preservation / processing increases the availability of foods, thus improving the nutrition of the peoples /population and checks nutritional deficiency
12. Availability of seasonal foods through the year and thus adding variety to the diet (to meet mixed diet practice) when seasonal food not available
13. Helps in storage of food by preventing microbial spoilage thus can be made available to public throughout the year.

Reasons for food spoilage

There are mainly the three reasons which are causing spoilage of the food in a food processing industry. These are i) micro-organisms, ii) enzymes and chemicals changes and iii) man, animals, rodents and insect-pests etc. The reasons of spoilage of food may also be elaborated as ahead

1. Fermentation caused by moulds yeast and bacteria.
2. Enzyme present in the product may affect the colour and flavor adversely e.g. apple juice turns brown due to the activity of oxidative enzyme in it
3. Chemicals present in the pulp/juice may react with one another and spoil its taste and aroma
4. Air coming in contact with the product, may react with the glucosidal materials present in it and render the product hitter, e.g. Navel orange and sweet lime juices often turn bitter when they are exposed to air even for a short time
5. Traces of metals from the equipment may get into the product and spoil its taste and aroma.

Among all the above-mentioned causes, micro-organisms are of utmost importance in causing spoilage of food followed by enzymes and chemical changes. Spoilage by the micro-organisms (in some cases) may lead to death of the consumers if not controlled properly. Spoilage of foods by enzymes and chemical changes results loss of sensory and nutritional qualities. Man, animals, rodents and insect-pests causes only physical loss of the food and so can be prevented easily by proper post-harvest handling practices like packaging. But, the spoilage by improper post-harvest handling (man, animals, rodents and insect-pests) always open doors towards spoilage by microbes as well as by enzymatic and chemical changes.

Principles of food processing / preservation

Main aim of principles of food processing is to **r**educe respiration rate, reduce transpiration rate (as the transpiration otherwise results weight loss, shrinkage and reduction in quality) and to reduce the amount / load of micro-organisms in food (without killing / by

heating). In order to prevent above mentioned spoilage and so preserve the food commodities for long duration, following three principles are to be followed.

1. **Prevention or delay of microbial decomposing**
   a. Keeping out undesirable micro-organisms from the food or prevent entry i.e. (Asepsis) e.g. egg shell, skin, and peel.
   b. Removal of micro-organisms from the food e.g. By filtration through bacterial sieve tube or Aqua guard
   c. Arresting or hindering the growth and activity of micro-organisms by
      - Low temperature
      - Drying
      - Anaerobic conditions, carbonation, controlled atmospheric (CA) storage
      - Chemicals preservatives or antibiotics
   d. Killing the micro-organisms by
      - Heat
      - Irradiation or mechanical means.
2. **Prevention or delay of self decomposition of the food (Chemical spoilage)**
   a. By destruction or inactivation of enzymes/food enzymes. e.g. By blanching,
   b. By prevention or delay of chemical reactions e.g. Prevention of oxidation by using antioxidants.
3. **Prevention of damages by insect, animals, mechanical means etc**
   a.Prevention of insects by using proper packaging material

Methods of food preservations

To retain the natural taste and aroma of a product it is necessary to preserve the food soon after harvest or preparation, without allowing it to stand for any length of time. The food processing / preservation method used in food processing always depends on any of the earlier mentioned three principles. There are different methods of preservation/ processing and each method has its own merits. Depending upon mode of action of method to kill or inactivate microbe or enzyme, effectiveness of the methods to kill / inactivate microbes /enzymes, durability of the preserved food, mode of preservation, various methods can be used to process / preserve the food. Various methods used for food preservations are illustrated in Table 1.

Home-scale production of processed products

Problem of lower income in agriculture is due to lack of local value addition. Much of the produce is sold as raw. Value addition is being made at cities and reaching back to the village at a higher price. This can be avoided by setting up value addition facilities at villages and marketing value added products to cities at a higher price. Value addition as a rural enterprise has potential to generate more local jobs, better income and services and reducing rural migration. In this direction, KVK is working with women in formation of SHGs as well as technological backstopping for establishing home scale processing units through various processes including technology standardization, awareness creation, technical and enterprise training, initiating and nurturing income generation activities.

It is technically feasible to make most fruit and forest products on a home scale using simple machinery, but it is likely that a group starting up in business will require substantial advice. A common problem for small producer groups is the lack of market research. Such enterprises are often production-led, and products may be manufactured in order to use up a glut before a definite need or market for the product has been identified.

Table 1: Various methods of preservations – In Nutshell

Process	Method	MOA	Eff	Db
Removal of water	Drying, evaporation	P	Bs	LT
Removal of Heat	Refrigeration	P	Bs	ST
Removal of Heat	Freezing	P	Bs	LT
Removal of heat and addition of water	Pre-cooling	P	Bs	ST
Removal of heat and addition of water	CA storage	P	Bs	S/LT
Exclusion/inclusion of oxygen	Waxing /skin coating, venting,	P	Bs	ST
Change in cell metabolisms	Irradiation, HPP, Ultra-sonication	P	Bs/c	ST
Removal of micro-organisms	Asepsis, washing	P	Bs	ST
Removal of micro-organisms	Filtration	P	Bs	S/LT
Addition of Heat	Thermal processing, Aseptic canning / packaging	P	Bc	LT
Addition of Heat	Blanching, pasteurization, steaming, Ohmic heat	P	Bs/c	ST
Removal of Air	Carbonation, vacuum packing, Smoking, N_2	P	Bs	S/LT
Reduction in water activity	Use of high conc. of sugar and salt	C &P	Bs	LT
Addition of mild anti-septic	Class I Preservatives (Spices)	C	Bs	ST
Addition of Chemical Preservatives	KMS, NaB (Class II)	C	Bc	LT
Addition of Biological Preservatives	Nisin, Tylosin	C	Bs	S/LT
Reduction in pH	Addition of acids like vinegar	C	Bs	LT
Removal of water	Addition of class I preservative	C	Bs	LT
Lowering of water activity	Class I preservative	C	Bs	LT
Stop growth of undesirable microbes	Fermentation (Alcoholic, acetic, lactic)	B	Bc	LT
Hurdle Technology	Use of sugar with heat, salt and acid etc	Cb	Bc	LT
MOA: Mode of Action, Eff: Effectivity, Db: Durability, LT: Long term storage, ST: Short term Storage, P: Physical, C: Chemical, B: Biological, Cb: Combination of PCB, Bc: Bacteriocidal, Bs: Bacteriostatic				

Therefore, marketing will require special emphasis as this is often the most serious problem facing a new business. Rural production of value-added fruit products for urban or middle-class markets has the added complication that the markets may be a long way from the producer group which may cause difficulties in negotiations and language problems, packaging supplies, and high distribution costs. It is a common mistake to assume that poor-quality fruits can be used to make high-quality goods. It is only possible to use rejected produce if it has been rejected for cosmetic reasons (e.g. the wrong size or slight blemishes).For year-round production, it may be necessary to part-process raw materials into a form that can be stored in readiness for future production. Alternatively, a sequence of fruits or vegetables can be processed throughout the year in some regions. Both methods can help overcome the highly seasonal nature of fruit and vegetable crops. Despite this, in many cases processors will need a high working capital to buy the majority of raw materials in mid-season when prices are at their lowest. A constraint in the production of preserves is that they require a large quantity of sugar. In many cases, refined white sugar has to be brought from urban centres, and may be expensive. Sometime vegetables crops or horticultural crops grown in the forest land as a part of agro-forestry system also need the post-harvest management, processing and value addition.

Potential Processed Products made through home scale processing

- ✓ Mango based products, i.e., pulp, pickles, jams, squash
- ✓ Guava based products, i.e., jelly, jam, juices, pulp, RTS
- ✓ Tomato based products: ketchups, powder, sauces, etc.
- ✓ Banana based products i.e., chips, pulp, powder, juice
- ✓ Citrus based products i.e., segments, squash, nectar, RTS, pectin
- ✓ Papaya based products, i.e., pulp, nectar, bar
- ✓ Aonla based products i.e. Candy,Murabba,Ayurvedic Chayvanprash Dried shreds, Powder,Juice etc.
- ✓ Onion based products: powder, flakes, pickles
- ✓ Potato based products, i.e., chips, powder/starch
- ✓ Aloe vera: Aloe vera juice, dehydrated aloe vera gel, nectar, Aloe vera based vermicelli
- ✓ Bael products: Pulp, powder, candy, appetizer, squash etc.
- ✓ Behra products: Dried behra powder
- ✓ Harad products: Dried Harad powder, Spiced Jam, Osmo-dehydrated harad.
- ✓ Jamun Products: Pulp, Appetiser, Seed powder, pulp powder
- ✓ Medicinal produce products: Essential oils, dried powder, syrups.

Technologies developed by department of PHT at NAU

The development of processing industries to preserve the perishable agricultural produce will not only improve economic and nutritional status of our population but it may help in employment generation in rural as well as urban areas of the country. This can be achieved by linking production, and post-harvest technology in synergistic way. For this purpose, the department is equipped with excellent Processing Units for pilot scale testing of technologies, providing in-plant training and imparting community canning service to the

students, farmers and enterpreneurers. Further, in view of wealth from the waste, NAU have done remarkable research on waste utilization particularly the banana pseudostem processing, water melon rind processing etc. Banana plant residue after harvesting is a major problem for the farmers and they are spending about Rs.15,000 – 20,000 per hectare to remove that from field to take ratoon crop or new crop. Instead of it, now farmers can get additional income of around Rs.1.25 lakh per hectare from the waste by preparing different value-added products. The research achievements of the PHT Unit of NAU, Navsari which can enhance the income of the farming communities are enlisted here under.

1. Developed process for freeze drying of sapota slices for high quality dehydrated sapota chips and powder. High quality dehydrated sapota chips can be prepared by pre-freezing 5 mm thick sapota slices in freezers for 10 hours followed by freeze drying under vacuum of 760mm Hg at a temperature of 70^{o}C for 12 hours.


Chips

2. Developed technology for utilization of banana peel for preparation of *sev*. Ripe banana peel can be utilized for preparation of *sev*. Ripe banana peel must be pre-treated immediately to prevent enzymatic browning by dipping in 2% salt (NaCl) solution along with 100 ppm ascorbic acid for 30 min. After pre-treatment, banana peel must be blanched, grind to make paste and mixed (30% ripe banana peel paste) with gram flour (70%) for preparation of fibre rich *sev*. The recipe for the preparation of ripe banana peel based *sev* comprised of 30 g ripe banana peel paste, 70 g gram flour, 2.5 g common salt, 1.5 g chilli powder, 0.75 g white pepper powder, 1.0 g turmeric powder, 2.5 g coriander powder and 5 ml edible oil.
3. Standardized method for extraction of 'Noni' (*Morindacitrifolia*) fruit juice. Noni juice can be extracted by treating crushed fruits with 0.10 % pectinase for 3 hours to get higher juice recovery. The juice after extraction must be filtered, pasteurized (96^{o}C), packed in glass bottles followed by processing (96$\pm$1^{o}C) for 30 min. The packed juice has storage stability for 12 months at ambient temperature.


Noni Juice

4. Standardized the formulations for preparation of noni mango nectar from Noni juice. Noni juice can be utilized for preparation of blended noni mango nectar to increase the acceptability of noni juice. For preparation of blended noni mango nectar, blend 5% noni juice with 15% mango pulp by maintaining 16^{0} Brix TSS and 0.3% acidity. The nectar after blending, filtered, pasteurized (96^{o}C), packed in glass bottles followed by processing (96$\pm$1^{o}C) for 30 min. The packed nectar has storage stability for 6 months at ambient temperature.


Noni Mango nectar

5. Developed technology for dehydration of onions rings. Red onions rings can be dehydrated by pre-treating onion rings with combination of 2000 ppm potassium meta-bisulphite (KMS) and 500 ppm citric acid for 15 minutes followed by dehydration at four stage dehydration temperatures (75, 70, 65 and 60^{o}C for 2 hours, 2 hours, 1 hour and


Dried Onion flakes

about 8 hours till drying, respectively).

6. Developed technology for dehydration of okra slices. Okra slices can be dehydrated by pre-treating okra slices with combination of 1500 ppm KMS and citric acid @ 500 ppm for 15 minutes following two stage dehydration temperatures (75 for 2 hours and 65^{o}C for about 10 hours till drying).


Dried Okra

7. Developed technology for dehydration of cauliflower segments. Cauliflower cut segments can be dehydrated by pre-treating cauliflower cut segments with combination of 1500 ppm KMS and 1000 ppm citric acid for 15 minutes following four stage dehydration temperatures (75, 70, 65 and 60^{o}C for 2 hours, 2 hours, 1 hour and about 7 hours till drying, respectively).


Dried Cualiflower

8. Developed technology for preparation of Ready to Serve (RTS) beverage from banana pseudostem sap. RTS beverage can be prepared from blend of banana psuedostem sap and aonla fruit juice having 3.5% and 8% TSS respectively with the ratio of 90:10 could be stored up to six months in glass bottle.


Banana Pseudostem RTS

9. Standardized technology for Processing of Banana Central Core Jam. The processors and house wives are recommended to prepare banana pseudo stem central core jam by replacing up to 50% fruits (mango, guava, papaya, pineapple) with central core. Mix fruit jam with central core is most acceptable combination as it not only reduces the production cost but also increase the fibre content of the jam without affecting jam quality.


Banana Central core Jam

10. Standardized technology for Processing of Banana Central Core into candy. Candy from banana pseudo-stem central core can be prepared by giving blanching pre-treatment for 3 min followed by osmotic dip to cubes of central core in 70^{o} Brix sugar syrup.


Banana Central core Jam

11. Standardized technology for preparation of water melon rind candy by mixing 100 g sugar per 100 g water melon rind along with 0.20 per cent acid. The prepared candy was rated best on the basis of higher sensory score as well as nutritional composition.


Watermelon rind candy

12. Standardized technology to utilize Mango peel and kernel powder for preparation ofbiscuits by using formulation of 5% mango peel powder, 7.5% kernel powder and 87.5% maida (F_7) and remained shelf stable during storage for three months in polypropylene bags.


Peel and kernel based biscuits

13. Standardized recipe for preparation of fruit bar from guava and papaya pulp (50:50).
14. Standardized recipe for preparation of mango bar containing desiccated coconut powder (2%).
15. Standardized recipe for preparation of guava (cv. Lalit) nectar containing 16% pulp and 17 ^{o}Brix TSS and 0.3% acidity.
16. Developed technology for pre-cooling of sapota for reduction in losses and extension of shelf life. Sapota fruit can be precooled at 10°C in pre-cooling chamber with air movement

of 263- 340-350 m^3/min for 5h can extends the shelf life of sapota fruits by 2 additional days

17. Standardized the recipe for the preparation of jam from the fruits of Palmyra palm. Jam from tender fruits of palmyra palm can be prepared by using pulp:sugar ratio (1:1.2) and addition of pectin 16g/kg of pulp and it also can be stored for six months at ambient temperature in glass bottle.
18. Standardized the recipe for the preparation of jelly from the *neera* of Palmyrah palm. Jelly from the *Neera* can be prepared by using pectin 13 g/kg of *Neera* and can be safely stored for six months. Recipe should be *Neera*: sugar (1:1.1), 0.5% acidity (50 g citric acid per kg of jelly) and pectin. Boil the mixture till 68^{o}Brix followed by hot filling in to glass bottle.
19. Standardized the recipe for the preparation of candy from the fruits of Palmyra palm. Candy from the fruits of Palmyra palm can be prepared by steeping the slices (5cm x 5mm) in sugar syrup having 65% TSS for 8 hours followed by drying of slices for 7 hours at 65^{o}C and packed in PE pouches can be stored successfully up to six month at ambient storage.
20. Standardized hot water dip treatment for eradication of fruit fly and extension of shelf life of mango fruits cvs. Kesar and Alphonso. Exporters are recommended to give hot water treatment at 50^{o}C for 20 min to eradicate fruit fly infestation in Kesar and Alphonso mango for getting export quality fruits.
21. Developed process for utilization of dropped immature mangoes to prepare ready to eat pickle. Ready-to-eat pickle (*Moriya*) can be prepare from the immature dropped mango (*Marva*) through the process of washing, cutting and subsequently dipping in hot water (50 ^{o}C) for 5 min, 2% brine solution for 5 min and 5% acetic acid (vinegar) for 5 min, and finally mixing with the groundnut oil (2.5%)-spices mix and packing of in 75 micron HDPE bag.
22. Developed protocol for shelf life extension of the mangoes. Kesar mango fruits can be pre-cooled at 10°C in pre-cooling chamber with air movement of 300-350 m^3/min for 8h and pack them in 75micron polypropylene bag and store at 11±1ºC with 90-95% RH. This would delay the initiation of ripening process up to 25days of storage and extend the shelf life up to 35 days.
23. Standardized the technique for colour extraction from *Butea monosperma* flowers for preparing herbal *gulal. Butea monosperma* flower could be used for colour dye extract using 50% methanol water based v/v solution at 60ºC temperature and 4 hr. process time. The extracted colour matter dye could be use for production of herbal '*gulal'.*
24. Optimized the level of temperature and KMS for processing of ripe banana puree at pilot scale. Addition of 250 ppm ascorbic acid at the time of milling with 750 ppm potassium matabisulphite is recommended to get good quality banana puree. Puree pasteurized at 90 ºC temperature for 10 min, filled hot in to the sterilized tin can, followed by seaming and processing at 100 ºC temperature for 30 min and cooling. Puree has storage stability up to 6 months.
25. Optimized the level of TSS and anti-caking agent in spray solution for preparation of powder from ripe banana at pilot scale. For preparing spray dried banana powder, use 10 ^{o}Brix spray solution of banana puree after adding 15 % Maltodextrin as anti-caking agent.

Spray should be done by keeping feed flow rate 35.0 kg/hr, feed temperature 70 ^{0}C, inlet temperature 170 ^{0}C and outlet temperature 100 ^{o}C for minimizing the sticking issue of banana puree in the inner chamber of spray drier.

26. Technology for preparation of organic liquid fertilizer from banana pseudostem has been developed at NAU and is internationally patented. This organic liquid fertilizer is rich source of all macro r and micro nutrients as well as plant growth hormones; which enhances the productivity of crop and reduce the use of chemical fertilizers. It can be use through micro-irrigation method as well as as can be use as foliar spray

Future strategy

1. Crop productivity and quality maintenance through selection, breeding, biotechnology and integrated pre - and post harvest management.
2. Minimization / prevention of wastage and quality loss through development of cool chain technology.
3. Minimization of wastage and quality loss by reduction in the numbers of intermediary produce handling stages and agencies.
4. Stabilization of produce supply and prices by maintenance of proper procurement and distribution chain.
5. Increase in the farmer's share of the consumer price.
6. Expansion of raw material availability and up gradation of its quality.
7. Harmonization of various food laws.
8. Rationalization of taxes and levies.
9. Investment and improvement in infrastructure like rural roads, rural electrification, waste land development, cold chain etc.

Expected output

Health, fitness, wellbeing, nutrition, convenience and freshness are likely to drive the Indian Food Processing Industry in the years ahead, as in the rest of the world. So, for the fulfilment of these needs; health-oriented nutraceuticals and functional foods, minimally processed foods, fresh cut, pre-prepared vegetables and salads, heart healthy, diabetic friendly foods and food supplements, low sugar / salt / fat / cholesterol foods, organically grown foods and other kindred food products may be the drive foods of the future. Convenience foods like instant mixes, ready – to – cook, ready-to-bake, ready -to – eat and ready-to-drink foods and beverages already becoming popular may soon become the order of the day.

Innovative Marketing Strategies for Entrepreneurs in Fruits and Vegetables Business

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"Business has only two basic functions: marketing and innovation" –Drucker

Marketing and innovation - an inseparable couple.

Marketing includes tasks to increase sales.The focus is on customer and market orientation; all products, services and processes are to be aligned with the needs of customers and users. Market is called to be a group of consumers (potential customers) who have purchasing power and unsatisfied needs. A new venture will survive only if a market exists for its product or service.

Innovation is a process by which a domain, a product, or a service is renewed and brought up to date by applying new processes, introducing new techniques, or establishing successful ideas to create new value.Innovation requires more creativity and more willingness to take risks than the implementation of typical projects.

Forms of Innovation

In the context of business there are different forms of innovation as mentioned below

- **Product /Service Innovation**: the changes in the things (product or services) that an organization offers. Innovate in WHAT we do **eg. Differentiate the products on quality or size**
- **Process Innovation**: the changes in the ways in which product/services are created and delivered. Innovate in HOW we do it? eg. juices, or ready-to-eat snacks.
- **Position Innovation**: the changes in context in which products/services are introduced/positioned in the minds of consumers. Innovate in Marketing mix and strategy and market segments fall in this category. Ex. organic fruit pulp as baby food
- **Paradigm /Business Model Innovation**: the changes in underlying business models which frame what the organization does. eg. RFID packaging is a system innovation for better traceability and export.

Examples of Innovated Fruit and vegetable Products

- **Fresh cut:** Salad, Fruit salad and Pre-cut vegetables
- **Prepared:** Soup mixes & Vegetable mixes
- **Freshly prepared:** Fruit juices and smooties-juice bars, Fruit ice-cream, Fruit based desert

- **Dried:** Fruits (apricot, apple, plums) Vegetables (tomatoes, mushrooms, chillies etc.) Deep-frozen(and canned) fruits and vegetables

Entrepreneurial Marketing

Marketing and entrepreneurship have been regarded traditionally as two distinct fields of study. A growing awareness of the importance of entrepreneurship and innovation to marketing, and of marketing to successful entrepreneurship, has led to attempts to combine the two disciplines as "entrepreneurial marketing". The main thrust of entrepreneurial marketing is an emphasis on adapting marketing to forms that are appropriate to small and medium-sized enterprises (SMEs), acknowledging the likely pivotal role of the entrepreneur in any marketing activities.

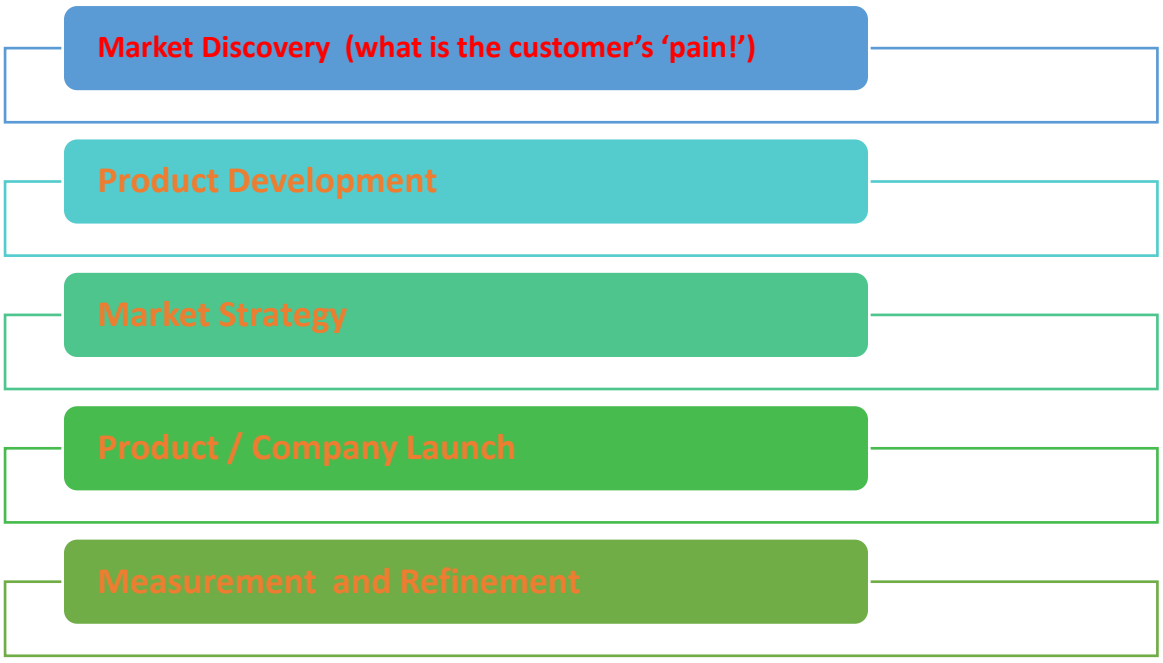
Entrepreneurial marketing includes innovation, risk taking, and being proactive. Entrepreneurial marketing campaigns try to highlight the company's greatest strengths while emphasizing their value to the customer. Focusing on innovative products or exemplary customer service is a way to stand out from competitors. They make this pitch using cheap and accessible tools including viral videos, Tweets, Facebook pages, and email marketing. Any and all marketing strategies can be considered as long as they produce results.

Entrepreneurial marketing mostly addresses environments where products and companies are rather new. Besides, the liability related to newness and the limited ressources of startups are the main problems in entrepreneurial marketing.

Entrepreneurial Marketing Framework

An entrepreneur must ask these questions to assess and evaluate the market opportunity.

- Significant customer problem/need/desire to develop a sufficiently large market?
- Is the customer ready to buy?
- Have you differentiated your value proposition?



Market Discovery is an important step as it is said "Great devices are invented in the lab; great products are created in the market". Identifying a market opportunity is the most critical step.

Market segmentation

FOCUS IS KEY. It is important to pick 1-3 well defined, accessible markets and dominate.Marketing must create complete product offerings and drive them into commanding positions in defensible market segments.Markets will support several players. They are not homogenous so defining segments is very important. 'Pain' (need) is best identified through rigorous and systematic primary research.Marketers must articulate the voice of the customer to segment the market. Forexample: Target Audience of food delivery marketplace could be Busy executives (30-40 years), people with Children (25 + years) or Tech savvy Millenials (20-30 years) who can be regular customers.

Unique Value Proposition

USP means Compelling reason for Consumers to purchase and also provides good profit margin to Marketer. It is necessary to quantify these benefits (for example money saved; time not wasted; family happier; children well fed) and position your product through your USP. For example, Pizza chain tells customer to get their pizza in 30 minutes of order.

Positioning Template:

Different players may use different positioning templates for conveying USP such as

- For (target customers) : for example Baby food product
- Who (has the problem/need/pain): Coconut water dispensing machine for convenient and hygienic consumption by consumers and selling by vendors?
- Our product ….*(is new)
- Provides… *(results)
- Unlike…*(competitors or substitutes)

4 P's of Marketing

The 4Ps of marketing is a model for enhancing the components of your "marketing mix" – the way in which you take a new product or service to market. It helps you to define your marketing options in terms of price, product, promotion, and place so that your offering meets a specific customer need or demand. The marketing mix and the 4Ps of marketing are often used as synonyms for one another. In fact, they are not necessarily the same thing.

"Marketing mix" is a general phrase used to describe the different kinds of choices organizations have to make during the process of bringing a product or service to market. The 4Ps is one way – probably the best-known way – of defining the marketing mix." The 4Ps are:

- Product (or Service).
- Place.
- Price.
- Promotion.

A good way to understand the 4Ps is by the questions that you need to ask to define your marketing mix. Here are some questions that will help you understand and define each of the four elements:

Product/Service

- What does the customer want from the product/service? What needs does it satisfy?
- What features does it have to meet these needs? Are there any features you've missed out? Are you including costly features that the customer won't actually use?
- How and where will the customer use it?
- What does it look like? How will customers experience it?
- What size(s), color(s), and so on, should it be?
- What is it to be called?
- How is it branded?
- How is it different from products by your competitors?
- What is the most it can cost to provide and still be sold sufficiently profitably? (See also Price, below.)

Place:How does your product/service reach the customer?

- Where do buyers look for your product or service?
- If they look in a store, what kind? A speciality store or in a supermarket, or both? Online? Or direct, via a catalogue?
- How can you access the right distribution channels?
- Do you need to use a sales force? Or attend trade fairs? Or make online submissions? Or send samples to catalogue companies?
- What do your competitors do, and how can you learn from that and/or differentiate?

Price

- What is the value of the product or service to the buyer?
- Are there established price pointsfor products or services in this area?
- Is the customer price sensitive? Will a small decrease in price gain you extra market share? Or will a small increase be indiscernible, and so gain you extra profit margin?
- What discounts should be offered to trade customers, or to other specific segments of your market?
- How will your price compare with your competitors?

An entrepreneur has to consider these factors affecting price.

- costs and expenses
- supply and demand
- Consumer perceptions
- Technological trends
- Government regulations
- Competition

Promotion

- Where and when can you get your marketing messages across to your target market?
- Will you reach your audience by advertising online, in the press, on TV, on radio, or on billboards? By using direct marketing mailshots? Through PR? On the internet?

- When is the best time to promote? Is there seasonality in the market? Are there any wider environmental issues that suggest or dictate the timing of your market launch or subsequent promotions?
- How do your competitors do their promotions? And how does that influence your choice of promotional activity?

Social Media Marketing: The use of social networks, online communities, blogs, wikis, and other online collaborative media tools for marketing purposes. Effective Social Media Marketing includes

- ***Create*** value with an event, a video, a tweet, or a blog entry, that attracts attention and becomes viral.
- ***Enable*** customers to promote a message themselves with multiple online social media venues.
- ***Encourage*** user participation and dialogue that fully engages customers with online conversations.

The New Marketing Concept for Entrepreneurs

Another approach is 4Cs, which presents the elements of the marketing mix from the buyer's, rather than the seller's, perspective. The customer is central to all effective marketing activity.

It is made up of:

- Customer needs and wants (the equivalent of product).
- Cost (price).
- Convenience (place).
- Communication (promotion).

Shift from the 4Ps to the 4Cs:

- From Product……..to *Cocreated(Customer solution)*
- From Promotion….to *Communities*
- From Price……..to *Customizable*
- From Place……..to *Choice/Convenience*

Using the 4Ps of Marketing

The model can be used to help you to decide how to take a new offer to market. It can also be used to test your existing marketing strategy. Marketing strategy is the set of decisions and actions focused on building a sustainable differential advantage, relative to competitors, in the minds of customers, to create value for stakeholders.

Whether you are considering a new or existing offer, follow the steps below to help you to define and improve your marketing mix.

1. Start by identifying the product or service that you want to analyze.
2. Now go through and answer the 4Ps questions – as defined in detail above.
3. Try asking "why" and "what if" questions too, to challenge your offer. For example, ask ***why*** your target audience needs a particular feature. What if you drop your price by 5 percent? What if you offer more colors? Why sell through wholesalers rather than direct channels? What if you improve PR rather than rely on online advertising?
4. Once you have a well-defined marketing mix, try "testing" the overall offer from the customer's perspective, by asking customer focused questions:

- Does it meet their needs? (Product.)
- Will they find it where they shop? (Place.)
- Will they think that it's priced favourably? (Price.)
- Will the marketing communications reach them? (Promotion.)

5. Keep on asking questions and making changes to your mix until you are satisfied that you have optimized your marketing mix, given the information and facts and figures you have available.
6. Review your marketing mix regularly, as some elements will need to change as the product or service and its market grow, mature and adapt in an ever-changing competitive environment.

To use the marketing concept, a small business should:

- ❖ Determine the needs of their customers (Market Research)
- ❖ Analyze their competitive advantages (Market Strategy)
- ❖ Select specific markets to serve (Target Marketing) and
- ❖ Determine how to satisfy those needs (Market Mix).

Marketing Performance

After marketing program decisions are made, owner-managers need to evaluate how well decisions have turned out. Standards of performance need to be set up so results can be evaluated against them. Sound data on industry norms and past performance provide the basis for comparing against present performance.

Opportunities and Risk in Fruits and Vegetables

F&V crops are considered more suitable for smallholders as they are more labour intensive, provide recurring income, have high value markets, offer value addition possibilities and are a mechanism of risk management against field crop failure risk. But they are more input intensive, require more post-harvest handling, are more perishable and their profitability is dependent on market acceptance. They also suffer from high wastage/rejection, there is no Minimum Support Price (MSP), and local markets are thin. Thus, it is high risk business and requires good market linkage for viability.

Fruits and vegetables are produced seasonally, but the market requires products throughout the year. For many decades, this problem of matching product availability with consumer demand was solved in two ways:

- Selling fresh products during harvest and shortly thereafter
- Processing the rest to meet demand during the rest of the year

As technology improved and consumer incomes increased, it became possible to provide fresh produce year-round. Consumers now expect fresh tomatoes, strawberries, and sweet corn every month of the year. In addition, a strong demand remains for processed fruits and vegetables.

Current Issues in F&V Marketing in fresh markets

- Horticultural commodities are highly perishable
- Till recently, horticultural commodities are routed through mandis, established under APMC.

- Non-existent infrastructure at the wholesale markets for packing, grading, sorting, cold storages
- Large amount of wastage (20-40%). They add to marketing costs of the produce
- Fragmented production, leading to fragmented chains
- Traders dominate the chain
- Markets are inefficient, which is evidenced by price gap between producer's price and consumer rupee.
- No transparency in pricing (farmer end)
- Consumer end: vegetables sold on small stores on the road side –weighing, bargaining, quality issues

Evaluating Market Demand

Small-scale growers should collect three types of information before deciding to produce and market fresh fruits and vegetables.

- Determine and define the geographic area where you will market fresh fruits and vegetables. Identify potential customers.
- Assess the level of unfulfilled demand among consumers within the defined marketing area. It is advisable to estimate the amount that consumers (buyers) within that market buy at present. In the process, you will gain insight into how they might be better served.
- Consider the competitive structure of your market. Knowing who your potential competitors are, where they are located, and what services they provide are important pieces of information for you as a new grower-marketer. Potential competitors who might have marketing advantages (lower costs, better locations, and higher-quality produce) or may provide potential consumers with similar products.
- An expected price is a vital piece of information for planning purposes. There is no simple, reliable way of predicting local market prices, but such information is very important to growers. Estimate prices by considering all the available information and using good judgment. When using these estimated prices for planning, remember to include marketing costs and the cost of unsold product.
- Introducing a new product to consumers and getting them to buy it is difficult because most will not be familiar with it or its potential uses. The learning process takes time.

Here are some important questions that you as a grower-marketer must answer:

- Who are the likely consumers of your produce and where do these consumers live?
- How many people live within your marketing area?
- Are consumers currently buying a particular fruit or vegetable?
- How much of the product(s) do your potential customers currently use? Is this use seasonal?
- What prices are consumers paying for high-quality products?
- Are consumers adequately served at present?

Quality Is the Key to Marketing Success

Price and quality are synonymous in fruit and vegetable production. Unfortunately, it is not always easy to know what is meant by "high quality" and quality judgment often varies from year to year. Buyers and consumers, however, often have additional criteria by which they judge produce quality, including flavor, ripeness, odor, cleanliness, and the presence of insects and foreign material. Proper disease management, harvest practices, and postharvest handling are critical to marketing success. Cooling produce to remove field heat and improve shelf life is especially important. Treatments to reduce decay may be another important consideration. Sorting and washing of some fruits and vegetables can also be done to help maintain quality and improve appearance.

Also, several major food distribution chains are beginning to require GAP- and GHP-certified products from their producers. Many of the requirements concern worker hygiene, use of manure, and the quality of the water supply used for irrigation and washing produce. Good Agricultural Practices (GAPs) and Good Handling Practices (GHPs) are voluntary programs that you may wish to pursue for your operation. The idea behind these programs is to ensure a safer food system in light of previous outbreaks of foodborne illnesses resulting from contaminated products.

Innovative Fruit products

Food innovation is **the development and commoditization of new food products, processes, and services**.Food and beverage companies are looking for ways to make healthy, nutritious offerings that are not only enticing, accessible, exciting, and unique, but also sustainable.

New Product trends of fruit products

- New products focusing on freshness, variety and flavor
- Wellness oriented fruit products on the rise
- Fruits are highly regarded as convenient products
- New products targeting different ethnic and demographic groups
- Some fruit products repositioning themselves as a substitute for other food products
- Focus on Traditional foods heritage

Marketing Strategies, ideas and approaches for Fresh Fruits & Vegetables Business

The **fruits and vegetable business** has seen a steep rise in the success rate, especially since the pandemic outbreak as more and more are becoming health conscious. People are prompted to to maintain a healthy lifestyle. As a result, they have become inclined toward consuming natural foods, including vegetables and fruits. Resultantly, the vegetable and fruit trade is growing well. Retailers of fresh produce like fruits and vegetables can enjoy sustainable earnings since these are the products that people would normally consume all year round. If you are thinking of entering this type of business, you must equip yourself with effective marketing strategies that cannot only help you promote your products but can also educate consumers about the consumption of fresh produce.

Nutrition Labelling

When you sell your fruits and vegetables, it is recommended that you supply the necessary nutritional information about these products with the help of package labels. Standard nutrition labels include a list of micro and macronutrients found on your fruit and vegetables. These labels also provide information on a product's serving size and the number of calories per serving. Potential health benefits from your products can also be included on the label.

Preparation Ideas

Some people don't know how to incorporate fruits and vegetables into their meals, which makes them shy away from purchasing fruits and vegetables. As a retailer, you have the power to encourage them in making their own nutritious meal and snacks out of fresh produce. Recipes that you will create for your products must be consulted first with professional cooks, registered dietitians, and other related professionals. Once you have consolidated all possible recipes, you can now include some of them on the packaging of specific fruit and vegetables.

Online Presence

Maintaining an online presence can boost your ability to sell more fresh produce.. Moreover, blog posts and e-book that have cooking tips and full recipes for main courses, side dishes, salads, and desserts can also be maximised online. One can partner with cookbook authors, bloggers, social media influencers, and television show hosts who want to receive fresh produce for their cooking activities. Working with them can help expand your business's market reach.

Pre-packaged Produce

One pre-packaging option that you can do is to pre-cut vegetables. Some consumers don't want to spend a lot of time washing, peeling, and cutting vegetables. Another option for a pre-packaging option is to produce single-serve snacks and meals and party tray. Single-serve snacks are often made up of pre-cut and prewashed vegetables and dips like hummus, crackers, or cheese. Party trays, on the other hand, include vegetable crudités and ranch or onion dip, fruit and cheese platters, and fruit platters with a sweet dip option.

Prepared Meals

There are some consumers who would like to just eat at home without the need to cook for a long time. To help them out, you may want to sell meal kits, heat-and-eat meals, and fully prepared food. Meal kits have pre-portioned ingredients and step-by-step instructions on how to cook them, allowing consumers to cook their food with adequate assistance.

Hydroponics farming

Hydroponics is the newest form of farming that involves soil-less agriculture. In this farming method, the produce is grown using a water culture where a mineral and nutrient-rich water solution is used in the setup. However, to start this business, you'll need basic training and knowledge about the various aspects of Hydroponic farming.

Production of organic plant-based food powder for health

Organic food powders have become an ideal solution for sellers and consumers to increase the shelf-life of perishable items. Moreover, it is a profitable vegetable and **fruit**

business where the products can be exported to any part of the world without any time constraint.

Exporting vegetables and fruits

Exporting vegetables and fruits is an ideal option for those who want to know **how to start a fruit business** and earn good profits while working in the industry. There is a huge demand for Indian produce in the international market. It is an ideal business option for those living in areas where vegetables and fruits are good enough. Reach out to the local growers when starting the **fruit business**. However, you need to have the right set of information about the markets of different countries.

Exotic fruits selling business

Fruits like Orange, Apple, and banana are familiar in the fruits market. But exotic fruits like durian, persimmon, dragon fruit, avocado, and pomelo are native to Southeast Asia. These exotic fruits are in great demand in the Indian market. You can consider selling two or more varieties of exotic fruits. However, consider the import value and other additional expenses required for importing the products from foreign countries. Also, define your market segment and strategise accordingly.

These marketing strategies for value addition and retailing fruits and vegetables can help boost your business at any given aspect.

Innovative Models of Marketing &Retailing in Fruits and Vegetables

- Marketing of F&V by Farmers: Rythu Bazaar
- Co-operatives -- MotherDairy, HOPCOMS
- Farm to Fork Complete Chain – Reliance, ITC
- Wholesaling – Adani Fresh, Metro
- Convenience Stores – Food Bazaar, Spencer
- Direct Marketing –Rythu bazar
- E retailing- Farm2 Kitchen, Mandies on wheel
  Mobile vans-Harra Fresh

Conclusion:

Marketing is a vital process for entrepreneurs because no venture can become established and grow without a customer market. The process of acquiring and retaining customers is at the core of marketing. Entrepreneurs must create the offer (design the product and set the price), take the offer to the market (through distribution), and, at the same time, tell the market about the offer (communications). These activities define the famous Four Ps of marketing: product, price, place (distribution), and promotion (communication). An important part of gaining the market's acceptance is building brand awareness, which, depending on the stage of the venture, may be weak or even non-existent. Entrepreneurs must differentiate their company's product or service so its distinctiveness and value are clear to the customer.

Efficient processing and marketing of fresh fruit and vegetables and their processed products is very much important to reduce the post-harvest losses estimated at 25-30% which is a

national wastage. This will also provide extra income to farmers and will generate employment for youth of the rural areas. The future of fresh appears promising. There's untapped consumer demand and multiple opportunities for Entrepreneurs in manufacturing value added innovative products as well as innovations in retailing to more efficiently provide fresh foods to consumers.

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Post-Harvest Management of Fruits for Entrepreneurship Development

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Introduction:

Post-harvest technology is a very important branch of agriculture and its importance further increased in the field of horticulture as the crops are highly perishable in nature. **Post-harvest technology / post-harvest management** may be defined as the branch of agriculture that deals with all the operations right from harvesting or even the pre-harvest stages till the commodity reaches the consumer, either in fresh (grains, apple, mango, tomato fruits) or processed form (flour, juice, nectar, ketchup) and utilization of the wastes (pomace, peel, seed, skin etc.) in a profitable manner (manufacture of fermented beverages, colour extraction, pectin extraction etc.). Whatever unit operations are done with the crops right from the harvesting stage till the product is consumed, all is dealt with in post-harvest technology. Sometimes some specific pre-harvest operations *i.e.*-harvest sprays of calcium and boron on fruits that result in improving firmness (Post-harvest quality) are also dealt with in post-harvest technology as these are not the regular agronomic practices but are done to affect the pre harvest quality. Post-harvest technology deals with 3 types of products *i.e.* fresh produce, processed products, and handling and processing wastes.

The three main objectives of applying postharvest technology to harvested fruits and vegetables are:

1. To maintain quality (appearance, texture, flavor and nutritive value)
2. To protect food safety, and
3. To reduce losses between harvest and consumption.

Effective management during the postharvest period, rather than the level of sophistication of any given technology, is the key in reaching the desired objectives. While large scale operations may benefit from investing in costly handling machinery and high-tech postharvest treatments, often these options are not practical for small-scale handlers. Instead, simple, low cost technologies often can be more appropriate for small volume, limited resource commercial operations, farmers involved in direct marketing, as well as for suppliers to exporters in developing countries.

Local conditions for small-scale handlers may include labor surpluses, lack of credit for investments in postharvest technology, unreliable electric power supply, lack of transport options, storage facilities and/or packaging

materials, as well as a host of other constraints. Fortunately, there is a wide range of simple postharvest technologies from which to choose, and many practices have the potential of meeting the special needs of small-scale food handlers and marketers. Many of the practices included in the manual have successfully been used to reduce losses and maintain produce quality of horticultural crops in various parts of the world for many years.

There are many interacting steps involved in any postharvest system. Produce is often handled by many different people, transported and stored repeatedly between harvest and consumption. While particular practices and the sequence of operations will vary for each crop, there is a general series of steps in postharvest handling systems that will be followed for the purposes of the manual.

Importance of post-harvest technology:

One of the most important considerations in the world today is to provide nutritious food to approximately six billion population of the planet. Fruits and vegetables, being a rich source of vital nutrients constitute an important component of human nutrition. The concerted efforts made in the horticulture sector have been amply rewarded with a tremendous increase in production of various fruits and vegetables, throughout the world. In consistent with the global trend, India has emerged as the second largest producer of fruits and vegetables and 25-40% of this hard earned valuable produce goes waste due to inadequate post-harvest infrastructure and poor utilization (2.4%) by processing industry. Moreover, there is little point in growing more if much of it is to be lost. Besides quantitative losses, the problem of quality and safety of produce is also significant to the consumers. The whole scenario thus, reflects a very gloomy picture. Unless *post-harvest technology* gets its due recognition and proper growth, the horticulture industry cannot thrive.

World production of fruits and vegetables at present is 878 million metric tons (fruit production- 392 million metric tons and vegetable production- 486 million metric tons). Worldwide post-harvest fruit and vegetables losses are as high as 30 to 40% and even much higher in some developing countries. Reducing post-harvest losses is very important; ensuring that sufficient food, both in quantity and in quality is available to every inhabitant in our planet. The prospects are also that the world population will grow from 5.7 billion inhabitants in 1995 to 8.3 billion in 2025. World production of vegetables amounted to 486 million ton, while that of fruits reached 392 million tonnes. Reduction of post-harvest losses reduces cost of production, trade and distribution, lowers the price for the consumer and increases the farmer's income.

Whereas, Indian production of fruits and vegetables are 112.52 million metric tons. It includes fruit production of 32 million metric tons which is about 8% of world production and second largest producer after Brazil in the

world and vegetable production of 80.52 million metric tons which is about 15% of world production and second largest producer after China in the world. But India loses about 30-40% of the produce due to improper Post-harvest Management. A loss estimated at Rs. 40,000 crores per year. India wastes fruits and vegetables every year equivalent to the annual consumption of the United Kingdom.

Recently, *post-harvest technology* of fruits and vegetables has engaged the attention of policy makers, planners and scientists in the developed countries. However, in the developing countries the situation is far from satisfactory, where even the recognition of the subject is a recent phenomenon. Development of *post-harvest technology* could save a lot of produce from spoilage, become a new diversified source of food and a tool to fight malnutrition, prevailing in these countries. For this, sustained efforts for in-depth research, value addition and efficient strategy for technology and then only it could absorb new innovations which are a slow process.

The following points shall high light the importance of Post-harvest technology

1. **Reduction in post-harvest losses:** Post-harvest technology ensures reduction of losses in what has already been produced. So; reduction of post-harvest losses is an alternative way of increasing production of agricultural and horticultural crops.
2. **Reduction of cost of production:** Post-harvest technology reduces cost of production, packaging, storage, transportation, marketing and distribution, lowers the price for the consumer and increases the farmer's income.
3. **Reducing malnutrition:** Proper post-harvest technology ensures availability of sufficient food to all thus reducing malnutrition and ensuring healthy growth of the nation. It also extends the season of availability of a particular commodity.
4. **Economic loss reduction:** Reduces economic losses at grower level, during marketing and at consumer’s end.
5. **Availability:** Had there been no knowledge of post-harvest technology, apples would not have ever reached Kerala and Banana in H.P. or Kashmir today. Today we can get perishable commodities like Banana, tomato etc. throughout the year and in almost every place in the country. Apples can be made available throughout the year although the cropping season is just for 2-3 months. Thanks to the advancement made in the field of post-harvest technology. The increasing exports of fruits and vegetables have become possible only by the interventions made in post-harvest technology.
6. **Employment generation:** The food processing industry ranks first in terms of employment generation with approximately 15 lakhs persons employed. Employment potential in post-harvest and value addition sector is considered to be very high. Every one crore rupee invested in fruit and vegetable processing in the organized sector generates 140 persons per year of employment as compared to just 1050 person days of employment per

year in small scale investment (SSI) units. The SSI unit in food industry employs 4, 80,000 persons, contributing 13% of all SSI units employed.

7. **Export earnings:** Export of fresh and processed horticultural commodities also attracts valuable foreign exchange.
8. **Defense and astronaut's requirements:** Defense forces posted in remote border areas as well as astronauts who travel into space have special requirements of ready to eat and high energy low volume food. The requirements are fulfilled by processing industries.
9. **Infant and sports preparations:** Today special infant and sports drinks and other processed preparations are available for use especially by these people. These preparations are done especially to meet the specific nutritional requirements of their body.

Causes of post-harvest losses:

The causes of post-harvest losses are many, but they can be classified into two main categories. The first of these is physical loss. Physical loss can arise from mechanical damage or pest or disease damage resulting in produce tissue being disrupted to a stage where it is not acceptable for presentation, fresh consumption or processing. Physical loss can also arise from evaporation of intercellular water, which leads to a direct loss in weight. The resulting economic loss is primarily due to the reduced mass of produce that remains available for marketing but can also be due to a whole batch of commodity being rejected because of a small proportion of wasted items in the batch.

Loss of quality is the second cause of post-harvest loss, and this can be due to physiological and compositional changes that alter the appearance, taste, texture and make produce less aesthetically desirable to end users. The changes may arise from normal metabolism of produce (e.g. senescence) or abnormal events e.g. chilling injury) arising from the post-harvest environment. Economic loss is incurred because such produce will fetch a lower price. In many markets there is no demand for second class produce, even at reduced price, which leads to total economic loss even though the goods may still be edible.

Despite decades of educational efforts, the most common causes of post harvest losses in developing countries continue to be rough handling and inadequate cooling and temperature maintenance. The lack of sorting to eliminate defects before storage and the use of inadequate packaging materials further add to the problem. In general, minimizing rough handling, sorting to remove damaged and diseased produce and effective temperature management will help considerably toward maintaining a quality product and reducing storage losses. Storage life will be enhanced if the temperature during the postharvest period is kept as close to the optimum as feasible for a given commodity (Table – 1.1).

Table 1.1: Causes of Post-Harvest Losses

Group	Examples	Principal causes of postharvest losses and poor quality (in order of importance)
Root vegetables	Carrots	Mechanical injuries
	Beets	Improper curing
	Onions	Sprouting and rooting
	Garlic	Water loss (shriveling)
	Potato	Decay
	Sweet Potato	Chilling injury (subtropical and tropical root crops)
Leafy vegetables	Lettuce	Water loss (wilting)
	Chard	Loss of green color (yellowing)
	Spinach	Mechanical injuries
	Cabbage	Relatively high respiration rates
	Green onions	Decay
Flower vegetables	Artichokes	Mechanical injuries
	Broccoli	Yellowing and other discolorations
	Cauliflower	Abscission of florets
		Decay
Immature-fruit vegetables	Cucumbers	Over-maturity at harvest
	Squash	Water loss (shriveling)
	Eggplant	Bruising and other mechanical injuries
	Peppers	Chilling injury
	Okra Snap beans	Decay
Mature-fruit vegetables and fruits	Tomato	Bruising
	Melons	Over-ripeness and excessive softening at harvest
	Citrus	Water loss
	Bananas	Chilling injury (chilling sensitive fruits)
	Mangoes	Compositional changes
	Apples Grapes Stone fruits	Decay

Relative perishability and storage life of fresh produce:

Classification of fresh horticultural crops according to their relative perishability and potential storage life in air at near optimum temperature and relative humidity (Table 1.2).

Table 1.2: Relative perishability and storage life of fresh produce

Relative perishability	Potential storage life (weeks)	Commodities
Very high	<2	Apricot, blackberry, blueberry, cherry, fig, raspberry, strawberry; asparagus, bean sprouts, broccoli, cauliflower, green onion, leaf lettuce, mushroom, muskmelon, pea, spinach, sweet corn, tomato (ripe); most cut flowers and foliage; minimally processed fruits and vegetables.
High	2-4	Avocado, banana, grape (without SO_2 treatment), guava, loquat, mandarin, mango, melons (honeydew, crenshaw, Persian), nectarine, papaya, peach, plum; artichoke, green beans, Brussels sprouts, cabbage, celery, eggplant, head lettuce, okra, pepper, summer squash, tomato (partially ripe).
Moderate	4- 8	Apple and pear (some cultivars), grape (SO2-treated), orange, grapefruit, lime, kiwifruit, persimmon, pomegranate; table beet, carrot, radish, potato (immature).
Low	8-16	Apple and pear (some cultivars), lemon; potato (mature), dry onion, garlic, pumpkin, winter squash, sweet potato, taro, yam; bulbs and other propagules of ornamental plants.
Very low	>16	Tree nuts, dried fruits and vegetables.

Fresh fruits and vegetables (F&V) have been part of human diet since the dawn of the history. The systematic nutritional value of the some F & V was recognized in the early 17^{th} century in England. One example is the ability of the citrus fruit to cure scurvy, a diseases wide spread among naval personnel.

An example of the importance of the field to post-harvest handling is the discovery that ripening of fruit can be delayed, and thus their storage prolonged, by preventing fruit tissue respiration. The knowledge of the fundamental principles and mechanisms of respiration, leading to post-harvest storage techniques such as cold storage, gaseous storage, and waxy skin coatings. Another well-known example is the finding that ripening may be brought on by treatment with ethylene.

Fruits and vegetables are being rich in vitamins and minerals, known as protective foods. Due to their high nutritive valve, ready availability, and being inexpensive they make significantly contributes to human well-being. Realizing the worth of fruits and vegetables in human health ICMR recommend consumption of 120g of fruits and 280g of vegetables per capita per day.

- F&V are rich in ascorbic acid which have beneficial effects of wound healing and antioxidant. Dietary source of Vit.C is essential, since human beings lack the ability to synthesize it.
- Some F&V are excellent source of beta -carotene (provitamin A) which is essential for the maintenance of eyes health; and folic acid which prevents anemia.
- These also prevent degenerative diseases which are prevalent in people with sedentary lifestyle. Concern about obesity and coronary heart diseases have led to reduced levels of fat intake. Antioxidants, phenolic compounds and dietary fiber are considered to be beneficial in reducing risk of various cancers.
- Many F&V have neutraceuticals properties.

F & V provide variety in the diet through difference in colour, shape, taste, aroma and texture that distinguish from the other major food groups of grains, meats and dairy products. Sensory appeal of F&V is not confined to consumption but also has market value. Diversity in their colour and shape is used by traders in arranging product displays to attract potential purchasers; and chefs have traditionally used F & V to enhance the attractiveness of the prepared dishes or table presentations; to adorn meat displays and F & V carvings have becomes an art.

The ornamental provide sensory pleasure and serenity, derived from the colors, shape and aroma of individual species. Garden plants, cut flowers, foliage and flowering plants are increasingly used in exterior and interior decoration. Considerable commercial opportunities arise from their role in social, religious and economic ceremonies and special greeting occasion such as festivals, Valentine's day and others occasion.

In India > 90 types of individual F&V are being produced by utilizing its varied agro climatic condition. India has now emerged as the largest producer of fruits relegating Brazil and 2nd largest producer of vegetables next to China.

The Indian total production during the year 2013-09 was of the order of 68.46 million ton fruits and 129.00 mill. ton vegetables and total horticultural produce was 214.71 mill. ton (Agri. Ministry, GOI, 2010) (Table – 1.3). India accounts for about 8.40% and 9.10% of global production of Fruits and Vegetable respectively (except potato and onion where it accounts for 7.60% and 9.70% respectively). Crop wise consideration shows that it has largest producer of mango, accounting to 66% of world production; holding record

highest productivity in grapes; contributing to 11% of world banana and; 3rd largest producer of coconut; largest exporter of cashew nut (production + import of raw nut and then export) and 1st in spice trade.

Table 1.3: India's Exports of Horticultural Products (Rs. in cores)

Items	***2007- 08***	***2008- 09***	***2009-10 (Provision)***
Fresh Fruits	1447	1946	2269
Fresh Vegetables	1473	2454	2904
Processed Vegetables	605	711	752
Processed Fruit Juices	769	1099	1156
Miscellaneous Processed Items	1362	2077	2137

(Source-Ministry of Agri. GOI-2010)

India share in global trade of horticultural produce is miniscule and it is < 1% and only 2.2% of the total horticultural produce is being processed (Table – 1.4). Due to inadequate post-harvest handling 20-30% of horticultural produce are lost annually and such loss in terms of monitory values goes to about Rs.7000/- per annum. This loss of great magnitude not only robs labour and recourses of the farmer and the nation but also dwindle away a big profit of the farmer. Managing the post-harvest losses is very much important. Preservation of the produce is one of the ways to manage post-harvest losses.

Table – 1.4: Fruits and vegetables used for processing in different countries

Sr. No.	**Countries**	**Percentage (%)**
1.	Malaysia	83
2.	Saudi Arabia	80
3.	Philippine	78
4.	Brazil	70
5.	Australia	60
6.	USA	40
7.	UK	50
8.	**India**	**2.20**

Though India produces large quantity of horticultural produce in the world, per capita consumption is very low for our over a billion population. Major portion is being wasted at various stages of from production till it reaches end-user and its mainly due to inadequate facilities for processing. Delay in the use of harvested produce will affect its - freshness, palatability, appeal and nutritive value.

Need for Post-harvest technology

F & V and ornamentals are ideally harvested based on optimum eating or visual quality. However, since they are living biological entities, they will deteriorate after harvest. The rate of deterioration varies greatly among

products depending on their overall rate of metabolism, but for many it can be rapid. For example marketing chains where produce is transported from farm to end user within a short time period, the rate of PH deterioration is of little consequences. However, with the increasing remoteness of production areas from population centers, the time lag from farm to market is considerable. The deliberate storage of certain produce to capture better return adds to this time delay between farm and end user, by extending the marketing periods into times of shorter supply. Thus a modern marketing chain puts increasing demands on produce and creates the need for the PH techniques that allows retention of quality over an increasingly longer period.

Harvest: is a specific and single deliberate action to separates the food stuff with or without non-edible portion from its growth medium.

Eg	Plucking of F &V	Reaping of cereals
	Lifting of fish from water	lifting of tuber or roots from soil *etc.*

Postharvest - all the succeeding action after harvest are defined as post-harvest technique. From this period of time all action is enters the process of preparation for final consumption.

Eg	Pre cooling	Waxing
	Cleaning/washing	Chemical treatments
	Trimming/sorting	Packaging
	Curing	Transportation
	Grading	Storage, ripening and distribution

Post-harvest Shelf Life - Once harvested, produce are subject to the active process of senescence. Numerous biochemical processes continuously change the original composition of the produce until it becomes unmarketable. The period during which consumption is considered acceptable is defined as the time of "post-harvest shelf life".

Post-harvest shelf life is typically determined by objective methods like

→ Overall appearance

→ Taste, flavor, and texture of the commodity. These methods usually include a combination of sensory, biochemical, mechanical, and colorimetric(optical) measurements.

Horticultural produce is biological entity with various physiological activities like transpiration and respiration continuing even after harvesting. This process leads to the bio-chemical breakdown and cause spoilage of the produce. Spoilage is initiated by enzymes present inside the produce, involvement of microorganism, infestation of insect-pest and invasion of pathogens. By taking care of these factors, food products can be stored for longer period.

Problems faced in establishment of entrepreneur in post harvest management.

→ insufficient demand
→ weak infrastructure
→ poor transportation
→ perishable nature of crops and
→ grower sustains substantial losses

The market for many 'exotic' crops has increased many folds over traditional ones. Every year new crops are being offered for sale in the markets and it demands innovation in the handling methods and study of their quality factors.

The process which deals with handling of parts of the plants, such as fruits, vegetables, root crops, spices, foliage and flowers which are often collectively referred to as perishable crops, is called postharvest management. Perishables are botanically and physiologically very diverse and therefore behave in very different ways and require a variety of different treatments and conditions.

Post-harvest handling is the stage of crop production immediately following harvest, including cooling, cleaning, sorting and packing. The instant a crop is removed from the ground, or separated from its parent plant, it begins to deteriorate. Post-harvest treatment largely determines final quality, whether a crop is sold for fresh consumption, or used as an ingredient in a processed food product. Effective handling decreases post-harvest losses. The most important goals of post-harvest handling are

1. Keeping the product cool, to avoid moisture loss and slow down undesirable chemical changes
2. Avoiding physical damage such as bruising, delay spoilage.

After the harvest, post-harvest processing is usually continued in a packing house. This can be a simple shed, providing shade and running water, or a large-scale, sophisticated, mechanized facility, with conveyor belts,automated sorting and packing stations, walk-in coolers. In mechanized harvesting, processing may also begin as part of the actual harvest process, with initial cleaning and sorting performed by the harvesting machinery.

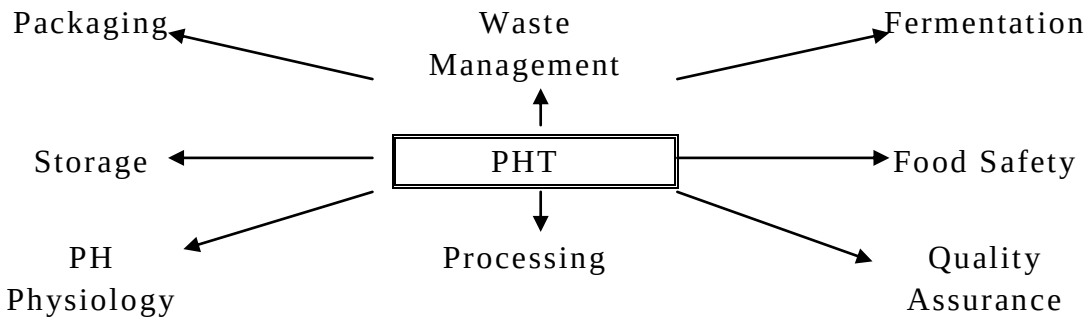

Fig. 1: Post-harvest technology and its sub – disciplines

Implementing Good Agricultural Practices (GAP) in production and harvest; Good Manufacturing Practices (GMP) especially during post-harvest and Quality and Safety Assurance Systems, such as HACCP (Hazard Analysis Critical Control Point), throughout the food chain to avoid and to control hazards are of the key factors for the flourishing nature of the post-harvest industries (Fig.1).

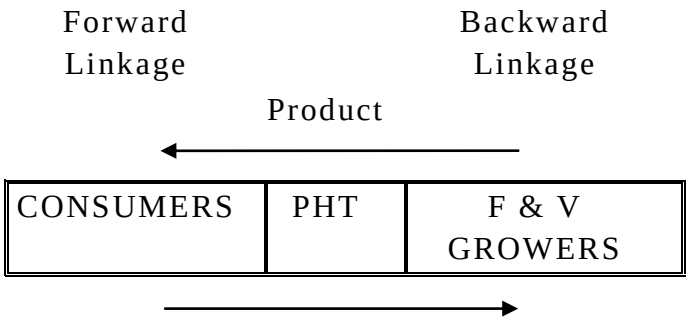

Fig. 2: Post-harvest technology functioning chain

Effective management during the postharvest period, rather than the level of sophistication of any given technology, is the key in reaching the desired objectives. Many simple practices have successfully been used to reduce losses and maintain produce quality of horticultural crops in various parts of the world for many years.

There are many interacting steps involved in any post-harvest system. Produce is often handled by many different people, transported and stored repeatedly between harvest and consumption. While particular practices and the sequence of operations will vary for each crop, there is a general series of steps in post-harvest handling systems that are often followed.

- Harvesting and preparation for market
- Curing root, tuber and bulb crops
- Packinghouse operations
- Packing and packaging materials
- Decay and insect control
- Temperature and relative humidity control
- Storage of horticultural crops
- Transportation of horticultural crops
- Handling at destination
- Packing and Packaging Practices

PHT - Importance and Role

1. PH Loss reduction
2. Value addition
3. Contribution to the Economy
4. Making availability of fruits and vegetables during off seasons
5. Tools for export earnings
6. Employment generation
7. Adding variety in taste and nutrition
8. Waste utilization
9. Home scale preservation
10. Supply of food to the defence forces
11. Special canned fruits for infants & children's
12. Food supplier to the Astronauts

Conclusion:

Many recent innovations in postharvest technology in developed countries have been in response to the desire to avoid the use of costly labour and the desire for cosmetically "perfect" produce. These methods may not be sustainable over the long term, due to socioeconomic, cultural and/or environmental concerns. For example, the use of postharvest pesticides may reduce the incidence of surface defects but can be costly both in terms of money and environmental consequences. In addition, the growing demand for organically produced fruits and vegetables offers new opportunities for small-scale producers and marketers

Best out of waste: Case study of Banana Pseudostem

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Introduction:

Secondary agriculture is a key to maximize that profit and major share can be gained from the agro waste utilization to create wealth. As a case study we have very good success story of Banana pseudostem on which NAU, Navsari has worked extra ordinary research. Banana (*Musa sp.)* is the second most important fruit crop in India next to mango. Its year round availability, affordability, varietal range, taste, nutritive and medicinal value makes it the favorite fruit among all classes of people. It has also good export potential. Banana is grown in about 120 countries. Total annual world production is estimated at 86 million tonnes of fruits.

Apart from fruit, banana crop generate also huge quantity of biomass in the form of pseudostem, leaves, suckers etc. At present, this biomass particularly pseudostem is absolute waste in most of the states of India to this practice of disposing pseudostem as waste which cost farmers about Rs. 12000 to 15000/ha. Disposal of pseudostem in a routine ways i.e., dumping on field bunds and burning, disposing in nalla/natural drains etc. causing environmental problems.

The activities envisaged in the project are standardize processes for extracting textile grade fibres from pseudostem and prepare home furnishings, handmade papers as well as industrial le vels from fibres and scutchering waste, edible products from central core, evaluating enriched sap as liquid fertilizer and scutchering waste based vermicompost in different crops and developing linkage for marketing of pseudostem based products. During

the process of fibre extraction, four components are obtained simultaneously. These components are fibre (600-800 kg/ha), scutcher (30 to 35 t/ha), sap (12000 to 15000 l/ha) and central core (8 to 10 t/ha).

Fibre **Scutcher** **Sap** **Central core**

1. Fibre based products

Banana Fibre is Eco friendly and Chemical free. It is grease proof, water and fire resistant and totally bio degradable. It is the Fibre extracted from the trunk of Banana tree which is considered as a waste. Banana fiber is used in manufacturing industries of fabric woven as well as non woven, Microcrystalline cellulose (MCC), handicrafts, home decorative, door mats, table mats, pooja and meditation mats. Banana fiber has got very wide usage in the Paper units *like*, 100% chemical free tissue paper, filter paper, paper bags, craft papers, carry bags, decorative papers, bond papers, products like pen stands, table decorative, land shades *etc*., Products that are made out of banana fiber has very good market.

2. Scutcher based products

2.1 As organic: Huge quantity of scutcher (about 30 to 35 t/ha) is generated during fibre extraction. The process has been standardized for vermicompost preparation using pseudostems cutcher and dungs. The vermicompost prepared had been tested for its quality and is being marketed in the NAU trade name NAUROJI. Application of vermicompost @ 3 kg /plant in banana and 5 t/ha in sugarcane in addition to recommended dose of fertilizer recorded comparable yields of both the crops with FYM and biocompost. Use of vermicompost also sustains soil health.

2.2 As a fish feed: An innovative experiment was conducted to explore the feasibility of blending vermicompost with fish feed. The results of two year study revealed that the routine fish feed (cattle feed) can be substituted by vermicompost up to 30 per cent without any reduction in body weight of fish.

3. Sap

3.1 Nutrient spray solution: About 12,000 to 15,000 litres of sap can be obtained from the pseudostem obtained from ne hectare. In addition to the direct use of sap as liquid fertilizer, its enrichment process has been standardized. That product launched by NAU in known as "NAUROJI Novel Organic Liquid Fertilizer".Apart from essential plant nutrient, it also contains growth promoting substances *viz.*, GA and cytokinin. Enriched sap of about 2500 litres have been prepared and distributed among the farmers for demonstration. The enriched sap has been tested through foliar application in different crops. Foliar application of enriched sap could improve the vigour of brinjal and chilli nursery. The seedlings become ready for transplanting 6 to 8 days earlier than traditionally grown. Similarly, fruit retention in mango was increased by 50 per cent due to 4 sprays of enriched sap.

4. Central core

Central core is inner most tender portion of the pseudostem which is edible. About 10 to 12 t/ha central core can be obtained. The work has been taken up for standardizing processes for developing various edible products from it. Process for preparing candy, RTS and pickles has been standardized. Left-out syrup after preparing candy can be use for preparing RTS. This RTS can be flavoured with any natural or synthetic flavours.

Various Byproducts Prepared from Banana Pseudostem

Organic Fabric and Handicrafts made from Banana Fibres and Yarn

Sample of files and different kind of papers made from Banana Fibres

Vermicopost from Scuture **Fish Feed from Scuture**

Chutney, jam and jelly (edible products) prepared from Centralcore

Organic Liquid Nutrient, Pesticide and Fungicide prepared from Banana

NAUROJI Novel Organic Liquid Nutrients

About 12,000 to 15,000 litres of sap can be obtained from the pseudostem obtained from one hectare. In addition to the direct use of sap as liquid nutrient, its enrichment process has been standardized. A banana pseudostem based organic liquid nutrients was invented by scientists of NAU, Navsari, known as "NAUROJI Novel Organic Liquid Nutrients".which is made with particular aimed at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of banana pseudostem based wastes (sap, fibre, scuture, *etc*.) and other biological materials along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an eco friendly pollution free environment. With the addition of botanical substitutes, farmers have been able to produce bigger crops on less land, increasing crop productivity by 20 to 50 percent.

The Products contains not only essential plant nutrient but also plant growth regulators viz. NAA, cytokinin and GA3 as well as some beneficial soil conditioning as well as waste decomposing organisms. It also contains bacteria which can improve soil health and can be useful in different stages of plant growth e.g. vegetative development, Flowering, Fruit setting, Fruit development etc. It also contains bacteria which can improve soil health and can be useful in different stages of plant growth e.g. vegetative development, Flowering, Fruit setting, Fruit development etc.

Product Application :

It can be use in different crops in different stages by various methods like fertigation, drenching, foliar spray, injection, cone feeding *etc.*

NOVEL : Organic Liquid Nutrients

- It is pure organic product
- It supply plant nutrients (N,P,K) including micronutrients
- It contains naturally occurring growth promototers
- It improves soil physical properties like structure, water holding capacity etc.,
- It contains botanical pesticides
- It increase the availability of nutrients
- The product which is used in agriculture to improve soil fertility and enhance crop productivity.
- Enhance vigorous root development and growth
- It enhances total plant growth, number of flower, maximum conversion of flowers into fruits and pods.
- It is a growth promoter; it is very helpful in nursery plants.
- It reduces fruit drop and increase fruit size and setting.

NOVEL PRIME (FUNGICIDE)

- NOVEL Prime (fungicides) refer to products that derived from natural plant sources with no chemical alteration.
- It is organic supplements with botanical fungicides.
- Contains major/micro nutrients.
- Contains naturally occurring PGRs
- Fortified botanical fungicides can control most of the anthracnose, mildews, leaf spot, rust, blasts, wilting and other harmful fungi/virus/bacteria.
- Can give plant a complete food
- It can improve plant health and its vitality because of availability of plant nutrients and hormones, which ultimately resulting in increasing crop yield and reducing cost of production.

NOVEL PLUS (pesticide)

- It refer to products that derived from natural plant sources with no chemical alteration
- It is organic supplements with botanical pesticides.
- Can give plant a complete food
- Contains major/micro nutrients.
- Contains naturally occurring PGRs
- Fortified botanical pesticide can control most of the insect-pest like aphids, jassids, white fly, caterpillars, borers and other harmful insect/pests.

- It can improve plant health and its vitality because of availability of plant nutrients and hormones, which ultimately resulting in increasing crop yield and reducing cost of production.

Prime (Fungicide)

Plus (Pesticide)

These are some photographs of various crops shared by farmer's with us, after using NOVEL organic liquid nutrients. They have good experience with these 3 NOVEL products and also increased their yield and quality of produce.

- ✓ Looking to such innovative benefits of Novel, it gets international patent also.
- ✓ For the benefit of the farmers of globe and to make it available in every corner of earth, Navsari Agricultural University has done agreements through technology transfer for commercial scale production and Marketing of it with different private companies.
- ✓ Currently, it is available in the commercial market with different brand names and all above brand packaging contain NAU symbol on it as a symbol of trust and quality.
- ✓ Farmers are advised to use it as per the suggestion by NAU.

- MoU signed with thirty six (36) parties for commercial production and marketing of organic liquid nutrient from banana pseudostem sap and Candy from central core

List of technology transfer done by Navsari Agricultural University, Navsari under Banana Pseudostem Value Chain Project

Sr No.	Party name	Address	Year
1	Blossom	Surat (Gujarat)	Mar-13
2	Green Globe Biotechnologies	Jalgaon (Maharashtra)	Mar-13
3	Kisan Agri Mall	Anand (Gujarat)	May-13
4	ShivamAgro Tech	Dhulia (Maharashtra)	Sep-14
5	The Tapti Valley Banana Processing and Products Co-operative Society	Jalgaon (Maharashtra)	Mar-16
6	Organico Inc.	Vadodara (Gujarat)	Sep-16
7	Sahjanand Bio-Organics	Navsari (Gujarat)	Mar-17
8	Happy Face Foundation	Ahmedabad (Gujarat)	Jul-17
9	Greemanity Industries LLP	Ahmedabad (Gujarat)	Jul-17
10	Eco Fillip Agro Industries	Jalgaon (Maharashtra)	Apr-18
11	Agricare Organic Solution	Banaskantha (Gujarat)	Oct-18
12	K3 AgrivalaEntrprise Pvt Ltd.	Palanpur (Gujarat)	Oct-18
13	Om Corporation	Surat (Gujarat)	Dec-18
14	Nirmaya Life Science Pvt. Ltd.	Vadodara. (Gujarat)	Nov-19
15	MSV Organic	Kheda (Gujarat)	Jan-20
16	Nutricare Organic Solutions	Suart (Gujarat)	Feb-20
17	LeafixAgritech Private Limited	Ahmedabad (Gujarat)	Mar-20
18	Bharti Organics	Anand (Gujarat)	Aug-20
19	PashupatiEquipments (P) Ltd	Palam,New Delhi	Aug-20
20	Laxmi Bio farms	Nandura (Maharashtra)	Aug-20
21	Green Guardian Agrotech Private Ltd	Jalgaon (Maharashtra)	Sep-20
22	Orbifert Organic	Italva,Navsari (Gujarat)	Oct-20
23	OmakshiAgro Private Ltd.	Delhi	Oct-20

24	Shree KhedutSahakari Ginning & Processing Society Ltd.	Bardoli (Gujarat)	Jun-21
25	Gencrest Bio-Products Pvt. Ltd.	Mumbai (Maharashtra)	Jun-21
26	GNX AgroBiochemPvt. Ltd	Valsad (Gujarat)	Jun-21
27	Bapa Sitaram Sakhi Mandal	Bhavnagar (Gujarat)	Jun-21
28	KTD Biotechnologies Pvt. Ltd	Buldana (Maharashtra)	Oct-21
29	GHK Organic Pvt. Ltd	Bharuch (Gujarat)	Oct-21
30	MaglamKalpataru industries LLP	Burhanpur (Madhyapradesh)	Oct-21
Central Core Candy			
1	ShivamAgro Tech	Dhulia (Maharashtra)	Sep-14
2	Green Globe Biotechnologies	Jalgaon (Maharashtra)	Mar-14
3	The Tapti Valley Banana Processing and Products Co-operative Society	Jalgaon (Maharashtra)	Mar-16
MoU under CAAST Project			
1	Unifab India Solutions, Nashik	Nashik, Maharashtra	Apr-19
2	Paperdom, Surat	Surat, Gujarat	Apr-19
International MoU for Organic Liquid Nutrients from Banana pseudostem:			
1	Accrued Gains Pty Ltd	Botsawana, Africa	Dec-19

Properly dealing with discarded products can reduce the potential for environmental pollution while also protecting the individual who is responsible for the discarded materials.

Conclusion:

Secondary agriculture helps in using all parts of an agricultural produce (e.g. crop residues), processing to enhance shelf-life, increasing total factor productivity, and generating additional jobs and income for farmers. Banana pseudostem waste which is abandoned in the field can be routed back to support agriculture. Thus, the present study revealed the possibility of utilising banana pseudostem waste as a substrate for the production various products.

Food Safety and Quality Specifications for fruits and vegetables in Indian Food Industry

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Introduction

The market-oriented, successful food production must focus on the final consumer. The aim of fruit and vegetable production is to deliver a safe and wholesome final product to the consumer. In order to develop proper practices and methods of production, hazards and the risks that they may impose to consumer health have to be fully understood. In recent years, agricultural exports to developed country markets have emerged as a potentially major source of export growth for many developing countries. But there are many challenges in exporting the agricultural commodities. The capacity of developing country exporters to enter these markets depends critically on their ability to meet stringent food safety standards imposed by developed countries. Not only are these standards stringent, but they are increasingly demanding. It is anticipated that improving the ability of developing countries to meet food quality and safety standards for horticulture products will facilitate greater international market access, reduce the impact of price competition, stimulate investment and mitigate risk, leading to increased exports. This increase in exports will stimulate commercial production and thus encourage employment creation and increased productivity, benefiting the poor through higher incomes and more jobs. Food Safety and Food Quality are the two most important aspects of any food-handling environment. For any organization dealing in food products should have proper Food Safety and Food Quality management system. The major difference between Food Safety and Food Quality are that one keeps consumers safe and the other keep consumers satisfied.

Today consumers have become more health conscious; the market for fresh foods and vegetables has steadily increased. Besides direct consumption, processing of fruits and vegetables has also seen an upsurge. An increase in the consumption of fresh fruits and vegetables has also brought to the forefront of food safety concerns. One of the important criteria for evaluating the quality of fruits and vegetables is their appearance like maturity, colour, shape, aroma, flavour as well as texture. Another important indicator of quality is the absence of harmful substances in these fruits and vegetables, as more often than not they are consumed raw, particularly fruit. Fruits and vegetables can be contaminated with harmful substances pre-harvest by animals, insects, water, soil, dirty equipment, and poor human handling. Post-harvest they can be contaminated by unclean wash water, packing materials,

process equipment, and dirty transportation vehicles. Food Safety and Standards Authority of India (FSSAI) has set the standards for fruits and vegetables that all food businesses must comply with if food safety and quality are to be maintained. The Indian agricultural sector already is a powerhouse – not least in the field of fruits and vegetables. There is immense opportunity to improve efficiency and food safety which will lead to better consumer health, increased farmers' incomes and export opportunities. This requires enhanced food safety awareness and traceability in the production chain. In this respect, food safety standards, cost-effective monitoring and enforcement as well as cooperation with industry and training of farmers are of the utmost importance. So is effective communication, as consumers are demanding more information on food safety, hygiene and quality.

Meaning of Food Safety

Food Safety refers to practices and conditions that preserve the quality of food to prevent contamination and food-borne illnesses during preparation, handling and storage. The correct Food Safety practices give assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use. The Food Safety procedures and policies include aspects likepersonal hygiene, ppersonal presentation and preparation, pest control, ccleaning and sanitizing, temperature control and measurement, food Safety hazard identification and control etc.

Meaning of Food Quality

Food Quality refers to the features and characteristics of a food product that is acceptable to consumers and meet their expectations;value for money;conforms to the required specifications, andprofitable to the company. The major aspects of food quality are appearance (size, color, shape and consistency), texture, flavor (odour and taste), correct labelling with the ingredients, nutritional information and supplier/manufacturer details listed, packaging, traceability etc.

Table 1. Categorization of Food Hazards

Deterioration factor	Determining causes
1. Biological and physiological • Pests (e.g. insects, rodents, birds) • Spoilage micro-organisms (e.g. bacteria and fungi) • Respiration rate • Ethylene production • Growth and development • Maturation, ripening, senescence • Transpiration and water loss	✓ Inadequate good agricultural/ manufacturing practices ✓ Inadequate hygiene and sanitation practices ✓ Excessive heat and high temperatures ✓ Environment (temperature, atmospheric pressure) ✓ Time and environment ✓ Time and environment ✓ Time, environment and improper packaging
2. Chemical and biochemical • Enzymic • Oxidation	✓ Environment, handling and bruising ✓ High oxygen concentration and availability ✓ Improper packaging, composition, heat

• Non-enzymic changes • Light oxidation	✓ Improper packaging
3. Physical • Bruising and crushing • Wilting • Texture changes • Moisture changes	✓ Improper handling and packaging ✓ High relative humidity and improper packaging ✓ Environment and improper packaging ✓ High relative humidity and improper packaging

The top management is responsible for establishing policies, guidelines and strategic objectives, as well as for providing leadership and direction for quality management within the organization. It should also establish those responsible and hold them accountable for a wide variety of management system processes to ensure quality management system. The Fig. 1 throws light on the top management responsibilities of a food organization according to FAO. The Fig. 2 discusses the main components of food supply chain efficiency for organizations in food industry. According to ISO 9001:2015 top management's responsibilities for quality management are:

- Take accountability for the effectiveness of the quality management system;
- Ensure that the quality policy and quality objectives are established for the quality management system and are compatible with the context and strategic direction of the organization;
- Ensure the integration of the quality management system requirements into the organization's business processes;
- Promote the use of the process approach and risk-based thinking;
- Ensure that the resources needed for the Quality Management System are available;
- Communicate the importance of effective quality management and of conforming to the quality management system requirements;
- Ensure that the quality management system achieves its intended results;
- Engage, direct and support persons to contribute to the effectiveness of the quality management system;
- Promote improvement;
- Support other relevant management roles to demonstrate their leadership as it applies to their areas of responsibility;
- Demonstrate leadership and commitment with respect to customer focus;
- Ensure that the responsibilities and authorities for relevant roles are assigned, communicated and understood within the organization.
- Perform management review of the organization's quality management system;
- Establish, implement and maintain a quality policy;
- Ensure that the responsibilities and authorities for relevant roles are assigned, communicated and understood within the organization.

Fig. 1 Top Management Responsibilities of a Food Organization

Source: FAO, 2021

Fig. 2 Food Supply Chain Efficiency

Source: http://www.gtz.de

Major food safety issues

- Residues & contaminants in food like pesticides residues, heavy metals, toxins, food additives, adulterants
- Pathogens and spoilage through micro-organisms
- Plant and animal pests and diseases for eg. banana Fusarium wilt disease, fruit fly in a variety of fruit and vegetable crops.
- Technological issues like GMO, nanotech, irradiation)
- Inefficient production practices like quality of water, test facilities
- Lack of adequate Infrastructure like testing, cold chain, packhouses etc.

- Physical contamination or foreign material
- Food allergens
- Labelling and claims
- Certification issues (HACCP, ISO22000, GAP, GMP, GHP, Orgainc, Properitary / Customer specific, National / Region specific ,Religious, Ethics etc.)

India's food safety policy

The Food Safety and Standards Authority of India (FSSAI) was created in 2008 under the Ministry of Health and Family Welfare to implement the Food Safety and Standards (FSS) Act 2006.FSSAI is an independent statutory authority that serves as a single point reference system in the country for laying down science-based standards and regulating the manufacture, storage, distribution, sale and import of food products to ensure availability of safe and wholesome food for human consumption. FSSAI has been proactively tackling food safety through its flagship Eat Right India movement that takes a food systems approach to engage with multiple stakeholders to bring safe, healthy and sustainable food to India. The Fig. 3 depicts the product specifications-example of Grapes and Fig. 4 highlights the example of defects in Grapes. The Fig.5 depicts the finished product standards and Fig.6 depicts Quantitative Standards for Grape Export to Malaysia and Thailand

Fig. 3 Product Specifications-Example of Grapes

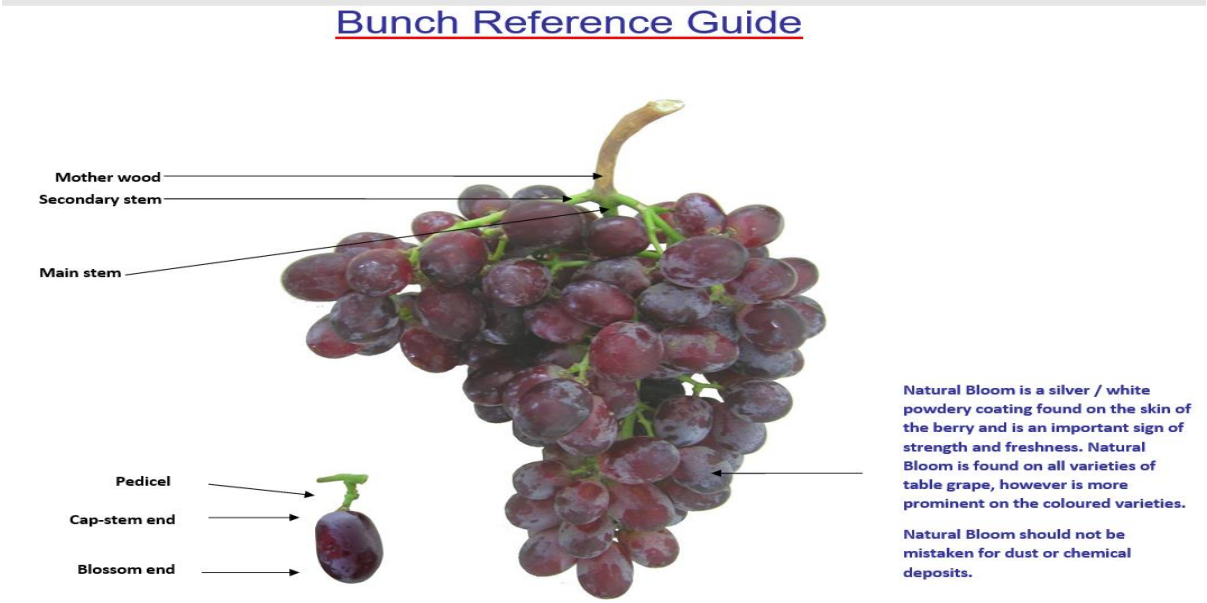


Fig. 4 Example of Defects in Grapes

SO_2 DamageShrivelling

Moulds

Fig.5 Finished Product Physical Standards for Grape Export to Malaysia and Thailand

PRODUCT LEGAL NAME:

Red Globe Grapes—china source

- **Physical Standards**

ORGANOLEPTIC PROPERTIES/ATTRIBUTES:
Insert extra rows as required

Appearance:	Grapes to be clean, free from dust, dirt, foreign matter, visible spray residues, pests, insect damage and pest infestation. To have fresh green stalk, firm berries, with full colour. Slight bloom is acceptable. Bloom is often characteristic of a red grape. Bloom is a white or tan coating on the surface of the grape, varying in evenness depending on how much handling the product has received. It is easily mistaken for light dusting. **Colour** - Maroon Red **Unacceptable Defects** - spray deposits, soil or dirt (not to be confused with the fruits natural bloom), non vegetative foreign bodies, and pests. **Progressive Defects** (1% total) – Rot mould, or decay **Major Defects** include Water berry (Collapsed brown berry), discolored bruise, shrivel, splits / crushing, dry blemish greater than 7mm, excessive S02, dry stem. **Minor defects** include sun scorch (yellowing, brown berries), dry blemish less than 7mm, slight S02, uneven berries, shatter (loose berries 3% tolerance) All defects to be measured by weight.
Aroma:	Free of foreign taint and odours
Texture:	Firm and crisp
Flavour:	Sweet and Juicy

Fig.6 Finished Product Quantitative Standards for Grape Export to Malaysia and Thailand

QUANTITATIVE STANDARDS:
Insert rows as required

Parameter	Minimum	Target		Maximum		Units	Method	Frequency
		Season	Off-season*	Season	Off season*			
Brix	15	16	12	-		%	refractometer	Per batch
Total defect (inc major & minor)	-	**11**	**11**	**18**	**18**	%	Calculation	Per batch
Total Major defect	-	**6**	**6**	**8**	**8**	%	Calculation	Per batch
Nesting mold / isolated rot		1	1	2	2			
Shrivel / splits / heavy soiling / waterberry		3	5	5	7			
Discoloured bruise		3	5	5	7			
Excess SO2 damage		3	3	5	5			
Pest damage		2	5	3	5			
Soft and dent		3	3	5	5			
Total Minor defect	-	**7**	**9**	**10**	**12**	%	Calculation	Per batch
Dry blemish (>7mm length)		6	7	8	10			
Slight SO2 damage		7	7	10	10			
Dehydration / sun scorch		6	7	8	10			
Small berries		7	7	10	10			
Underweight (bunch)		7	7	10	10			
Berry drop-shattering		3	3	10	10			
Green colour berry		5	7	20	20			
Berry size –Thailand	>22 >24			-		mm	Grape size ring	Per batch
Berry size--Malaysia	>20							
Bunch weight --Thailand	350	> 350	> 350	-		g	Scale	Per batch
Bunch weight--Malaysia	200	>200	>200					
Carton Net Weight	8.0	8.0	8.0	-		Kg	Scale	Per Carton

- Off season—sugar level : min 12
- 1. early season is from end of Jun to middle of Jul for grape shipments (ETD) depending on season

Quality Assurance is a part of quality management focused on providing confidence that quality requirements will be fulfilled. All planned and systematic activities implemented within quality system that can be demonstrated to provide confidence a product or service will fulfil requirements for quality. Quality Assurance in contrast to quality control is the implementation of quality checks and procedures to immediately correct any failure and mistake that is able to reduce the quality of interim products at every production step. In this regard Fig. 7 throws light on the quality assurance procedures for fruit processing.

Fig. 7 Quality Assurance procedures for fruit processing

Summary of quality assurance procedures for fruit processing

Stage	*Process Activity*	*Control Point*
Raw material harvest	Liaison with farmers, pick fruit and load it into crates or purchase from markets.	Specifications of fruit quality required. Trained pickers and handlers required to minimise damage to fruit. Use of correctly designed boxes. Rejection of damaged or rotten fruit and vegetables.
Raw material transport	Transport in crates to the processing unit.	Control of fruit temperature by use of water, shade or covers. Correct stacking and handling to minimise damage.
Raw material inspection and preparation	Sort fruit, wash and peel/slice as required for the specific product.	The setting of acceptable standards for incoming fruit. Proper sorting, preparation and recording procedures and management are required. Accurate slicing to required sized pieces. Operator and plant hygiene. Water chlorination with regular waste disposal.
Ingredient formulation / batch preparation	Weigh and mix ingredients.	Training in, accurate weighing and keeping records of ingredients used.
Processing	Heating, drying, pickling etc. to make the required product.	Preparation of processing schedules and training of operators to ensure: control of temperature and time of heating or drying, correct amounts of ingredients added in the process. Establish standards for cleaning of equipment and processing room.
Packaging	Fill product into packages, seal and label.	Establish specifications for package quality, labels, and fill-weights. Implement inspection, check-weighing and recording procedures.

Importance of Good Manufacturing Practices (GMPs) in Food Industry

Good Manufacturing Practices* (GMPs) are the basic operational and environmental conditions required to produce safe foods. They ensure that ingredients, products and packaging materials are handled safely and that food products are processed in a suitable environment. GMPs address the hazards associated with personnel and environment during food production. They provide a foundation for any food safety system. Once GMPs are in place, processors can implement a Hazard Analysis Critical Control Point (HACCP) system to control hazards that may affect the ingredients and packaging material during food processing. GMPs are systems put in place to ensure that food prepared in a plant is sound and free of contamination. It includes the aspects like:

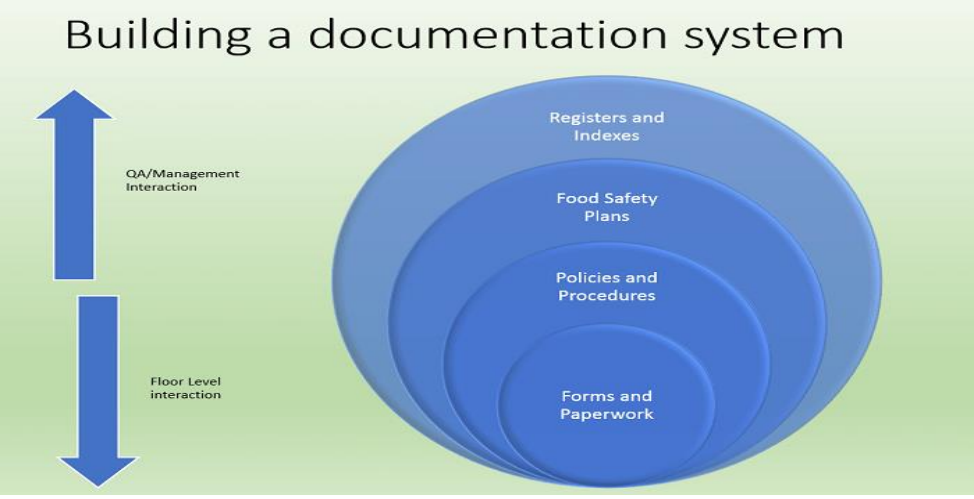
- **Environmental control (premises):** location, design and construction of the building and its interior, equipment, water supply

- **Personnel practices:** personal hygiene, hand washing, clothing/footwear/headwear, injuries and wounds, evidence of illness, access and traffic patterns, chemical use •
- **Shipping, receiving, handling, storage:** inspection procedures for transport vehicles; loading, unloading and storage practices; inspection procedures for incoming products; shipping conditions; returned and defective products; allergen control; chemical storage; waste management
- **Pest control:** monitoring procedures for the exterior and interior of the building (ex: surveillance, fumigation) and the use of pesticides
- **Sanitation:** cleaning and sanitizing procedures and pre-operational assessment
- **Equipment maintenance:** procedures describing preventive maintenance and calibration of all the equipment and instruments that can affect food safety (ex: thermometers, thermocouples, metal detectors, scales, pH meters)
- **Recall and traceability:** procedures that ensure final products are coded and labelled properly; incoming materials; in-process and outgoing materials are traceable; recall system is in place and tested for effectiveness (ex: procedures for mock recalls)
- **Water safety:** water safety monitoring procedures for water, ice and steam, and water treatment procedures that ensure it is potable for use in food processing.

Quality Management System (QMS) of Food Industry

QMS should be developed, established and implemented by every food industry to achieve objectives and implement the GMP/HACCP policies. QMS should give the organizational structure, functions, responsibilities, procedures, instructions, processes and resources for implementing the GMP / HACCP and quality management. The QMS should make ensure that samples of raw materials, starting materials, intermediate, and finished products are collected and tested, examined to decide their release or rejection based on their results and other available evidence of quality parameter. The Fig. 7 discusses the different components for building documentation system in food organizations to develop effective Quality Management System (QMS).

Fig. 8 Building Documentation system in food organizations



Responsibilities of Technical Manager / Consultant in the Indian Food Industry

The key responsibilities of Technical Manager / Consultant in the Indian Food Industry are as follows:

- Maintain and improve the Quality System to ensure Food Safety and Legal Compliance
- Lead the delivery of the Quality Proposition and Quality Plan across the departments
- Coordinate HACCP across all departments
- Provide Technical Monitoring and auditing
- Ensure that team structure is communicated with clear roles and responsibilities – playing a role in recruitment, induction, and training
- Lead audits, ensuring that business critical audits are supported by the entire team. Monitor and audit compliance as well as driving lean principles in achieving compliance
- Lead the hygiene teams to deliver effective hygiene operations, achieving agreed standards and driving lean principles for Continuous Improvement
- Ensure appropriate intake checks are completed on all products, ingredients, and packaging.
- Arrange Supplier performance reviews with Purchasing and visiting suppliers as required
- Ensure that both internal and external audit schedules are maintained and audits are completed. Communicate audit corrective actions plans and ensure non-conformances are signed off within agreed time scales
- Ensure compliance with environmental legislation and that all requirements are understood by the team
- Liaison with external legal enforcement agencies
- Play a client facing role with customers.

Conclusion

An increase in the consumption of fresh fruits and vegetables has also brought to the forefront of food safety concerns. The market-oriented, successful food production must focus on the final consumer. The aim of fruit and vegetable production is to deliver a safe and wholesome final product to the consumer. Food Safety and Food Quality are the two most important aspects of any food-handling environment. For any organization dealing in food products should have proper Food Safety and Food Quality management system. The major difference between Food Safety and Food Quality are that one keeps consumers safe and the other keep consumers satisfied. The food industry stakeholders must play an important role in assessing food quality and safety through application of Good Manufacturing Practice, quality assurance and risk-based food safety system utilizing current scientific knowledge. So, in order to boost the growth of Fruits in food industry through value addition and processing there is need to consider food safety and quality as important perspective.

FPC Business Model of Sahyadri Farms with respect to marketing and value addition of fruits

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Introduction:

Aggregation of the farmers, especially small and marginal ones, into producer organizations has been identified as a solution to address many of the traditional ills of the agriculture sector. It goes without saying that access of the small holders to technology, inputs and markets is a necessity for ensuring the growth of the sector. Different tired models of aggregation instruments like cooperatives, SHG, FIG etc. have their own demerits. Hence in order to introduce the benefits of corporate professionalism in a famer producer organisation, Prof Y. K. Alagh Committee recommended constitution of Farmer Producer Company by incorporating requisite provisions in the Companies Act. Accordingly a new chapter has been incorporated in the Act vide chapter IX A in 2002.Subsequently, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmer Welfare, Govt. of India has identified FPC as the most appropriate institutional form of aggregation of farmers. Now a large number of FPCs are in operation in different states, thanks to the special move by the Government of India. It is time to take stock of the operational efficiency and effectiveness of the aggregation instrument of FPC.

FPCs have performed extremely well in the states like Maharashtra, Madhya Pradesh and Kerala. Studies have revealed that farmers have been able to realize higher returns for their produce. Most of the FPCs remain focused on of crop planning, technology infusion, input supply and primary marketing. However, amongst the registered FPCs, at least one fourth to a third, have the potential to leverage their presence further up the value chain. Such companies are involved in direct retailing, value addition, storage and processing and are also engaged in contract production of primary and processed agricultural produce. ‘Sahyadri Farmer Producer Company’ is one such farmer producer company operating in Nasik district of Maharashtra which has excelled in a short span of time. It has leveraged its presence in the

total value chain by involving itself in all the activities of the supply chain including processing and export.

Sahyadri Farmer Producer Company Ltd. (SFPCL) came into being in the year 2011, as a revenue model, while ensuring reasonable returns to the farmers and quality and safe food to the consumers. SFPCL is a leading farmer producer company working with 8000 farmer members with a capital base of ₹52 crore. The company is working with a tagline "of the farmers, by the farmers, for the farmers". Sahyadri was a movement started by Shri. Vilas Shinde, Chairman of the company, with focus on the welfare of the farmers to get them their righteous due, while doing business profitably.

Profile of the Company

The company has emerged from the scratch. Today it can boast state-of-the- art technology with integrated supply chains of different produce both for the international and domestic market.

Vision:

- ✓ To be a leading Farmer Producer Company (FPC) with the power to bridge the gap between the rural and urban communities;
- ✓ To make farming a profitable & sustainable business for all farmer members
- ✓ To provide safe, healthy, affordable - farm produce and value added products to the consumers

Mission:

- ✓ Sahyadri Farms to be a trusted, value driven and professionally managed Farmer Producer Company (FPC) of the farmers, by the farmers, for the farmers.

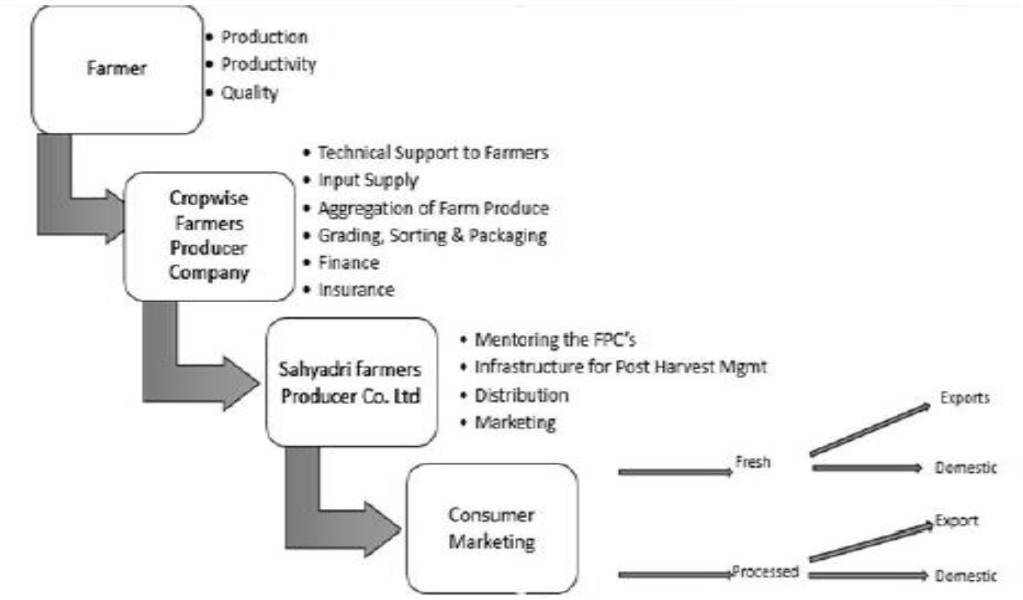

Fig.1: Sahydri Farmers' Producers Company – Activities

Areas of Business and Performance

The company carries out both backward and forward linkages. As a part of backward linkage, the company provides services such as scientific cultivation or production of crops with the help of extension functionaries of the company. Out of the total procurement, 'A' and 'B' grade produce is sold after primary processing such a cleaning, grading and washing. The 'C' grade produce are subject to processing into different products such as jam, jelly, ketchup, etc. The vegetables such as pea, okra, carrot, corn and fruits such as pomegranate aerials, mango slices and guava and custard apple pulp are subject to Individually Quick Frozen (IQF) process.

To meet the commitment of safe food, the company pursues the following:

- ✓ To comply with statutory, regulatory and mutually agreed requirements of the customer
- ✓ To procure excellent quality raw material and process & pack it in hygienic conditions with advance technology
- ✓ Controlling the food safety hazards at the supplier level by approving the Supplier and checking the incoming raw and packaging material before use at factory
- ✓ Efficient utilization of all the resources

- ✓ Meeting customer expectations of required standards of the product in time and at a competitive price
- ✓ Effective Internal and External Communication
- ✓ To review and communicate our Quality and Food Safety Policy to all levels of organization.

I. Production:

Production includes scientific cultivation of specific fruits and vegetable which is having enormous demand, both in the national and international market.

II. Processing

Aseptic fruit processing is followed for products by sterilizing and is packed in drums/containers to maintain the sterility, which allows the products to maintain a longer shelf life without any preservatives till the opening of the aseptic bags. The products covered by this process include tomato, mango, guava and papaya pulp. With the all latest technologies in processing, Sahyadri Farmer Producer Company is involved in production of following product in aseptic manner and are stored in aseptic bags/ drums in techno- enabled aseptic warehouse. Following are the products subject to processing:

1. Alphonso Mango Pulp
2. Totapuri Mango Pulp / Conc.
3. Tomato Puree
4. Red Papaya Pulp / Conc.
5. Kesar Mango Pulp
6. White Guava Pulp / Conc.
7. Tomato Paste
8. Banana Pulp / Conc.
9. Tomato paste processing
10. Red papaya pulp/puree
11. Tomato paste

Frozen Fruit Pulps/Purees

Plate freezers are used for freezing fruit pulps/purees like Mango, Guava, Papaya etc. Pulp is made with State-of-the-Art pulp processing line and then packed in unit packs using FFS machines. The product is loaded into the station in trays, the freezing plates then closed hydraulically, thus ensuring double contact, both on the top and bottom of the product. A

rapid, efficient and even freezing is thus achieved using advance designed Plate Freezer imported from Temp Tech Thailand.

Following are the products subject to frozen technology:

1. Frozen Mango Pulp
2. Frozen Guava Pulp
3. Alphonso Mango Pulp (Sweetened)
4. Kesar Mango Pulp (Sweetened)
5. Guava Pulp (Sweetened)
6. Alphonso Mango Pulp (Natural)
7. Totapuri Mango Pulp (Sweetened)
8. Custard Apple Pulp

IQF (FRUITS & VEGETABLES)

The Individual Quick Frozen (IQF) process perhaps the only method whereby all the natural parameters of the Fruits & Vegetables can be preserved. The most important feature of this process is the ultra-rapid freezing to a very low temperature (-30 degree C to -40 Degree C), designed to arrest the activities of micro-organisms that may cause the decay and deterioration of a particular fruit or vegetable. Such process also gives a much longer shelf life of say 24 months keeping intact properties like colour, flavour and texture of the product.

Following are fruits and vegetables subject to IQF technology:

Fruits

- Totapuri Mango Dices
- Papaya Dices
- Musk Melon Dices
- Pomegranate Arils
- Pineapple Dices
- Chiku Slices

Vegetables

- Sweet Corn, Cut Okra
- Cut Beans, Carrot Dices
- Onion Dices, Cauliflower
- Capsicum Dices

- Green Chilli, French Beans
- Cut Bitter Gourd

III. Marketing

Sahyadri Farmer Producer Companies adopts a comprehensive marketing strategy covering both domestic as well international markets. Such strategy helps the company in ensuring farmers remunerative price for their produce. Over a period of time, the company has created its own brand due to its approach for providing clean and hygienic products. It has been able to establish linkages with reputed retail chain operators in the country, thereby ensuring remunerative price to its members for their produce. The company has made its presence felt in the International market also by fulfilling safety and quality norms as per the international standards. It is sharing its profits earned through processing and exports amongst its members. Due to collective approach, the company is able to reduce the transaction costs to a considerable extent, the benefit of which are percolating down to the farmer members.

Sahyadri Famer Producer Company has also ventured into retailing through its subsidiaries like Sahyadri Agro Retail Limited to develop better integrated supply chains.

Backward Linkage

In order to provide back-end support to the member-farmers, the company has started a Farmer Facility Centre in the company premises. The Centre includes facilities like Consumer Mall, Agri-input retail centre facilitating farmers having easy access to modern agriculture inputs with latest varieties, farm equipment's and technology for scientific crop cultivation to attain maximum output. The company is also providing other services like Bank Finance, Insurance and welfare measures.

Forward Linkage

As a part of forward linkage, the company has developed a good network of domestic retail chain operators for selling produce of its members, mainly vegetables. The company has also developed a chain of retail outlets by establishing stores under different models like, own, franchisee, dealers/distributors. The company has a retail chain of 200+ Stores in western Maharashtra under different models as mentioned below:

A. Business to Consumer (F&V)

It includes following channels of marketing

1. Company – C & F – Own Outlet
2. Company – C & F – Franchisee
3. Company – C & F – Shop in Shop/Modern Store
4. Company – C & F – Dealers & Distributors

Figure: Mohadi- Farmers Services- Backend

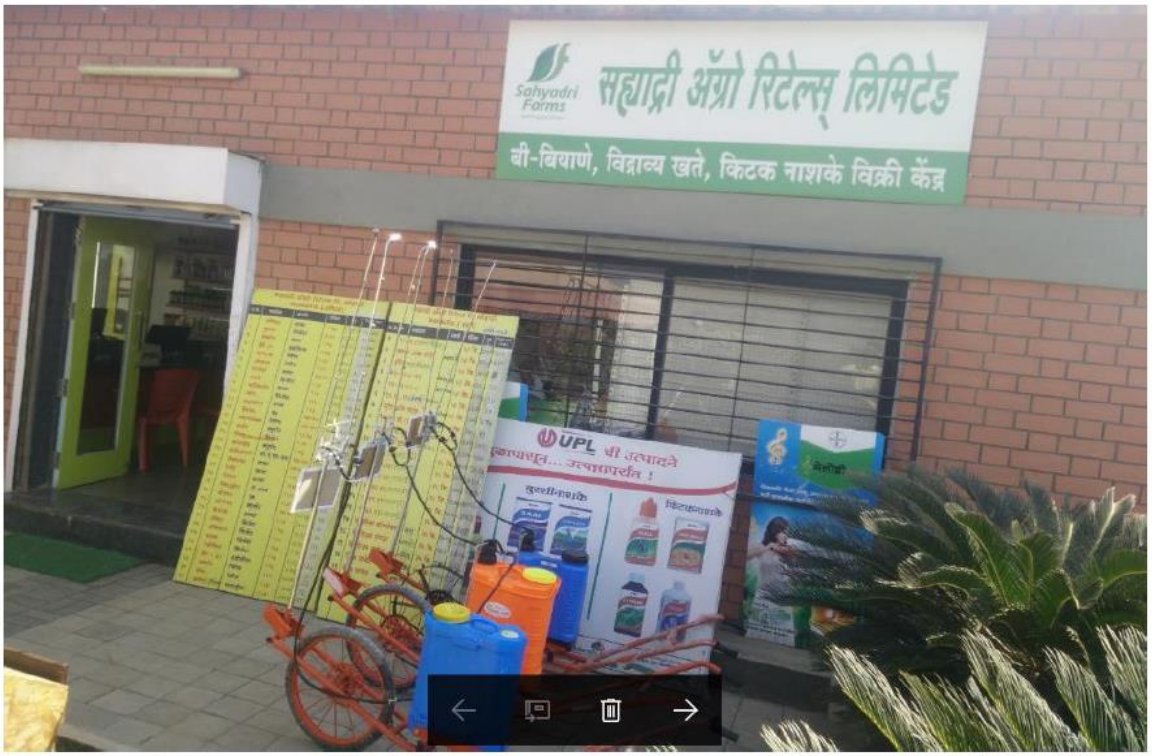

Fig. 2: Mohadi-Farmers Services-Backend

B. Business to Consumer (FMCG)

Fig. 3: Nashik- Frontend Retail Store

Fig. 4 : Mumbai- Frontend Retail Store

Quality Management Tools used by SFPC

a) Initiative of Croplan - Crop Plan Traceability and Farm Management

This Croplan portal of the company assembles farm data in structured format to run analytics to give insight on farm productivity, operational efficiency and output forecast. This customized dashboard helps to monitor the data with 360 degree angle on following aspects:

- ✓ Forecasting
- ✓ Analyses historical data
- ✓ Advance Report
- ✓ 360 degree view
- ✓ Customizable Reports and dashboards
- ✓ Report exportable to pdf
- ✓ System generated alerts and & Highlights for all levels
- ✓ Big data analytics

Crop Stage Monitoring

The initiative facilitates independent crop monitoring and field visits during the development stage with pre-harvest measurements and harvest monitoring. Crop stage monitoring service embraces field visits and qualitative and quantitative assessment. The system helps in undertaking initial survey to evaluate the factors that may influence productivity, creating clear and conclusive final reports to facilitate decision-making, monitor crop development and also track the activities relating to harvest and the receipt of the crop into the storage and/or processing units.

Farm to Fork traceability

The initiative helps in tracking the products during the delivery of the crop to the first storage/processing point, as follows:

Confirmation of receipt of the products at the storage and/or processing units

Comparison between received and estimated production output

Verification of possible product deviations

Creation of reports containing a total receipt of products from the areas being monitored

Certification and Food Safety Standards

Sahyadri Farmer Producer Company lays emphasis on scientific cultivation with quality production of crops to meet all the food & safety standards. This helps the company increase their exports. Presently SFPCL got certified by

1. Lloyd's Register Quality Assurance: Food Safety Management System Standards ISO 22000:2005 applicable to the manufacture aseptic fruit pulps and concentrate, Tomato pulp and puree, IQF(Individually Quick Frozen) fruits and vegetables, Frozen Fruit pulps (Natural and sweetened) and packing of fresh fruits and vegetables.

2. Food Safety Standard Authority of India Licences for Fresh fruits, Fresh Vegetables, Frozen fruit/fruit Products, Frozen Vegetables, Thermally processed Mango Pulp/Puree, Sweetened Mango Pulp/Puree, Thermally processed fruit Pulp/Puree, Sweetened processed fruit Pulp/Puree other than Mango.

3. Global G.A.P. - Certificate of Conformity by British Retail Consortium Certification Body.

4. U.S Food and Drug Administration, Federal Food, Drugs and Cosmetics Act.

5. Kosher Certification- Rabbi Don Yoel Levy, Kashruth Administrator, New York, U.S.A.

6. Halal JamiatUlama E- Maharashtra

Conclusion

The Sahyadri Farmer Producer Company has established itself in less than a decade time and has become a leading exporter of grapes from India. It has emerged as a successful model for management and operation of a Farmers producer company in Indian agricultural environment. A lot may be learnt from the success of the Company. The capacity of the leader of a company to conceive an idea and translate it into a business and push it forward through its rough and tumble is something worth quoting as an inspiring example for others. It is the leader only who can motivate the team and encourage farmers to come along for establishing a successful partnership. An association of committed team of workers and loyal farmer members is sine qua non for evolving a common goal for the success of a Farmer Producer Company. Furthermore, the culture of a FPC should necessarily be farmer-friendly

for its long term success. Besides, ability to tap the opportunity through a balanced produce mix and diversification as per requirements of domestic and international market and strategies to deliver the same to the consumer in time-bound manner at competitive prices are some of the other business principles to be followed by a FPC. Though a company may have different stakeholders operating at different levels with varied interests including financial stakes, what counts as a necessary condition for ensuring its long-term success is the democratic principle of 'for the farmers, by the farmers and of the farmers'.

Value Chain Approaches for Effective Fruits and Vegetables Marketing in India

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Navsari

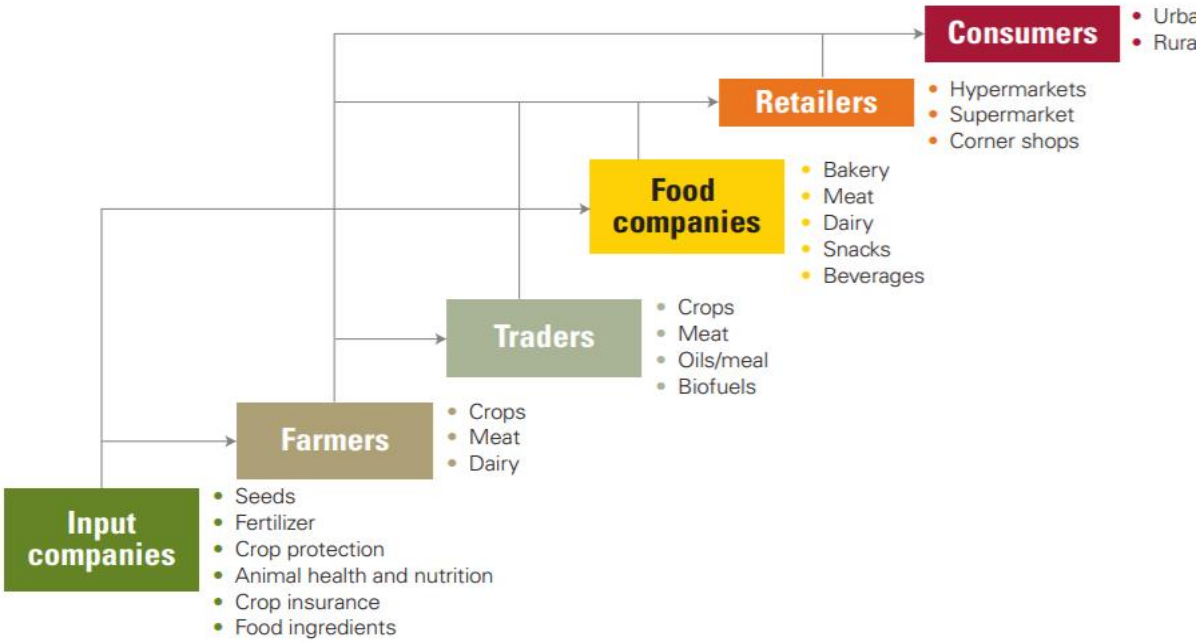
Introduction

India's diverse climate ensures availability of all varieties of fresh fruits and vegetables. It ranks second in fruits and vegetables production in the world, after China. As per National Horticulture Database (Second Advance Estimates) published by National Horticulture Board, during 2019-20, India produced 99.07 million metric tonnes of fruits and 191.77 million metric tonnes of vegetables. The area under cultivation of fruits stood at 6.66 million hectares while vegetables were cultivated at 10.35 million hectares. According to FAO (2019), India is the largest producer of ginger and okra amongst vegetables and ranks second in production of potatoes, onions, cauliflowers, brinjal, Cabbages, etc. Amongst fruits, the country ranks first in production of Bananas (26.08%), Papayas (44.05%) and Mangoes (45.89%). The vast production base offers India tremendous opportunities for export. During 2020-21, India exported fruits and vegetables worth Rs. 9,940.95 crores/ 1,342.14 USD Millions which comprised of fruits worth Rs. 4,971.22 crores/ 674.53 USD Millions and vegetables worth Rs. 4,969.73 crores/ 667.61 USD Millions. The major destinations for Indian fruits and vegetables are Bangladesh, UAE, Netherland, Nepal, Malaysia, UK, Sri Lanka, Oman and Qatar. Though India's share in the global market is still nearly 1% only, there is increasing acceptance of horticulture produce from the country. This has occurred due to concurrent developments in the areas of state-of-the-art cold chain infrastructure and quality assurance measures. Apart from large investment pumped in by the private sector, public sector has also taken initiatives and with APEDA's assistance several Centres for Perishable Cargoes and integrated post-harvest handling facilities have been set up in the country. But in order to boost the market for fruits and vegetables at both domestic and global level there is need for effective value chain management system and to adopt innovative approaches for effective marketing leading to better returns. The effective value chain encompasses the flow of products, knowledge and information, finance, payments, and the social capital needed to organize producers and communities.

Meaning of Value Chain

The Value Chain in agriculture describes the range of activities and set of actors that bring agricultural products from production in the field from final consumption wherein at each stage value is added to the product. Also the value chain is sequence of steps and participants involved in the process from production to delivery of a product to market is called a value chain. The value chain approach involves a shift in focus from producers to consumers. The competitive advantage in value chains is derived from inputs to supply chains that create value, as perceived by the consumer and result in backward and equitable flow of value. The main advantages to the stakeholders of an effective value chain comprise being able to reduce the cost of doing business; increase revenues and bargaining power; improve access to technology, information, and capital; and, by doing so, innovate production and marketing processes to gain higher value and provide better quality to customers. The Fig. 1 depicts the value chain of agricultural commodities presently operational in food industries.

Fig 1. Value Chain of Agricultural Commodities



Challenges in the Value Chain of Fruits and Vegetables in India

The major challenges in the effective functional of value chain approach in the fruits and vegetable sectors in India are as follows:

1. The fruits and vegetables are highly perishable in nature.

2. **Lack of adequate cold chain facilities:** In India the major area of concern is the unavailability of cold storages or insufficient cold storage capacity making difficult for the farmers and companies to do their business effectively and get proper remuneration for their produce. According to a study conducted by the National Centre for Cold Chain Development, at all-India level, the requirement of additional cold storage capacity is 3.26 million tonnes (mt), which was just about 12% of about 26.85mt capacity in 5,367 working cold stores as of 2014. India has just 12,800 reefer vehicles against the requirement of about 62,000. India needs about 70,000 pack houses, but have just about 350. Most losses take place immediately after harvesting and they can be reduced by pre-cooling the crop.
3. **Market Fragmentation:** One of the main issues in the value chain of fruits and vegetables sector in India is the involvement of large number of local trader and middlemen in the value chain leading to decrease in farmers share in consumer rupees. The fruits and vegetable markets are thin and sparsely spread. The markets are controlled by few big traders and there operations are transparent.
4. **Lack of market Integration:** Linkage and integration between the various players in the supply chain plays a very important role to make the value chain effective and profitable. But in the value chain of fruits and vegetables sector in India there is a lack of forward and backward integration between the farmers and the other partners.
5. **Lack of adequate Infrastructure:** Value chain infrastructure plays an important role in the fruits and vegetables sector. Proper and adequate infrastructure helps farmers and other stakeholders to deliver the goods in the right time with right condition to the right customer in right quality. But in India, infrastructure in the main impediment in the value chain of agricultural products which leads to high amount of losses. It includes problems like lack of storage/warehouse condition in the village areas, poor loading/unloading facilities in the farm and mandi place, lack of processing facilities Lack of packaging facilities, poor road connectivity, poor transportation infrastructure, inadequate marketing Infrastructure such as grading, standardization.
6. **Improper and costly packaging:** Packaging is very important for fruits and vegetables sector as they are highly perishable and require adequate packaging for the handling of these fresh produce to maintain the shelf life of produce. But the cost of packaging material is high so it becomes difficult for the farmers to go for packaging of their goods.
7. **Lack of Technological advancements:** the lack of advanced technology lead to product failure, poor quality produce and losses. Due to these concerns it has become difficult for

the farmers and companies to use an appropriate technologies and techniques to reduce the post-harvest losses.

8. **Low Processing and Value addition:** Processing and Value addition is a key to increase the shelf life of food produce and reduce the losses. It gives an immense opportunity to export the processed food to the various destinations. But, in India the food processing is very low as compared to other countries.
9. **High Price Fluctuations:** The income of farmers is very low as they are not able fetch better prices of their produce and also the large number of intermediaries in the value chain take away the margins. Also in case of fruits and vegetables there are huge fluctuations in prices and there is lack of transparencies in pricing due to which farmers are not able to get right prices for their efforts and fresh produce.
10. **Huge Post-harvest losses:** Post-harvest losses are the major problem in the of Fruits and Vegetables sector in India. Around 30 -40 % of total food produce gets wasted in India. Huge amount of losses incurred after harvesting during transportation, distribution and storage of fresh produce. Postharvest losses are high in India because of lack of cold chain facilities, poor logistics connectivity etc.
11. **Lack of adequate Transportation facilities**: The Fruits and Vegetables because of short shelf life, high perishable, and required controlled temperature while transportation and distribution. In India the major issue is the lack of adequate transportation facilities like refrigerated vehicles which is cost effective and leads to on time distribution with minimum losses. Transportation related challenges are very high in the India because of unavailability of well transportation mode, high cost of transportation, lack of temperature controlled vehicle for the movement of goods etc.
12. **Lack of access to Market Demand and Information:** Proper information is the basis of efficient value chain. In India, farmers have lack of access of information regarding the prices in the market, technological innovations, consumer demand, competition, demand, food processing units etc. Poor information leads to poor realization of prices, high amount of losses, late delivery of goods in the market place etc.

Importance of Efficient Value Chain Management for fruits and vegetables

The below are the key aspects depicting the importance of efficient value chain management for fruits and vegetables in India:

- Reduces product losses in transportation and storage.
- Increasing the sales of fruits and vegetables.

- It leads to dissemination of technology, advanced techniques, capital and knowledge among chain partners.
- It helps in generating on time and adequate information about the flow of products, markets and technologies.
- Through efficient value chain management it becomes easy to Track and trace the source.
- The efficient value chain management leads to better control of product safety and quality.
- The large investments and risks in activities like production and marketing are shared among partners in the chain.
- The efficient value chain management leads to increasing efficiencies and increasing the volume of trade.
- The efficient value chain management leads to customer satisfaction, loss and wastage reduction increase profitability of farmers.
- The adoption of cold storage infrastructure helps in increasing shelf life of fresh produce.
- The efficient value chain management balances the demand and supply gap in the market providing produce at affordable price and at desired place.

Fig. 2 Benefits of Effective Value Chain Management

Value chain approaches for effective marketing of fruits and vegetables in India

1. Direct Marketing- Direct marketing is the sale of agricultural goods and products from the farm straight to the consumer, without intervening distributors or retailers. It encourages farmers to undertake grading of farm produce at the farm gate and obviates the necessity to haul produce to regulated markets for sale. Direct marketing enables farmers and processors and other bulk buyers to economize on transportation costs and to considerably improve price realization. Examples are Rythu Bazaar, Apni Mandi, Uzhavar Sandhai, Hadaspar vegetable market, Shetkari bazaars etc.

2.Cooperative Marketing Society- It isform of organization, where in person voluntarily associate together as human beings, on the basis of equality for the promotion of economic interests of themselves. The need for cooperative marketing arose due to many defects in the private and open marketing system. It can eliminate some or all of the intermediaries. And make commodities cheaper and ensure good quality for the consumers. Some successful cooperative marketing societies model for fruits and vegetables are MAHAGRAPES, HOPCOMS etc.

3. Contract Farming- It is an agreement between farmer-producers and the agribusiness firms to produce certain pre-agreed quantity and quality of the produce at a particular price and time. This is an important initiative for reducing transaction costs by establishing farmer-processer linkages. Few examples are Pepsi Company for potato, chillies and tomato in Punjab and Rajasthan, Ion Exchange Enviro farms for organic products of Banana, Pineapple, Papaya etc. in Maharastra, Gujarat, MP, Varun foods for tomato in Maharastra, McCain for potato in Gujarat, Punjab.

4. SAFAL Model- NDDB started a fruits and vegetable unit of SAFAL at Delhi as one of the first fruit and vegetable retail chain. SAFAL (Mother Dairy Fruit and Vegetable Pvt. Ltd.) the main operations are procurement and marketing. This model is a move to introduce a transparent and efficient platform for sale and purchase fruits and vegetables by connecting growers through Grower's associations. The growers association manage back end aggregation and transport and last mile distribution is done through owned outlets. The SAFAL deals with 180 grower associations and has 390 retail outlets.

5. Electronic market- E-NAM is an electronic trading portal that networks the existing APMC mandis to create unified national market for agricultural commodities. E-NAM Portal is a single window service for all APMC related information and services that includes commodity arrivals and prices, buy and sell trade offers, provision to respond to trade offers among other services. The material flow of agriculture products continue to happen through mandis, an online market portal for such produce reduces transaction costs and information asymmetry. In 2018 E-NAM has been established at 585 APMCs. E-NAM market provides primary processing facilities, which will result in easier and direct procurement of raw material by the processing units and retail leaders, thereby increasing the income of farmers.

6. Organized Food retailing- Organized Food retailing taken off during 1990s and early 2000 in India. The Supermarket chains are the alternative marketing system to the traditional marketing system. Examples are Reliance Fresh, ITC (Choupal Fresh), Aditya Birla (More), Pantaloon Retail(Food Bazaar), Bharti(Easy Day), Heritage Fresh.

7. Mega Food Park-It aims at providing a mechanism to link agricultural production to the market by bringing together farmers, processors and retailers so as to ensure maximizing value addition, minimizing wastage, increasing farmer's income and creating employment opportunities particularly in rural sector. It is based on cluster approach and emphasize in creation of state of the art infrastructure in well-defined horticultural zone for setting processing units. It includes collection centres, Primary processing centres, central processing centers,, cold chain etc. The Food processing ministry has sanctioned 42 mega food parks across the country.

8. Farmer Producer Company- It is the hybrid between a private limited company and a cooperative society. It combines the goodness of cooperatives and efficiency of corporate company. Producer companies aim to integrate smallholders into modern supply networks minimizing transaction and coordination costs, while benefiting from economies of scale. Example Sahyadri Farms, Chameli Swayam Sahayata Samuha in Chattisgarh, Babpur Krishak Sangh in West Bengal, Harihar Samruddhi Utpadak Samuh in Madhya Pradesh.

9. Agro Processing Cluster- Effective backward and forward linkages are created by linking groups of producers/ farmers to the processors and markets through well-equipped supply chain consisting of modern infrastructure for food processing closer to production areas and provision of integrated/ complete preservation infrastructure facilities from the farm gate to the consumer.

Strategies for strengthening Value chain efficiency in fruits and vegetable sector

In the case of fruits and vegetables sector postharvest management and marketing are the key important areas of consideration. To overcome the challenges faced in implementation of effective value chain management there is need for effective and efficient state of the art infrastructure for providing consumers value added food at low prices along with assuring ensuring remunerative prices to the farmers. The EY report had discussed the solutions based accordingly on four basic principles, or the 4Vs as discussed in Fig. 3.

Fig. 3: Strategies for strengthening value chain efficiency

Minimizing Value Loss
➢ Promote **production of in-demand varieties and grades** ➢ Improve **supply chain** and **storage infrastructure to cut down wastage** ➢ **Crop planning** like **introducing crop diversification, multiple cropping and staggered production** techniques

Maximizing Value Creation
➢ Establishing **processing** and **marketing infrastructure** for farm produce through private investments leveraging government support ➢ **Attracting big brands, retailers, etailers and promoting local brands/entrepreneurs** with the ability to export and market large quantities of available surplus after processing as strategic partners with the farmers to help maximize the "processed to produce ratio"
Higher Value Capture
➢ Sorting, grading and packing know-how for fresh product retailing ➢ Creating FPOs (like Producer Companies) which have part ownership of supply chain and enabling them to form market linkages with end buyers ➢ Promotion of out grower model between buyers and FPOs farmer members to minimize market risk for the farmer
Value Added Services for farmers
➢ Sustainable farming techniques together with enhanced use of high quality climate resilient and pest resilient crops for improved productivity ➢ Enhanced availability of credit and insurance products for farmers ➢ Ecosystem development for service oriented Agripreneurs ➢ State level institution for market development and regulation ➢ Economic and market information and intelligence services (EMIS) including Price information mechanism for farmers ➢ Establishment and operations of Project Coordination Unit (PCU) ➢ Setting up of Monitoring and Evaluation (M& E) system

Source: Rawat and Vatsyayan (2018)

Conclusion

The fruits and vegetables account for nearly 90% of the total horticulture production in the country. India is now the second largest producer of fruits and vegetables in the world and is the leader in several horticultural crops. But in India at present the large part of the agriculture value chain comprises primary processing of fruits and vegetables with very limited value addition. The fruits and vegetable sector is facing many challenges like lack of adequate infrastructure, post-harvest losses, high perishability of produce, lack of market

information, poor price realization by producers etc. In this regard in order to overcome the challenges there is need to focus on effective value chain approaches like direct marketing, cooperative marketing, organized retailing, contract farming, farmer producer company etc. to strengthen the growth of fruits and vegetable sector leading to benefit for the both producer and consumer in the supply chain.

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Fruits and Vegetables Export: A Case Study of Kashi Exports, Tapi

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Introduction

Horticultural crops provide a better alternative for diversification of Indian agriculture in view of higher returns available from them. Horticulture sector helps in improving productivity of land, generating employment, improving economic conditions of the farmers and entrepreneurs, enhancing exports and foreign exchange earnings and above all providing nutritional security to the people. Conditions for increasing production of horticultural crops are very favourable in the country. This is partly because production of horticultural crops in general is labour-intensive. India endowed with abundant labour in relation to capital has competitive advantage in production and exports. Horticultural products not only have good potential for generating employment in cultivation but also in processing, marketing, and distribution. And they are frequently produced on small farms, thus providing an important source of additional income for poor farmers in developing countries. There are many horticultural products, especially fruits and vegetables, that fetch high prices in world trade. The growing interest in horticultural exports in the country also reflects the search for diversified non-traditional agricultural exports in order to expand foreign exchange earnings so that the country can meet rising import requirements for accelerated economic growth and mounting debt service payments.

Global scenario of fruits and vegetable export

According to APEDA Agri Exchange data, global export of fruits and vegetables in the year 2020-21 was 142.34 million MT which accounts US$ 155.42 billion in value terms. The major exporters of fruits and vegetables in the world are Spain, Mexico, Netherland, Chile, USA and China. India ranks 30th in the world export of fruits and vegetables in value terms. Table 1 depicts the global scenario of fruits and vegetables export in the year 2020-21.

Table:1 Top 10 fruits and vegetables exporting countries in the World (2020-21)

Rank	Exporting Country	Qty (MT)	Value (USD Mill)	Percent share in World Import	
				Qty (MT)	Value (USD Mill)
1	Spain	13154752.30	18550.77	9.24	11.94
2	Mexico	11707165.01	17455.59	8.22	11.23
3	Netherland	8480927.66	9734.07	5.96	6.26
4	Chile	3103573.05	8070.7	2.18	5.19
5	U S A	3436167.93	7562.53	2.41	4.87

6	China	7792082.38	6978.24	5.47	4.49
7	Peru	2426823.50	5678	1.70	3.65
8	Thailand	4998703.64	5549.89	3.51	3.57
9	Italy	3526778.05	5039.94	2.48	3.24
10	South Africa	3772665.80	4848.55	2.65	3.12
30	**India**	**1441302.56**	**1333.75**	**1.00**	**0.74**

Source: APEDA

Despite of being second largest producer of fruits and vegetable in the world, India has very minute share in total export (1.00 & 0.74 percent in quantity and value terms respectively). There is no international business until world has importing countries for fruits and vegetables. Table 2 presents top 10 fruits and vegetables importing countries in the world in year 2020-21.

Table:2 Top 10 fruits and vegetables importing countries in the World (2020-21)

Rank	Importing Country	Qty (MT)	Value (USD Mill)	Percent share in World Export	
				Qty (MT)	Value (USD Mill)
1	U S A	20970383.88	26512.55	14.73	17.06
2	Germany	9754675.24	14134.33	6.85	9.09
3	China	8797952.09	10122.35	6.18	6.51
4	Netherland	7656571.6	9212.2	5.38	5.93
5	U K	6218883.94	8816.3	4.37	5.67
6	France	5750522.61	7610.91	4.04	4.90
7	Canada	2955743.25	6772.89	2.08	4.36
8	Russia	7119210.78	6094.96	5.00	3.92
9	Hong Kong	2744792.43	4419.16	1.93	2.84
10	Spain	3421111.45	3598.45	2.40	2.32
32	**India**	**905795.97**	**875.87**	**0.64**	**0.56**

Source: APEDA

Counties like USA, Germany, China, Netherland, UK etc. are the top importers in the global market have highest share in the world export. India ranks 32nd in the world import of fruits and vegetables in value terms. Export of fruits and vegetable from India is at higher side as compare to import denotes its scope in the global market.

Fruits and vegetables export: an Indian context

India's diverse climate ensures availability of all varieties of fresh fruits & vegetables. It ranks second in fruits and vegetables production in the world, after China. As per National Horticulture Database (Second Advance Estimates) published by National Horticulture Board, during 2019-20, India produced 99.07 million metric tonnes of fruits and 191.77 million metric tonnes of vegetables. The area under cultivation of fruits stood at 6.66 million hectares while vegetables were cultivated at 10.35 million hectares. The vast production base

offers India tremendous opportunities for export. During 2020-21, India exported fruits and vegetables worth 1,333.75 USD Millions which comprised of fruits worth 674.53 USD Millions and vegetables worth 659.22 USD Millions. Grapes, Pomegranates, Mangoes, Bananas, Orange account for larger portion of fruits exported from the country while Onions, Mixed Vegetables, Potatoes, Tomatoes, and Green Chilly contribute largely to the vegetable export basket.

The major destinations for Indian fruits and vegetables are UAE, Netherland, Malaysia, UK, Sri Lanka, Oman and Qatar (table 3). Though India's share in the global market is still nearly 1% only, there is increasing acceptance of horticulture produce from the country. This has occurred due to concurrent developments in the areas of state-of-the-art cold chain infrastructure and quality assurance measures. Apart from large investment pumped in by the private sector, public sector has also taken initiatives and with APEDA's assistance several Centers for Perishable Cargoes and integrated post-harvest handling facilities have been set up in the country. Capacity building initiatives at the farmers, processors and exporters' levels has also contributed towards this effort.

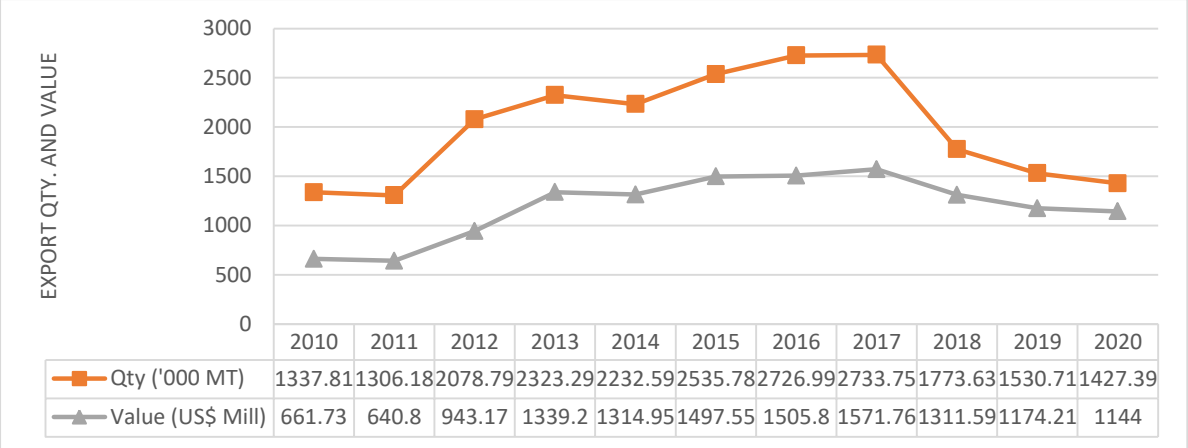
Table 3: India's export destination for fruits and vegetables in 2020-21

Importing Country	Qty ('000 MT)	Value (USD Mill.)
UAE	379.62853	231.05
Netherland	49.89944	131.49
Kuwait	101.0857	90.11
Malaysia	204.72665	84.71
Saudi Arab	136.155	83.95
U K	32.89403	77.46
Qatar	84.59342	75.56
Germany	29.82757	70.22
Sri Lanka	162.47201	60.01
Russia	25.52186	47.03

Source: APEDA

India's export of fruits and vegetables seems instable over the period of time as previous 11 years data reveals that from 2010-11 to 2017-18, export have increased marginally every year. After 2017-18, export drastically came down in 2018-19 and then after it shows marginal decline every year (figure 1).

Figure 1: India's export of fruits and vegetables from 2010-11 to 2020-21



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Qty ('000 MT)	1337.81	1306.18	2078.79	2323.29	2232.59	2535.78	2726.99	2733.75	1773.63	1530.71	1427.39
Value (US$ Mill)	661.73	640.8	943.17	1339.2	1314.95	1497.55	1505.8	1571.76	1311.59	1174.21	1144

Source: APEDA

Hence, there is a huge scope for Indian export agencies in international trade of agricultural commodities. Most of the international market still remained untapped by India and this very concern create several opportunities to entrepreneurs to venture in this business. Numerous export agencies are already into the business in India. This chapter will deal with a success story of one of such export agencies ventured in international market and running feasibly since several years.

Kashi Exports – An integrated fresh produce company

It is evident that India as a country have diversified cultural and social base, as tastes, preferences, belongings etc. vary state to state. Food consumption habits are no exception to this. Varying food consumption patterns may be witnessed all over the country. Indians those are residing overseas always have curiosity of own Indian food and that too of same culture. Tapping this particular opportunity, Kashi Exports has been established with the aim of proving own traditional fruits and vegetables to the Indians residing abroad.

Kashi Exports is a leading integrated export organization engaging in various types of horticulture and agricultural produce. It operates on a contractual farming model, including operating on privately owned farms in remote areas of Tapi District in heart of Western state of India, Gujarat.Their packaging facility is approved by the APEDA as per European norms having pre-cooling, cold storage, hot water immersion treatment plant for mango processing and in-house lab for phytosanitary requirement. Kashi Exports export basket includes major vegetables like okra, brinjal, cluster beans, pointed gourd, spiny gourd, ivy gourd, bitter gourd, cabbage, cowpea etc. and fruits like sapota (chikoo), mango etc. Major export destinations for these products are Canada, Netherland, UK, USA, Germany and Japan. Year wise export figures shows significant growth over the period of time as in 2017-18 they export 48 MT of fruits and vegetables which rose to 232 MT in 2019-20. Export hits after 2019-20 due to COVID19 pandemic, but they still manage to grab the market with export of 152 MT in 2020-21 and 143 MT in 2021-22. Thus, it shows there is tremendous scope in

international market for Indian traditional fruits and vegetables. Pictorial presentation of various facilities at Kashi Exports has been provided below.

Facilities at Kashi Exports

Unloading area

Mango processing unit

Pre-cooling chamber

Loading area for refer van

As Kashi Exports runs on contractual model, they persistently keep on guiding and consulting member farmers regarding the production of quality produce. They have huge network of around 150 fruits and vegetable growers. Awareness is created through various farmers training programme imparted by renowned and experienced personalities like progressive farmers, agricultural university scientists etc.

For export of agricultural produce it is very important to pass all the quality specifications. Thus quality of a product play very crucial role in international trade. The main task of the agency is to promote their member farmers to produce quality product that can meet up the international specifications. Some of the quality products has been presented below.

Bhindi

Guar (cluster bean)

Pointed gourd

Spiny gourd

Brinjal

Chilly

Cowpea

Bitter Gourd

Pathara

Haldi

Papdi

Sponge gourd

Tur

Wal papdi

Garlic

Drum stick

Anola

Chikoo

Mango

Conclusion

Several international markets still remained untapped by Indian export, which creates various opportunities and considerable scope. Despite of being second largest producer of fruits and vegetables, India's share in world export is merely 1%. Thus, government should encourage young entrepreneurs to venture themselves into the business of EXIM. The success story of Kashi Exports precisely explains the economic feasibility and of export business of food commodities. In order to grab untapped market, government should create awareness about entrepreneurial opportunities among the various stakeholders.

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