

SUPPLY CHAIN MANAGEMENT OF TOMATO BASED FOOD PROCESSING INDUSTRIES

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ABSTRACT: This Research work deals with the supply chain management of tomato based food processing industries. An attempt has been made to ensure regular supply of raw material for the effective running of food processing industries even in the period when tomato is not available the alternative arrangements have been made to meet the demand. The main attention is given on the existing problems faced by the food processing industries and their rectification by suggesting latest technologies to increase the maximum yield of production by using minimum quantity of hybrid seed and by using minimum acres of land. The post-harvest losses which occur during production have been removed by suggesting suitable measures. The harvesting season of tomato and the sowing period of tomato along with the other fruits and vegetables have been given so that during the period of non-availability of tomato other fruits can also be processed and give the maximum output. Arrangements have been made to get the raw material at right price on right time, in right place, in right quantity, in right quality. As there is lot of wastages during physical distribution in transportation alternative suggestions have been made for reducing such losses occurring during transit by suggesting suitable packaging material from growers place to cold storage and from cold storage place to processing centre and then from processing centre to ultimate consumer. The important guidelines have been made for the development of prospective tomato entrepreneurs.

Tomato based food processing would be an attractive alternative source of income for the rural sector from the cities/industrial centres can generate man power for employment and solve the problem of growers, those are having no income due to the non-availability of the industries of such type which can consume all their production and give better amount to growers as well as workers and by increasing production can meet the economical challenges faced by the country.

1. INTRODUCTION

TOMATO GROWING: BACKGROUND AND STATISTICS: -

ORIGIN / HISTORY

Tomato is one of the most important vegetable crops grown under different climate conditions. It is grown in temperate, sub-temperate and tropical & sub-tropical region of the world under different types of soils and climatic conditions in India.

The major tomato producing belts in India are as under: -

- 1) Uttar Pradesh (hills) and Himanchal Pradesh (Shimla, Kullu, & Solan).
- 2) Punjab (Amritsar, Ropar, Jalandhar, Hoshiyarpur), Haryana (Rohtak, Sonapat, Karnal, Gurgaon) and Rajasthan (Jaipur, Dholpur).
- 3) Uttar Pradesh (plains) and Bihar (Vaishal, Sitamarhi, Bhagalpur, Patna, Aurangabad, Nalanda, Bhojpur, Gandhinagar, W&E Champaran).

- 4) Maharashtra (Nashik, Ahmednagar, Pune, Nagpur) and Gujrat (Surat, Valsad, Baroda, Ahmedabad, Gandhinagar, Khera, Jamnagar).
- 5) Orissa, Madhya Pradesh (Raipur, Durg, Bastar, Satna, Sagar, Sarguja, Jabalpur, Bilaspur, Raigarh) and Andhra Pradesh (Vishakhapatnam).
- 6) Karnataka (Belgaum, Dharwad) and Andhra Pradesh (Rangareddy), Mahabubnagar, Prakasam).
- 7) Karnataka (Kolar, Bangalore, R&U, Bellary), Tamilnadu (N.Arcot Ambedhkar, Tirumenenieli, Kottabomman) and Andhra Pradesh (Chittore)

2. PROBLEMS OF THE TOMATO GROWERS:

The tomato is a short distribution crop and three crops of tomato can be taken in a year but the major problem is the shelf life as mature green vegetable can be kept for a 10 to 15 ° C temp. the relative humidity is kept at 80-90%. Transport of the crop needs special care through the refrigerated van under suitable packaging for the factories delivery. The problem is being solved in some of the states through the refrigerated van by subsidizing the transport system.

3. OBJECTIVE

TO DEVELOP GUIDELINES FOR A PROSPECTIVE TOMATO ENTREPRENEUR SIZE OF THE PRODUCTION PLANT, FORECAST OF DEMAND, COST STRUCTURE INVESTMENT. THE BEST ANNUAL PLAN OF OPERATION, PRODUCT MIX. LINKAGES / AGREEMENTS WITH SUPPLIERS

TOMATO PROCESSING INDUSTRY

INTRODUCTION- About 30% of the vegetable produced in India are wasted due to improper handling & storage. One way of preventing wastage and adding value to the marketable surplus of agricultural products is through the development of the food processing industry. Apart from preventing the food processing industry can achieve the following:

- Ensure availability of select vegetable during "off season" periods.

Make available certain vegetable that are currently available only in certain specific regions in the country

SIZE AND STATUS OF INDUSTRY

It is estimated that about 1.3 percent of the fruits and vegetables produced in India are used by the processing industry. This figure is in sharp contrast to the figure of 30% for Thailand, 70% for Brazil and the United States, 78% for Philippines and 83% for Malaysia. However, the capacity for fruit and vegetable processing has grown steadily from 0.275 millions tonnes in 1980 to 2.10 million tonnes in 1999. The fruit and vegetable processing industry in India is extremely decentralized, as a large number of processing units are in the cottage and small scale sectors. At the end of 1990, 3626 units were registered under the fruit products Order (FPO). At the end of 1994, 4270 processing units were the cottage and household sector (estimated production per unit less than 50 tonnes per annum). Another 17% of the units are small-scale (estimated production per unit between 50 and 250 tonnes per annum). In most units the cottage and small scale sector, traditional methods of the art technologies like vacuum concentration, aseptic packaging of tomatoes, mushrooms, topical fruit juices and pulps and concentrates. A few well-known Indian and multinational companies have established production facilities in this sector. The largest capacities of 30 tonnes per hour.

TECHNIQUES USED FOR VEGETABLE PROCESSING

Vegetable processing essentially involves their preservation and their processing to obtain the final product (such as wafers, tomato ketchup etc.)

PRINCIPLES OF PRESERVATION BY PROCESSING

1. Removal of water: reduction in the moisture content of fresh fruits or vegetables will lower the activity of microorganism responsible for spoilage.
2. Heat sterilization: Destroy the microorganisms and inactivates enzymes.
3. Lowering of temperature: Slow down most of the biochemical reaction and some of the enzymes that can lead to the deterioration of food.
4. Providing a chemical environment: which will not permit certain deteriorative action to proceed.
5. Sterilizing with Ionizing Radiation: Inactivate or destroys enzymes and microorganisms. Though each of these are effective, combination of two or more principle will work better.

Preservation techniques essentially utilize the application of heat or radiation, or the removal of heat and water content in order to obtain the desired preservation effect.

The major processes used for vegetable preservation and processing are:

- Preparation of vegetable for processing
- Blanching
- Cold preservation /freezing
- Thermal processing (canning)
- Dehydrating/ concentration
- Radiation/ irradiation

Chemical preservation

PREPARATION OF VEGETABLE FOR PROCESSING

The first step is the cleaning of the raw food. Vegetables are washed by high pressure sprays or by strong flowing streams of water while being passed along a moving belt or on a agitating or revolving or screens. With certain products, washing is preceded by dry-cleaning treatment in which a adhering soil and other five materials are mechanically removed by revolving/agitating screens or by strong air blasts.

This is followed by sorting by passing through a series of moving screens with different mesh sizes or differently shaped rollers. Separation into groups according to degree of ripeness or perfection of shape is done by hand. Pees and Beans are separated into more and less nature proportions by flotation in salt solution. This operation is fully automatic.

Trimming, if necessary, is done by hand operators trained in locating and removing blemishes. Sometimes trimming is restricted in cutting which is necessary to prepare the foods for the desired style of pack. In other cases vegetables are sliced & diced and peeled by machines designed for each vegetable.

BLANCHING

Blanching is done to expel air and gases to inactivate enzymes and thus arrest changes in flavor, and to soften the product.

In general foods are conveyed through hot water or steam by mechanical devices that subject them to a particular temperature range for a proper period of time.

Blanching is generally done in two ways :

- > Water blanching
- > Microwave and hot air blanching

Water blanching may result in loss of water soluble nutrients (in leafy vegetable) and also a large amount of liquid waste. Hence, high temperature short time (HTST) blanching in steam is more conducive to water-soluble nutrients in vegetables.

COLD PRESERVATION/FREEZING

This technique involves the extraction of heat by the application of refrigeration in order to effect the chilling or the freezing of the food product. The essential principle lies in the ability to slow down or immobilize the agents or spoilage in the food. These include active enzymes, microorganisms (bacteria or fungi), and chemical or bio-chemical reactions, all of which can lead to food losses. Other method includes cryogenic freezing, frozen storage and dehydro-freezing.

MAJOR PRODUCTS PRODUCED

The major products from tomato are: Tomato Juice

Tomato Puree Tomato Ketchup

3.4 PROCESSING FOR PRODUCTION OF KETCHUP

TOMATO KETCHUP: It is made by concentrating tomato juice or pulp without seeds and pieces of skin and with the addition of spices.

PRODUCT PREPERATION:

METHOD:

1. Take fully ripe, red colored tomatoes. Wash thoroughly.
2. Cut the fruits crush and boil the mass for about 5 minutes.
3. Strain the boiled mass through a fine mosquito net of 1mm stainless steel sieve by rubbing. Press out the juice /pulp completely.
4. Add 1/3 quantity of sugar and salt to the juice.
5. Prepare spice bag by tying in muslin cloth the ground spices and chopped pieces of onion and garlic.
6. Put the bag in juice.
7. Boil till the volume reduces to one third.
8. Remove the spice bag after squeezing to get all the extract.
9. Add the remaining quantity of salt and sugar, mix well without allowing to char.
10. Finally add acetic acid and sodium benzoate (dissolved in small quantity of water) to the product.
11. Boil for 2-3 minutes and fill in the clean, sterilized bottles keeping them on a wooden plank.
12. Close the bottle and seal.

PROBLEM OF RAW MATERIAL PROCURREMENT

A lot of wastage of vegetables occurs after harvesting and many technologies have been developed to minimize these losses. Losses are by no means confined to the post harvest sector, but range across the total food system. However, we shall discuss the losses at different post harvest stages as also the technologies available at each of these stages. The

different stages at which the losses occur can be studied by examining the different stages where vegetables are handled, as result of which there is a possibility of causing damage and increasing losses.

These stages are:

- Production
- Harvesting
- Pre-treatment/Packing
- Storage/Ripening
- Transportation
- Processing
- Wholesale storage
- Retail storage and preparation
- Consumption

TRANSFER TO PROCESSING SITE

In India transportation of fresh vegetables to terminal markets or processing units is done by head loads, animal loads cart loads, slow moving mechanical means, truckloads and railway wagons. Transportation in non-ventilated & non-refrigerated, container results in heating and quick decay of vegetables and accounts for a major proportion (accounting for about 10-15% of total produce) (accounting for the loss of about 10-15% of total produce) of post harvest losses. In addition improper handling during transportation causes loss by injury (especially in non-compartmentalized containers). In most developed nations transportation is done in refrigerated, ventilated and compartmentalized containers by road, rail or air.

5. PROBLEMS OF FINISHED GOODS DISTRIBUTION

CURRENT STATUS:

It is estimated that India produces nearly 300 million tonnes of food products, which comprise grains, cereals, pulses, fruit and vegetable, meat fish and poultry and marine products etc. Most of these are marketed fresh in and around the producing centres. Even then, nearly 30 to 35% of fruit and vegetables valued at Rs 3000 crores go waste each year due to lack of post-harvest facilities and the absence of linkages with the processors and markets. Nearly 10 to 20% of grains are spoiled due to inadequate transportation and storage facilities. Only a marginal quantity 1.5% of the produce is processed and packaged in contrast with the developed countries such as Malaysia and Brazil where 83% and 70% of the fruit and vegetable are processed. It is in this context that packaging and distribution play the key role in the growth of the food

processing industry. Packaging forms an integral part of food manufacture providing the essential link between the processor and consumer. The packaging lines generally occupies 50% of the floor space while the packaging and the related areas engage about 60% of the 5 million labour force concerned with the Indian food industry. It is estimated that presently, the money spent on food packaging materials and packages alone amount to nearly by Rs. 29.00 crores per annum. At least another Rs. 1000 crore is spent on packaging operation and related activities making a total value of the primary processed foods (about Rs 100,000 crores) and 15% of the value of the secondary and tertiary processed foods (Rs. 12,000 crores) produced in the country. It could be estimated that the amount can nearly twice as much in the next 5 years at the current pace of growth.

FRESH FRUITS AND VEGETABLES

It is estimated that nearly 30% of produce is lost due to poor handling and packaging. Scientific method of packaging and transportation plays a significant role in reducing the harvest losses. Fresh fruits and vegetables are living organisms and continue their physiological activity like respiration and transpiration even after their harvest. Absorption of oxygen (respiration) breaks down carbohydrates to water and carbon dioxide. Aerobic respiration continues till oxygen content falls below 2%. Then the system changes over to anaerobic respiration resulting in development of off flavours and reduction in shelf life. Fresh produce contains 85-90% moisture or even more and equilibrate humidity as high as 98%. Under normal atmospheric conditions, they will dry rapidly (transpiration). This causes wilting and shriveling due to shrinkage of the cells. With loss of about 10% moisture, the produce loses marketability. Transpiration is controlled by factors such as RH of the atmosphere, movement of the air, surface area exposed, temperature etc. microorganisms causes spoilage's invading the interior through bruise cuts or wounds. The primary factors in extending the shelf life include (1) harvesting at optimum maturity with minimum injuries (2) using proper sanitation procedures (3) providing optimum storage conditions namely, humidity, temperature and storage atmosphere.

A CASE STUDY

The case study is being carried out in five districts of states Delhi, Haryana, Punjab, and Rajasthan and Uttar Pradesh. By going through the population of districts and arrival rate of tomato at various market centre to know about the availability of tomato and the

consumption per capita. The assessment of demand and supply is being done to know the economy of scale for setting up food processing industries. As the per capita consumption of tomato per person is 1 Kg. /year. By going through the demand and supply of tomato the shortages/ surplus have been checked and alternative means have been made to run the industry without affecting the supply chain of tomato.

THE PROBLEM DEFINED

For the effective running of tomato based food processing industry supply chain management of tomato. The undermentioned districts are taken into consideration for the regular supply of tomato in various seasons and other fruits which can be processed during the period when tomato is not available at all guava, mango, orange, pineapple, mosambi, etc. are the source of the fruit can be processed during this period and arrangement have been made for regular supply from the market centre of Delhi, Punjab, Haryana, Chandigarh, Uttar Pradesh (plain), and Andhra Pradesh etc. The market centre in Delhi at Azadpur mandi, Punjab Jalandhar mkt., Amritsar mkt. Chandigarh mkt. Uttarpradesh plain Kanpur and Lucknow mkt. and from Hydrabad market in Andhra Pradesh.

A SUGGESTED SCHEME OF UTILIZATION FOR THE CHOSEN PROBLEM

As the growers are facing problems because of non availability of any industry at there place nearby, who can consume there produce tomato and give the maximum earnings and to solve the problem of un-employment in that area. The problem can be solved by establishing food processing industries who can consume there all produce at the economical rate and generate employment for their children.

CONCLUSION

HIGHLIGHTS ON THE WORK DONE

Collection of all the relevant information's related to the supply chain management of tomato is done by



having discussions with the concerned authorities like Agricultural Processing Export Development Authority. From there the information on all the facts and figures of fruits and vegetables have been noted and discussed about the export of tomato. Further visited NAFED Processed food at Lawrence Road, and other manufacturing unit of tomato ketchup, sauce, juice, puree, and seen the production procedures and

visited several times to know about the latest techniques used and the problems faced by the industry for meeting of there demand. Visited Indian Agricultural Research institute and ICARI and the post harvest division of Horticulture to know about the latest techniques used for production of tomato and the seeds to be used to increase the production on small acres of land available with the farmers. Collected information on food processing from Ministry Of Food Processing at Delhi and discussed the various issues related to packaging and distribution system and there involvement in food processing industries development techniques. The ministry has various schemes for the food processing by providing loans and complete guidance on installation of machinery. The details of the National Horticultural Board on the tomato is being collected. Correspondence have been made with the suppliers of machinery and discussions with the machine manufacturers on machine latest development. Then the correspondence is made with CFTRI Mysore and Indian Institute of Horticulture, Banglore, and received the information on the latest hybrid seeds availability and the techniques of manufacturing process of tomato ketchup, sauce, juice, and puree and the refrigerated storage requirement for tomato and the other fruits and vegetables used in the lean period so that the production does not suffer. Received information from the Panth Nagar Agricultural University about the tomato and visited university to discuss all the related issues of tomato and visited development comm. office at Okhla to know about the tomato production details and collected all the relevant information. Further visited association of food processing for collecting the information on tomato facts and figures and the share of the production of fruits and vegetables. Further from Planing Commission the details of Agro climatic regions in India have been colleted and discussed the relevant details of tomato. After going through all the details made the prospective frame work for the tomato entrepreneur. Visited at various market centers of Delhi Haryana Punjab to know about the availability of tomato in previous years to know the forecasting of demand. Met the growers of tomato in different distt. to understand there problems of tomato.

LIMITATIONS AND SCOPE FOR FUTURE WORK

Our economy is still largely based on agriculture. The recognition of the need to upgrade agro-based industries and in turn to give that extra impetus to the agricultural sector. A strong food processing sector, it

was felt, would help accelerate agricultural activities, aid the diversification and commercialization of agro-products and give it an orientation towards increased exports on the one hand, and create greater opportunities to nutritional enhancement, employment and income generation in rural areas on the other.

A diverse agriculture sector with varied soils and climates, provides a wide ranging and large raw material base suitable for producing a rapidly growing range of processed foods.

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