BVFP 365S Preparation of Food Processing Plant Proposal (Skill based)

Tomato Ketchup Processing

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report on,

Tomato Ketchup Processing

Submitted by,

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ROLL NO. 2

Submitted to,

M.V.P. Samaj's Arts, Science & Commerce College, Uttam Nagar CIDCO, Nashik 08
(Affiliated to SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

Under the guidance of

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CERTIFICATE

This

is to certify that,

MS. Banugade Akanksha Krushnat Roll no 2 of VI semester, of B. Voc. (**Food Processing Technology**) has completed the necessary work for the requirement of Course No. **BVFP 365S** Course Title: **Preparation of Food Processing Plant Proposal (Skill based)** in the year 2021-2022.She has undergone fair exposure to start new industry on food processing and agro based includes present market position and expected future demand, market size, statistics, trends, SWOT analysis and forecast.

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Date:30/06/2022
Place: Nashik

DECLARATION

I’ am hereby declare that this report is record authentic work carried out by us during the VI th semester and has not been submitted to any other university or institute.

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Tomato Ketchup Processing Unit:

1. Introduction:

Tomato, though botanically a fruit for the purpose of trade, is generally considered a vegetable because of the way in which it is consumed. Tomatoes are widely grown in all parts of the world. Tomatoes are produced and processed during the two main seasons across much of India – August to October (kharif) and December to April (rabi). Tomatoes are also grown during the off-season (May to July) where conditions suit and also under protected cultivation. Tomato fits easily into different cropping systems, has high economic value and fruits can be processed, dried, canned and bottled. Moreover, tomatoes contribute to a healthy, well balanced diet. Tomatoes are rich in potassium, magnesium, phosphorus and small amounts of calcium. Tomatoes contain a lot of vitamin A, vitamin C and vitamin B3. They have small amounts of other B vitamins, and vitamin E. Tomatoes are mostly grown by a large number of smallholder farmers with holdings of between 1-3 acres of land. The southern and central states constitute much of India's production including the states of Andhra Pradesh, Telangana, Karnataka and Maharashtra. Tomato production is growing worldwide because consumers demanding a wider range of innovative, value-added products. Tomatoes are an important crop for both the farmer and the consumer in India. It grows in almost every state of the country. Due to increasing standards of living in the cities and the rapid urbanization taking place in the rural areas, consumption of tomato based products is expected to go up steadily. The major institutional customers of tomato paste are restaurants.

At present, the market of ketchup/puree, especially in the urban areas, is dominated by brands likes MEGGI and KISSAN. Some medium and small companies are also engaged in its production. However, because of poor post harvest infrastructure and value addition, a huge quantity of tomato get wasted in the supply chain. Therefore, processing of tomato can not only minimize wastage but also offers huge scope for entrepreneurship development at micro or small scale level through government schemes such as PMFormalization of Micro Food Processing Enterprises Scheme of MoFPI, Government of India.

Project at Glance

1.	Name of the proposed project	Tomato ketchup processing unit
2.	Name of the entrepreneur/FPO/SHG/ Cooperative	
3.	Nature of proposed project	Proprietorship/Company/Partnership

4.	Registered office	
5.	Project site/location	
6.	Names of Partner (if partner)	
7.	No of share holder (if company/FPC)	
8.	Technical advisor	
9.	Marketing advisor/partners	
10.	Proposed project capacity	150 MT/annum (70,80, & 90% capacity utilization in the 2nd , 3rd and 4th years' onwards respectively)
11.	Raw Materials	Tomato
12.	Major Product Outputs	Tomato Ketchup
13.	Total Project Cost	Rs. 30 Lakhs
	• Land development, building & civil construction	Rs. 2.00 Lakhs (only for expansion of existing built-up area)
	• Machinery and equipments	Rs. 18 Lakhs
	• Utilities (Power & water facilities)	Rs. 2.00 Lakhs
	• Miscellaneous fixed assets	Rs. 1 Lakhs
	• Pre-operative expenses	Rs. 0.67 Lakhs
	• Contingencies	Rs. 2.00 Lakhs
	• Working capital margin	Rs. 4.33 Lakhs
14.	Working capital requirement	
	• 2nd year	Rs. 13.00 Lakhs
	• 3rd year	Rs. 14.85 Lakhs
	• 4th year	Rs. 16.72 Lakhs
15.	Means of Finance	
	• Subsidy grant by MoFPI (max 10 lakhs)	Rs. 10.00 Lakhs
	• Promoter's contribution (min 20%)	Rs. 6.00 Lakhs
	• Term loan (45%)	Rs. 14.00 Lakhs
16.	Debt-equity ratio	2.33:1
17.	Profit after Depreciation, Interest & Tax	
	• 2nd year	Rs. 26.62 Lakhs
	• 3rd year	Rs. 32.39 Lakhs
	• 4th year	Rs. 38.16 Lakhs
18.	Average DSCR	11.58

19.	Benefit-Cost Ratio	1.95
20.	Term loan repayment	7 Years with 1 year grace period
21.	Payback period for investment	3 Years

1.1. Origin and Distribution of Tomato:

Tomato is originated in Peru of South America. It is important commercial vegetable crop of India. It is the second most important crop of world after potato. Fruits are eaten raw or in cooked form. It is rich source of vitamin A, C, potassium and minerals. It is used in soup, juice and ketch up, powder. The major tomato producing states are Bihar, Karnataka, Uttar Pradesh, Orissa, Maharashtra, Andhra Pradesh, Madhya Pradesh and West Bengal

1.2. Production of Tomato in India:

Table 1: Tomato production in India during 2017-18 ('000 Tonnes)

Sl. No.	State	Production	Share (%)
1	Andhra Pradesh	2,744.32	13.90
2	Madhya Pradesh	2,419.28	12.25
3	Karnataka	2,081.59	10.54
4	Gujarat	1,357.52	6.88
5	Orissa	1,312.07	6.64
6	West Bengal	1,265.25	6.41
7	Telangana	1,171.50	5.93
8	Chattisgarh	1,087.33	5.51
9	Maharashtra	1,086.56	5.50
10	Bihar	941.56	4.77
11	Tamil Nadu	887.08	4.49
12	Uttar Pradesh	841.61	4.26
13	Haryana	753.72	3.82
14	Himachal Pradesh	481.94	2.44
15	Assam	396.24	2.01
16	Jharkhand	265.26	1.34
17	Punjab	224.26	1.14
18	Uttarakhand	103.85	0.53
19	Rajasthan	88.73	0.45
20	Tripura	56.5	0.29
21	Jammu & Kashmir	52.96	0.27
22	Meghalaya	35.51	0.18
23	Manipur	33.72	0.17
24	Nagaland	22.47	0.11
25	Kerala	12.61	0.06
26	Mizoram	11.87	0.06
27	Sikkim	8.03	0.04
28	Arunachal Pradesh	2.15	0.01

1.3. Popular Tomato Varieties in India:

Table 2: Popular Tomato Varieties

Punjab Ratta	Ready for first picking in 125 days from transplanting. Gives average yield of 225qtl/acre. This variety is suitable for processing.
Punjab Chhuhara	Fruits are seedless, pear shape, red and firm with thick wall or skin. Marketable quality remains for 7 days after harvesting and thus suitable for long distance transportation and processing. It gives average yield of 325qtl/acre.
Punjab Tropic	Plant height is about 100 cm. Ready to harvest in 141days. Fruits are of large size and round shape, they borne in cluster. Gives average yield of 90-95qtl/acre.
Punjab Upma	Suitable for cultivation in rainy season. Fruits are oval shape, medium size and of firm deep red color. Gives average yield of 220qtl/acre.
Punjab NR -7	Dwarf variety having medium size juicy fruits. It is highly resistant to fusarium wilt and root knot nematodes. Gives average yield of 175-180qtl/acre.
Punjab Red cherry	These cherry tomatoes are used in salads. These are of deep red color. Sowing is done in August or September and plant is ready to harvest in February and gives yield up to July. Its early yield is 150 qtl/acre and total yield is 430-440 qtl per acre.
Punjab Varkha Bahar 2	Ready to harvest in 100days after transplanting. It is resistant to leaf curl virus. Gives average yield of 215 qtl/acre.
Punjab Varkha Bahar 1	After transplanting, ready to harvest in 90days. It is suitable for sowing in rainy season. It gives resistance to leaf curl virus. Gives average yield of 215qtl/acre.

Punjab Swarna	Matures after 120 days of transplanting. It gives an average yield of 166qtl/acre till endMarch and gives total yield of 1087qtl/acre. The variety is suitable for table purpose.
Punjab Sona Cherry	It gives an average yield of 425qtl/acre. The fruits are yellow in color and bears in bunches. The average weight of the fruit is approximately 11gm. It contains 7.5% sucrose content.
Punjab Kesari Cherry	It gives an average yield of 405qtl/acre. The average weight of the fruit is approximately 11gm. It contains 7.6% sucrose content.
Punjab Kesar Cherry	It gives an average yield of 405qtl/acre. The average weight of the fruit is approximately 11gm. It contains 7.6% sucrose content.
Punjab Varkha Bahar-4:	It gives an average yield of 245qtl/acre. It contains 3.8% sucrose content.
Punjab Gaurav	It gives an average yield of 934qtl/acre. It contains 5.5% sucrose content.
Punjab Sartaj	It has round shape fruit, moderate and hard. Suitable for rainy season. It gives an average yield of 898qtl/acre.
HS 101	Suitable for growing in north India during winter condition. Plants are dwarf. Fruits are round and medium size and juicy. Fruits are borne in cluster. It is resistant to Tomato Leaf Curl Virus.
HS 102	Early maturing variety. Fruits are small to medium in size, round and juicy.
Swarna Baibhav Hybrid	Recommended for cultivation in Punjab, Uttarakhand, Jharkhand, Bihar and Uttar Pradesh. It is sown in September- October. Fruits keeping quality is good so suitable for long distance transport and processing. Gives yield of 360-400qtl/acre.
Swarna Sampada Hybrid	Recommended for cultivation in Punjab, Uttarakhand, Jharkhand, Bihar and Uttar Pradesh. Suitable for sowing in Aug-Sept and Feb-May. Yield is 400-420qtl/acre.
Keekruth	Plant height is about 100 cm. Ready to harvest in 136days. Fruits are medium to large size, round shape, deep red color.
Keekruth Ageti	Plant height is about 100cm. Fruits are medium to large size, round shape having green shoulder which disappears on ripening.

1.4. Nutritional Value of Tomato:

Tomato is rich in nutrition and per 100 gram
Calories: 16
Fat: 0.2g
Sodium: 5mg
Carbohydrates: 3.5g
Fiber: 1.1g
Sugars: 2.4g
Protein: 0.8g

1.5. Health Benefits of Tomato:

Health benefits of tomato include eye sight, good gut health, low hypertension, diabetes, skin problems and urinary tract infections. Tomato is considered both a fruit and vegetable and forms an integral part of the cuisine all across the globe especially in the Mediterranean region. Daily consumption of tomato provides a great boost to health apart from improving the flavor of food. It consists of a large number of antioxidants which have been proven to fight different forms of cancer. It is a rich source of vitamins and minerals and exerts a protective effect against cardiovascular diseases. It also improves eye health and prevents hypertension and urinary tract infections.

- **Diabetes :** Tomatoes also have plenty of the mineral chromium, which helps diabetics to keep their blood sugar level under control.
- **Kidney stones and gallstones :** Eating tomatoes without the seeds has been shown in some studies to lessen the risk of gallstones and kidney stones
- **Heart Troubles :** Due to potassium and vitamin B, tomatoes help to lower blood pressure and to lower high cholesterol levels. This, in turn, could help prevent strokes, heart attack and other potentially life-threatening heart problems.
- **Cancer :** Various studies have shown that because of all that lycopene in tomatoes, the red fruit helps to lessen the chances of prostate cancer in men, and also reduces

the chance of stomach cancer and colorectal cancer. Lycopene is considered somewhat of a natural miracle anti-oxidant that may help to stop the growth of cancer cells. And, interestingly enough, cooked tomatoes produce more lycopene than do raw tomatoes, so enjoy that tomato soup.

Smoking : No, tomatoes can't help you stop smoking, but what they can do is to help reduce the damage smoking does to your body. Tomatoes contain chlorogenic acid and coumaric acid, which help to fight against some of the carcinogens brought about by cigarette smoke.

- **It reduces risk of prostate cancer:** Eating tomato sauce two or more times a week reduces a man's risk of developing prostate cancer by around 20 per cent.
- **It increases sperm count:** Lycopene, which gives tomatoes their red colour, could also boost male fertility.
- **It cuts cholesterol:** Tests carried out by Finnish scientists found that ketchup could cut low-density lipoprotein, aka 'bad cholesterol'.
- **It improves your eyesight:** As well as being high in vitamin C and low in fat, ketchup contains vitamin A, which is key for a healthy immune system and, perhaps crucially, good vision.
- **It makes actually healthy food bearable to eat:** Let's be honest here - despite the health benefits above, ketchup is also packed with sugar and salt, so it's possibly not the best thing for a serious health kick.

2. Cultivation, Post Harvest Management and Storage of Tomato:

Land preparation

Tomato plantation is done in well pulverized and leveled soil. Land is ploughed for 4-5times to bring soil to fine tilth, then planking is done to make soil level. At time of last ploughing well decomposed cow dung and Carbofuron@5kg or Neem cake@8kg per acre should be applied. Transplantation of tomato is done on raised bed of 80-90cm width. To destroy harmful soil borne pathogen, pest and organism, soil solarization is carried out. It can be done by using transparent plastic film as mulch. This sheet absorbs radiation and thus increases soil temperature and kills pathogen.

Nursery Management and Transplanting

Solarization for one month before sowing is done. Tomato seeds are sown on raised beds of 80-90 cm width and of convenient length. After sowing, bed covered with mulch and irrigation of bed must be done with Rose-Can daily in morning. To protect crop from virus attack nursery bed is covered with fine nylon net. To make plants healthier and stronger and to harden seedling against transplanting sock, spray of Lihocin@1ml/Ltr water at 20 days after sowing is good. Damping off damages crop to great extent, to prevent crop from it, overcrowding of seedlings is avoided and soil is kept wet. If wilting is observed, drenching of Metalaxyl@2.5gm/Ltr water is done 2-3 times till plants are ready for transplantation. Seedling is ready for transplantation 25 to 30 days after sowing with 3-4 leaves. In case if seedlings age is more than 30 days transplantation must be done after de-toping. Watering of

seedling beds is done 24 hours before transplanting so that seedlings can be easily uprooted and be turgid at transplanting time. To protect crop from bacterial wilt, seedlings are dip in 100 ppm. Streptocycline solution for 5 minutes before transplanting.

Transplanting and Spacing

For northern state, tomato cultivation for spring season is done in late November and transplanted in second fortnight of January. For autumn crop, sowing is done in July - August and transplanted in August - September. In hilly areas sowing is done in March- April and transplantation is done in April -May. Depending upon variety and its growth habit, spacing of 60x30cm or 75x60cm or 75x75cm is good.

Harvesting

Plant starts yielding generally by 70 days after transplantation. Harvesting is done depending upon purpose like for fresh market, long distance transport etc. Mature green tomatoes, 1/4th fruits portion gives pink color are harvested for long distance markets. Almost all fruits turn into pink or red color but having firm flesh are harvested for local markets. For processing and seed extraction purpose, fully ripe fruits with soft flesh are used.

Post-harvest Management

After harvesting, grading is done. Then fruits are packed in bamboo baskets or crates or wooden boxes. To increase self-life of tomato during long distance transport pre-cooling is carried out. From ripe tomatoes several products like puree, syrup, juice and ketch up are made after processing.

Storage and Food Safety

Full ripe tomatoes are stored at a temperature of 55°F for up to several days. Temperature cooler than this, will cause chilling injury, producing poor colors and off flavors. Due to improper storage, there is a loss in fresh weight of about 10-15%. This causes them to appear shriveled and stale, thus considerably lowering their market value and consumer acceptability. Proper storage facilities are important in stabilizing the supplies by carrying over the produce from periods of high production to periods of low production.

Vegetables	**Temp $_0$C**	**RH (%)**	**Storage life (weeks)**
Tomato, unripe	8.0-10.0	85-90	4.5
Tomato, ripe	7.2	90	1

2.1.Methods of storage of tomatoes:

Low temperature storage

This is a time tested reliable method used for retention of freshness and extending shelf life of fresh produce as it reduces rate of respiration and thermal decomposition. Chilling injury may erode the quality of fruits if storage temperature is less than 12.5$_0$C.

Ethylene treatment

By treating ethylene either as a dip treatment or gaseous exposure using etherl as a source of ethylene, uniform accelerated ripening can be obtained. Further, by removing the ethylene produced by fruit with the use of ethylene absorbent either prepared indigenously or by use of 'purafil' (commercial form of ethylene absorbent), significant extension of shelf life.

Evaporative cooling of tomato

Evaporation of moisture from tomatoes causes wilting and shriveling, resulting in weight loss. The process of evaporative cooling is an adiabatic exchange of heat when ambient air is passed through a saturated surface to obtain low temperature and high humidity, which are desirable for extending the storage life of tomato.

MAS using silicon membrane

It is controlled ventilation system, which regulates the gas levels in the storage environment by recycling on selective gas permeation. The membrane makes use of ability of the polymer to allow the selective passage of gases at different rates according to their physical and chemical properties.

2.2. Processing and Value Addition of Tomato:

Tomato production is a growing worldwide as consumers demanding a wider range of innovative, value-added products. This results in high demand on mixing technology for production and processing. Tomato processing industry is huge. A large part of the world tomato crop is processed into tomato paste/puree, which is subsequently used as an ingredient in many food products, mainly soups, sauces and ketchup. India has been exporting processed tomato in the form of tomato paste and ketchup. Tomato sauce is being used with snacks like rolls, cutlets, samosas, chops, soup, chowmin and other continental as well as chinese dishes. Bright mixture made from tomato is used as important items with all modern food/snacks. The only ketchup and sauce market in India is pegged at Rs 1,000 crore and growing at around 20% year-on-year. There is a big market for the processed tomato

products. Tomato products are one of the chief ingredients in ready-to-eat or fast food products.

3. Importance of Tomato Processing:

Tomato is one of the important crops used as fresh vegetables and for preparing a variety of processed products like tomato juice, ketchup, sauce, canned, puree and paste. In advanced countries, nearly 80% of the fresh tomatoes are processed. In India, although tomato production is increasing the growth of tomato processing industry is slow, mainly due to the lack of constant supply of good quality and cheaper raw material to the processing centre.

In India, tomato sauce and ketchup are very popular and are being manufactured on an increasingly large scale, mostly in small units. As tomatoes are available practically throughout the year there is scope for setting up large-scale processing units. The quality of a tomato product is judged by its colour, which is dependent on the redness of the tomatoes used. In fact, the red pigment (lycopene) can be used as an index of the amount of tomato actually present in a product. High quality tomato products can be prepared only by:

(i) Using plant – ripened uniformly red tomatoes as the yellow and greenish portions not only mask the red colour but also cause browning due to oxidation.

(ii) Avoiding prolonged heating, and cooling the product quickly after preparation; and

(iii) Not using iron and copper equipments at any stage of processing. Lycopene (Selfoxidizing isomer of carotene) turns brown when it comes into content with iron. Iron also forms black compounds with the tannin in the tomatoes and the spices used. Equipments used should be glass-lined or made of stainless steel.

3.1. Points to be considered while processing of tomato:

(i) Use only plant-ripened red tomatoes as far as possible. The yellow and greenish portions not only mask the red colour of the fully ripe tomatoes, but also turn brown due to oxidation.

(ii) Avoid use of iron equipment during processing. Lycopenes turns brown when it comes in contact with iron. Iron also forms black compounds with the tannin of the tomatoes or of the spices used.

oxidized
(Iron + tannin ferrous tannate black ferric tannate)

(iii) Avoid prolonged heating and cool the product quickly after preparation of tomato based processed products like ketchup, sauce, chutney and soups.

(iv) Mere rinsing of tomatoes in water is not enough, because mould filaments and other microorganisms found in the cracks, wrinkle, folds and stem cavities, are not easily removed by gentle washing alone.

(v) After filling tomato products in bottle it is better to pasteurize to avoid fermentation.

(vi) Black neck formation is one of the major problem in tomato ketchup and sauce like products. It affects the quality of the product. Black neck can be prevented by

(vii) Filling hot sauce at a temperature not less than 85°C temperature.
(viii) Leaving minimum headspace in bottles (the more the air than greater is the blackening)

(ix) Reducing contamination with iron, source of iron are salt and metal equipments

(x) Partial replacement of sugar by corn syrup or glucose, syrup which contain sulphur and prevent blackening.

(xi) Addition of 100 ppm sulphur dioxide or 100 mg per cent ascorbic acid.

(xii) Storing bottles in horizontal or inverted position to diffuse the entrapped air (O_2) throughout the bottle thus reducing its concentration in the neck sufficiently to prevent blackening.

(xiii) Use cloves after removing the head

3.2. Effect of Processing on Nutrients in tomato products:

- Bioavailability of certain carotenoids viz. β-carotene, lycopene, phenolics increases after processing of tomato into value added products
- The proportion of all trans lycopene – 96% of total lycopene in preserved tomato paste and 77% in tomato ketchup
- 65% flavonoid present in fresh tomato retained in processed tomato paste
- The total phenolics content in tomato pulp and puree increased during storage due to release of bound phenolics
- Ascorbic acid loss 40% in tomato pulp, 55% in tomato puree and 60% in tomato paste
- Processed tomato products have a distinctively different aroma from fresh tomato products. This is due to both the loss and the creation of volatiles

4. Model Tomato Processing Unit under PM-FME Scheme

4.1. Introduction:

The Central Sector scheme for Formalization of Micro Food Processing Enterprises under Ministry of Food Processing Industries, Government of India is an important scheme that offers for formalization and mainstreaming the unorganized home based or micro food processing units. The scheme is useful for expansion of the existing units in

terms of capacity and technology through installation of new machineries and additional civil infrastructures. Further, the scheme promotes establishment of new micro units on the principle of ODOP (One District One Product)
Establishment or expansion of **Tomato Processing Unit** is an attractive option in potential tomato growing states in India as tomato offers huge scope for value addition and market demand. A model generalized DPR is therefore, prepared for expansion of existing un-formalized Tomato Processing Unit. A detailed account of the model DPR prepared on the basis of certain generalized assumptions is discussed in the sequent sections. ***An entrepreneur can use this model DPR template and modify according to his/her need in terms of capacity, location, raw materials availability etc.***

4.2. Form of the Business Enterprise:

The entrepreneur concerned must specify about the form of his/her business organization i.e. whether Sole Proprietorship, Cooperative, FPO/FPC, SHG Federation, Partnership Firm or Company and accordingly attach all the required documents. The documents may be registration certificate, share holding pattern, loan approval certificate etc as specified in the FME scheme guidelines.

4.3. Background of the Promoters/Owners and Required Documents:

The detailed bio-data of promoter/promoters inter-alia name, fathers name, age, qualification, business experience, training obtained, contact number, email, office address, permanent address, share holding pattern, definite sources of meeting the commitment of promoters contribution details of others business along with certified balance sheet and profit loss account for the last 3-4 years, tax registration, PAN number, income tax return etc for 3-4 years and other requirements as specified in the FME guidelines must be provided with the DPR.

4.4. Background of the Proposed Project:

The entrepreneur must specify whether it is a new project or expansion of the existing project. If new project is proposed then the reason to go in to the project and if expansion of the existing project, the must specify what kind of expansion is proposed in terms of capacity, product, machines, civil infrastructure etc.

4.5. Location of the Proposed Project and Land:

The entrepreneur must provide description of the proposed location, site of the project, distance from the targeted local and distant markets; and the reasons/advantages thereof

i.e. in terms of raw materials availability, market accessibility, logistics support, basic infrastructure availability etc. The entrepreneur must mention whether project is proposed in self owned land or rented/allotted land in any industrial park or private location. Accordingly, he/she must provide ownership document, allotment letter/ lease deed. Land clearance certificate must be from village authority/municipality or any other concerned authority. ***The ideal locations for establishment of exclusive Tomato Processing Units are in the production clusters of the major tomato growing states such as Andhra Pradesh, Madhya Pradesh, Karnataka, Gujarat, Orissa, West Bengal, Telangana, Chattishgarh, Maharashtra and Bihar where adequate quantities of surplus raw materials can be available for processing.***

4.6. Installed Capacity:

The maximum installed capacity of the Tomato Processing Unit in the present model project is proposed as150 tonns/annum. The unit is assumed to operate 300 days/annum @ 8-10 hrs/day. The 1st year is assumed to be construction/expansion period of the project; and in the 2nd year 70 percent capacity, 3rd year 80 percent capacity and 4th year onwards 90 percent capacity utilization is assumed in this model project.

4.7. Raw Material Requirements for the Unit:

A sustainable food processing unit must ensure maximum capacity utilization and thus requires an operation of minimum 280-300 days per year to get reasonable profit. Therefore, ensuring uninterrupted raw materials supply requires maintenance of adequate raw material inventory. The processor must have linkage with producer organizations preferably FPCs through legal contract to get adequate quantity and quality of raw materials which otherwise get spoiled. In the current model tomato processing project, the unit requires 350 kg/day, 400 kg/day and 450 kg/day raw tomato at 70, 80 and 90 percent capacity utilization, respectively.

4.8. Product Profile of the Unit:

In the present model tomato processing unit, the targeted product output is **Tomato Ketchup**. Tomato ketchup has huge demand in India and the existing market can still accommodate micro or small scale units on their own or under other’s brand.

5. TOMATO KETCHUP:

5.1. Introduction:

Ketchup, also known as catsup, ketchup, red sauce, and tomato sauce, is a sauce used as a condiment. Originally, recipes used egg whites, mushrooms, oysters, grapes, mussels, or walnuts, among other ingredients, but now the unmodified term usually refers to tomato ketchup. Ketchup is a sweet and tangy sauce now typically made from tomatoes, sugar and vinegar, with assorted seasonings and spices. The specific spices and flavors vary, But commonly include onions, allspice, coriander, cloves, cumin, garlic, and mustard, and sometimes include celery, cinnamon, or ginger. Tomato ketchup is most often used as a condiment to dishes that are usually served hot and may be fried or greasy: French fries, hamburgers, hot dogs, chicken tenders, tater tots, hot sandwiches, meat pies, cooked eggs, and grilled or fried meat. Ketchup is sometimes used as the basis for, or as one ingredient in, other sauces and dressings, and the flavour may be replicated as an additive flavouring for snacks such as potato chips. In fast food outlets, ketchup is often dispensed in small sachets or tubs. Diners tear the side or top and squeeze the ketchup out of the ketchup packets, or peel the foil lid off the tub for dipping. In 2011, Heinz began offering a new measured-portion package, called the "Dip and Squeeze" packet, which can be opened in either way, giving both options. Some fast food outlets previously dispensed ketchup from handoperated pumps into paper cups. This method has made a comeback in the first decade of the 21st century, as cost and environmental concerns over the increasing use of individual plastic ketchup tubs were taken into account.

5.2.Ingredients:

The main ingredients of ketchup are tomatoes, sweeteners, vinegar, salt, spices, flavourings, onion, and/or garlic. The types of sweetener used are usually granulated cane sugar or beet sugar. Other sweeteners include dextrose or liquid sugar in the form of corn or glucose syrup. The various brands of ketchup have slightly different formulas, which vary primarily in the amounts of spices or flavorings. Thicker consistencies require a greater ratio of sugar and spices relative to the tomato juice. Occasionally formulas must be slightly adjusted according to variations in the acid and sugar content of tomatoes, which occurs with changes in growing conditions and types of tomatoes.

5.3. Description of Tomato Ketchup Machine

Machinery for Tomato Ketchup includes the following:

- Rotary Fruit & vegetable washng machine
- Sorting/ inspection conveyor
- Screw fedder
- Fruit Mill Crusher

- Hopper tyre pump
- Twin pulper
- Pulpr
- Steam Jacketted Kettle
- Steam Jacketted Kettle
- Transfer pump



- Homogenizer
- Overhead filling tank
- Baby steam Boiler
- Rotary Bottle Washer
- Double head Penumatic Filler
- Crown corking Machine
- Steam boiler
- Induction sealer

Tomato ketchup machines is mainly used to produce final eatable Tomato sauce from the raw material. With the help of these machines the work of washing, pulping, mixing, homogenizing, boiling, filling & sealing completes in a very short span.

5.4. Quality changes during storage:

The main processing problem is related to the issue that the product turns black at the contact zone with air due to the action of iron on the tannins. This can be prevented by avoiding the

use of iron equipment, avoiding the crushing of tomato seeds and sealing the bottles in a vacuum.

Black-neck formation comes across sometimes during storage of tomato ketchup in bottles. As oxygen is primarily responsible for this phenomenon, by employing techniques such as :
 Absorption of oxygen from the head space in the ketchup bottles+

 Addition of substances capable of readily reacting with oxygen in the head space

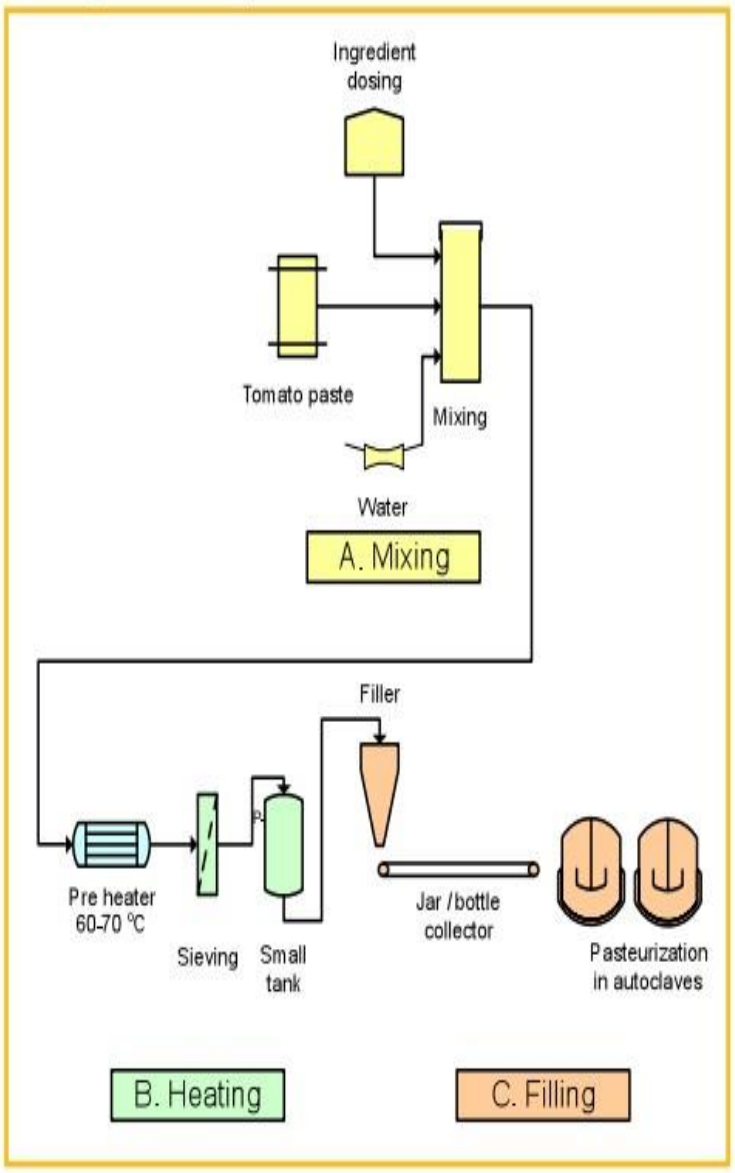
 Minimising the contact between iron of the crown cork and tannin present in the lining material etc.

This defect in tomato ketchup can be overcome by adding to the surface of the ketchup in the bottle, before closing ascorbic acid at the rate of about 100 parts per million based on the total weight of the ketchup in the bottle. To render this technique very effective, it is necessary to fill the bottle completely with hot ketchup and thereby minimize the incorporation of oxygen and also not to disturb the bottle for atleast 1-2 days so that the topping with ascorbic acid may be fully effective. It may, however, be pointed out that black ring formation is quite distinct from general darkening of the ketchup and addition of ascorbic acid cannot be considered a remedy for the latter defect. it is better to rely more and more on the quality of the tomato itself to manufacture ketchup of high quality rather than resort to the use of artificial colour.

5.5. Marketing issues:

Ketchup is a branded product and the recipe is the key secret of the producer. The product knows strong international labels such as Heinz and is heavily promoted via marketing efforts. Year-round availability on the shelves is a must to achieve customer loyalty.

Figure 1: Flow diagram of tomato ketchup process at pilot scale level



6. Tomato Ketchup Market Analysis

According to the "**India Ketch Up, Pizza & Pasta Sauces Market Outlook, 2023**" report. Tomato Ketchup market is primarily driven by the growing demand for fast food and increasing number of QSRs across the country.

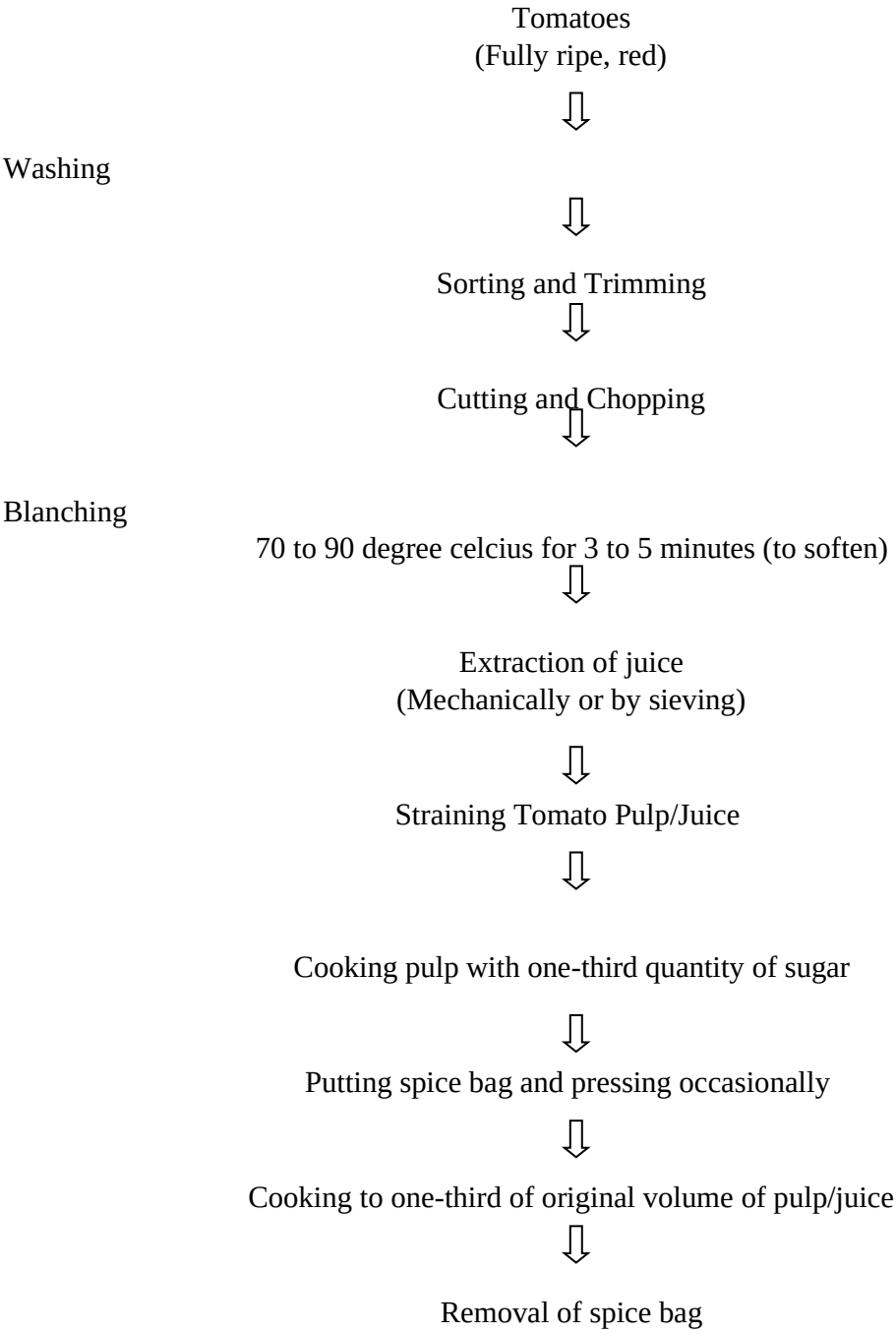
According to the report, currently, the market for tomato ketchups and sauces is anticipated to reach to more than INR 2000 crores. The major companies in this market are Swiss company Nestle with its brand Maggi, which holds a lion share of more than a third of share in the market, Hindustan Unilever Limited with its brand Kissan, that holds a share of more than a quarter of the market and G.D. Foods with Tops brand. These three companies together hold the market share of more than three-fourth of the total market of ketchup and sauces.

7. Tomato Ketchup Manufacturing Process

 Procurement of tomatoes.
 Firstly, washing of tomatoes and then sort the good quality tomatoes.
 After that put the chopped tomato into the twin pulper, which separate seeds, skins, and stems from the pulp.
 Cooking & add ingredients: Then the pulp is pumped into cooking tanks or kettles and heated to boiling. Foaming may occur if fresh tomato pulp is used, but can be corrected with anti-foaming compounds or compressed air. Precise amounts of sweeteners, vinegar, salt, spices, and flavourings are added to the tomato pulp. Most spices are added early in the cooking process.
 Finishing: Once the cooking is complete, the ketchup mixture passes through a finishing machine. Finishers remove excess fibre and particles through screens, creating a smoother consistency.
 Removing Air: The ketchup must be de-aerated to prevent discoloration and growth of bacteria. Excess air might also create unattractive air pockets and impede the closure process.
 Filling: To prevent contamination, the ketchup passes from the receiving tanks to the filling machines at a temperature not lower than 190°F (88°C). The containers are filled with the ketchup and immediately sealed to retain the freshness of the product.

 Cooling
 Labelling & Packaging

7.1. Process flowchart for Tomato Ketchup preparation is given below:



(after squeezing in pulp)

⇩

Addition of remaining sugar and salt

⇩

Cooking

⇩

Judging of end-point
(tomato solids by hand refractometer volume by measuring sick, (ie) one-third of its original volume)

⇩

Addition of vinegar / acetic acid and preservative

⇩

Filling hot in to bottles at about 88 degree celcius

⇩

Crown cooking

⇩

Pasteurization
(At 85 to 90 degree Celsius for 30 minutes)

⇩

Cooling

⇩

Storage at ambient temperature
(in cool and dry place)

8. FOOD SAFETY AND STANDARDS AND GUIDELINES

REGULATION 5.3.27 TOMATO KETCHUP AND TOMATO SAUCE

Tomato Ketchup and Tomato Sauce means the product prepared by blending tomato juice/Puree/Paste of appropriate concentration with nutritive sweeteners, salt, vinegar, spices and condiments and any other ingredients suitable to the product and heating to the required consistency. Tomato Paste may be used after dilution with water suitable for the purpose of maintaining the essential composition of the product. It shall meet the following requirements:-

S. No.	**Product**	**Total Soluble Solids (w/w)**
1.	Total Soluble solids (m/m) Salt free basis	Not less than 25.0 persent
2.	Acidity as acetic acid	Not less than 1.0 percent

The container shall be well filled with the product and shall occupy not less than 90.0 percent of the water capacity of the container, when packed in the rigid containers. The water capacity of the container/net weight of the container is the volume of distilled water at 20oC which the sealed container is capable of holding when completely filled.

The product may contain food additives permitted in FSSR 2011 regulations Appendix A & Appendix B - Tomato Ketchup

PRESERVATIVES	Benzoic Acid Sorbic Acid	750 ppm max. 1000 ppm max.

ACIDIFYING AGENTS	Acetic Acid Citric Acid Fumaric Acid Lactic Acid L-Tartaric Acid Malic Acid	GMP GMP 0.3% max. GMP GMP GMP
ANTIOXIDANT	Ascorbic Acid	GMP
THICKENING AGENT	Xanthan Gum Modified Starches Calcium Alginates	0.5% max. with declaration on the label GMP
MICROBIOLOGICAL REQUIREMENT	Mould count	Positive in not more than 60.00 percent of the field examined
	Yeast and spores Total plate count	Not more than 125 per 1/60 c.m.m Not more than 10000/ml

Technology Accessibility

IIFPT and its liaison offices at Guwahati and Bhatinda have all the technical knowhow on fruit and vegetable processing including tomato ketchup. These technologies are available through training, incubation and consultancy. The entrepreneur can first avail training or consultancy and then undergo business incubation before venturing into the business. Other than IIFPT, NIFTEM, CFTRI and other institutes also have the technical knowledge and training facilities.

9. Market Demand and Supply

The tomato based value added products such as puree, paste sauce and ketchup are extensively used in daily consumption pattern both in rural and urban India. Due to increasing standards of living in the cities and the rapid urbanization taking place in the rural areas, consumption of tomato based products is expected to go up steadily. A large part of the world tomato crop is processed into tomato paste/puree, which is subsequently used as an ingredient in many food products, mainly soups, sauces and ketchup. India has been exporting processed tomato in the form of tomato paste and ketchup. Tomato sauce is being used with snacks like rolls, cutlets, samosas, chops, soup, chowmin and other continental as well as chinese dishes. Bright mixture made from tomato is used as important items with all modern food/snacks. The only ketchup and sauce market in India is pegged at Rs 1,000 crore and growing at around 20% year-on-year. Therefore, there is a big market for the processed tomato products. Tomato products are one of the chief ingredients in ready-to-eat or fast food products. The major institutional customers of tomato paste are restaurants. At present, the market of ketchup/puree, especially in the urban areas, is dominated by brands likes MEGGI and KISSAN. However, the existing

market can still accommodate micro or small scale units on their own or under other's brand.

9.1. Marketing Strategy

The increasing urbanization and income offers huge scope for marketing of tomato based value added products. Urban organized platforms such as departmental stores, malls, super markets can be attractive platforms to sell well packaged and branded tomato ketchup and other products. Processors can also have tie-up with hotels and restaurants for supply.

Detailed Project Assumption

Table 3: Detailed Project Assumptions		
Parameter		**Value Assumed**
Capacity of the processing unit	:	150 MT/annum raw tomato
Utilization of Capacity	:	1st year implementation, 70% in 2nd year, 80%in 3rd year, and 90% in 4th year onwards.
Working days per year	:	300 days
Working hours per day	:	8-10 hrs.
Interest on term and working capital loan	:	12%
Repayment period	:	Seven years with one year grace period is considered.
Average prices of raw material	:	Rs. 20/Kg.
Average sale prices	:	Tomato Ketchup
Recovery rate	:	65% of final ketchup per kg tomato

10. Statistics:

10.1. Land & Building

The DPR is for FME scheme to upgrade/formalize existing micro enterprises which already has land &built-up area. However, they can invest to expand the built-up area (Table 4) as required **Table 4: Land and Civil Infrastructures**	
i. Land 10000 Sq ft	Assumed land already developed and has 6000 sq m built area. So additional 1000 sq ft can be built in @ Rs. 200/sq ft Rs. 2.00 Lakhs
ii. Built-up processing area 6000 sq ft	
iii. Storage area 1000 sq ft	
Total	Rs. 2.00 Lakhs

10.2. Machinery & Equipment: Rs. 18 Lakhs

S..No.	Descriptions	Power required	Area required (Sq.ft)	Qty	Amount (Rs.) in lakhs

1.	Tomatoes Washer Capacity : kg /hr	210V	16	1	1.50	**Table 5: Machineries and Equipmets**
2.	Blancher Capacity : 15 kg /hr	KW	10	1	1.50	
3.	Fruit Pulper Capacity : kg /hr	HP	25	1	2.00	
4.	Pasteuriser with Boiler Capacity : lt /hr	KW	25	1	5.00	
5.	Mixing Tank Capacity : 500 lt /hr	HP	25	1	1.00	
6.	Vacuum Pan/ Stem Kettle Capacity : 500 lt /hr	5 HP	25	1	5.00	
7.	Ketchup Packing Machine Capacity : 500 lt /hr	1 HP	10	1	2.00	

10.3. Utilities and Fittings

Table 6: Utilities and Fittings	
i. Power	Rs. 2.00 Lakhs
ii. Water	

10.4. Other Fixed Assets

Table 7: Other Fixed Assets	
i. Furniture and Fixtures	Rs. 1 Lakh
ii. Plastic trays capacity	
iii. Electrical fitting	

10.5. Pre-operative Expenses

Table 8: Pre-operative Expenses	
Legal expenses, start-up expenses, establishment cost, consultancy fee, trial runs & others	Rs. 67000
Total Pre-operative Expenses	**Rs. 67000**

10.6. Total Fixed Capital Investment

Total Fixed Capital Investment = (Land & Building + Machinery & Equipment+ Utilities and Fittings + Other Fixed Assets + Pre-operative Expenses) = Rs. (2+18+2+1+0.67) Lakhs = Rs. 23.67 Lakhs

10.7. Working Capital Requirement

Working capital is critical input in tomato ketchup processing unit as raw materials are seasonal and perishable thus need to maintain high inventories.

Table 9: Working Capital Requirement (Rs. In Laskh)				
Particulars	**Period**	**Year 2 (70%-105MT)**	**Year 3 (80%120MT)**	**Year 4 (90%-135MT)**
Raw material stock	7 days	0.49	0.56	0.63
Work in Progress	15 days	2.21	2.53	2.85
Packing material	15 days	0.34	0.39	0.44
Finished goods' stock	15 days	4.43	5.06	5.70
Receivables	30 days	8.86	10.12	11.40
Working expenses	30 days	1.00	1.14	1.28
Total current assets		17.33	19.8	22.3
Trade creditors		0	0	0
Working capital gap		17.33	19.8	22.3

Margin money (25%)		4.33	4.95	5.58
Bank finance		13.00	14.85	16.72

10.8. Total Project Cost and Means of Finance

Table 10: Total Project Cost and Means of Finance	
Particulars	**Amount**
i. Land and building	2.00
ii. Plant and machinery	18.00
iii. Utilities and Fittings	2.00
iv. Other Fixed assets	1.00
v. Pre-operative expenses	0.67
vi. Contingencies	2.00
vii. Working Capital margin	4.33
Total project cost (i to vii)	**30**
Means of finance	
i. Subsidy	10
ii. Promoter's contribution	6
iii. Term Loan	14

10.9. Manpower Requirement

Table 11: Manpower Requirement		
Particulars	**No. & Wage**	**Total Monthly Salary (Rs.)**
i. Manager (can be the owner)	1 @ Rs. 20000	20000
ii. Skilled worker	2 @ Rs. 10000	20000
iii. Semi skilled	2 @ Rs. 7500	15000
iv. Helper	1 @ Rs. 5000	5000
v. Sales man	1 @ Rs. 7500	7500
Total	**7 person**	**Rs. 67500/- per month**

Note: Manager, two skilled workers are permanent staffs only (Salary Rs. 40000/month). Others are causal staffs

10.10. Repayment Schedule

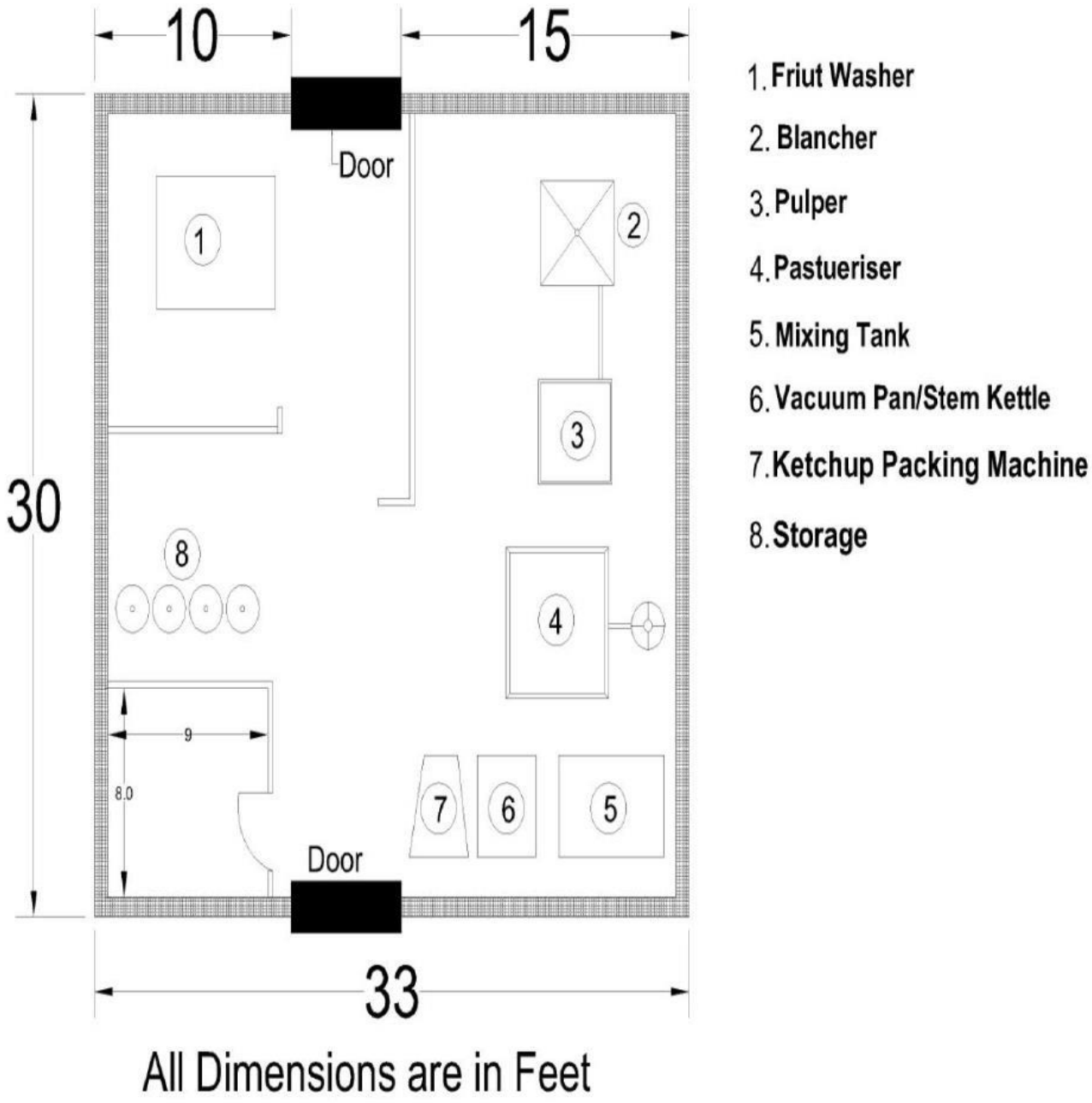
Table 12: Repayment Schedule									
Year	Outstanding loan at start of yr.	Disbursement	Total outstanding loan	Surplus for repayment	Interest payment	Repayment of principal	Total outgo	o/s loan at the end of the yr.	Balance Left
1	0	14	14	-3.20	1.68	0	1.68	14	-4.88
2	14		14	30.14	1.68	2	3.68	12	26.46
3	12		12	35.49	1.44	2	3.44	10	32.05
4	10		10	40.85	1.20	2	3.20	8	37.65

5	8		8	40.78	0.96	2	2.96	6	37.82
6	6		6	40.71	0.72	2	2.72	4	37.99
7	4		4	40.64	0.48	2	2.48	2	38.16
8	2		2	40.58	0.24	2	2.24		38.34

10.11. Financial Assessment of the Project

Table 13: Benefit Cost Ratio (BCR) and Net Present Worth (NPW)										
SI.	**Particulars**	**1st Yr**	**2nd Yr**	**3rd Yr**	**4th Yr**	**5th Yr**	**6th Yr**	**7th Yr**	**8th Yr**	
i.	Capital cost (Rs. In lakh)	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
ii.	Recurring cost (Rs. In lakh)	3.20	51.18	57.02	62.84	62.84	62.84	62.84	62.84	
iii.	Total cost (Rs. In lakh)	32.20	3.2	51.18	57.02	62.84	62.84	62.84	62.84	394.96
iv.	Benefit (Rs. In lakh)	0.00	88.72	101.40	114.07	114.07	114.07	114.07	114.07	
v.	Total Depreciated value of all assets (Rs. In lakh)								9.36	
vi.	Total benefits (Rs. In lakhs)	0.00	88.72	101.40	114.07	114.07	114.07	114.07	114.07	769.83
	Benefit-Cost Ratio (BCR): 1.95 (Highly Profitable Project) Net Present Worth (NPW): 374.87									

Plant Layout



Machinery Suppliers :

The entrepreneur must provide tentative supplier list and quotations with respect to his project However; there are many machinery suppliers available within India for tomato processing machineries and equipments. Some of the suppliers are:
i. Shiva Engineers, Pune, Maharashtra ii. Jwala Techno Engineering Pvt. Ltd. Thane, Maharashtra iii. Zigma Machinery and Equipments Solutions, Coimbatore,

Tamil Nadu iv. Sagar Engineering Works. Sindhudurga, India v. Jupiter Scientific Company, Salem, India vi. M/s Sri Bramha Industries, Trichy, Vii. India Guru Engineers, Pune, Maharashtra

SWOT analysis of Tomato Ketchup:

1. **S-Strength:**

    - Raw material & manpower availability
    - Day by day tomato ketchup selling is increasing
    - Innovative (New tastes)
    - Export growing in market day by day
    - Off season availability of tomato products

2. **W-Weakness:**

    - High cost equipment
    - Brand acknowledgment
    - Nutritional affect

3. **O-Opportunities :**

    - High export market potential
    - Demand in foreign country

4. **T-Threats:**
    - High capital investment
    - High power
    - The same products are also available in the market
    - Competition with global giants
    - High supply chain cost

Forecasting:

Global marketing forecasting used a modeling approach such as statistical techniques and forecasting, both techniques are being used to estimate and forecast market data. Each regional market is evaluated separately.

Drivers of growth of agricultural marketing in India:

1. Technological changes in agriculture:

Technological developments in agriculture, such as the evolution of high yielding varieties of seeds, increased use of modern inputs and cultivation practices in the agricultural sector, have resulted in substantial increase in farm production. The marketed surplus of agriculture produce has resulted into the growth on the marketing system.

2. Specialization:

The tendency towards increasing specialization by farmers and regions in certain crops or livestock has resulted an increase in their efficiency and the breakdown in the self-sufficiency of the family unit. Specialization thus has resulted in increased production production, which is the base for the growth of marketing and, in turn, of the economy. This has also resulted in improved use efficiency of natural resourses like land and water.

3. Urbanization:

Urban people are the main buyers of agricultural surpluses. The urban population of India has increase significantly which necessitated a faster growth of agriculture marketing activities. The rate of growth of urban population is much higher than rural population (due to rural – urban migration) which has further increased the importance of marketing system for farm products.

4. Transportation and communication:

The increase in transportation and communication facilities has widened the market for farm products. The length and breadth of the market to which a product is taken from the production areas have increased. In the absence of these facilities, the movement of produce from one area to another was limited, and the consumption of a product was restricted only to the areas of production or , at the most, to nearby areas. The scope of marketing has, thus increased manifold.

Factors limiting market growth:

The following are some of the factors which put a limit on the growth of a business:

1. Shortage of Lobour or capital:

If increased suppliers of trained labour are not available the growth of a business will be automatically checked.

In the same way, if fresh capital cannot be raised, expansion stops. But these are not insurmountable obstacles.

If the business prospects are very bright and if the entrepreneur is a man of established reputation, he will be able to cross these hurdles.

2. Nature of the market:

If demand is limited or fluctuating, it will be imprudent to increase the size of business. The nature of demand is most important limiting factor. It most settles the matter. If individual's tastes have to be satisfied, large scale production is ruled out.

3. Managerial Capacity:

Another serious limitation comes from the capacity of the manager. A point is reached in the expansion of a business beyond which it is not possible foe the manager to control it efficiently. There is a limit to what a man can successfully manage. Beyond the point, supervision will become lax. Materials will be wasted and machinery mishandled. Cost will overtake profits and , in the end, the profits may vanish. The limit is reached when the marginal revenue is equal to the marginal cost.

Key highlights:

Ketchup, also known as catsup, ketchup, red sauce, and tomato sauce, is a sauce used as a condiment. Originally, recipes used egg whites, mushrooms, oysters, grapes, mussels, or walnuts, among other ingredients, but now the unmodified term usually refers to tomato Ketchup.

Health benefits:

Health benefits of tomato include eye sight, good gut health, low hypertension, diabetes, skin problems and urinary tract infections. Tomato is considered both a fruit and vegetable and forms an integral part of the cuisine all across the globe especially in the Mediterranean region. Daily consumption of tomato provides a great boost to health apart from improving the flavor of food.

Required equipment:

- Rotary Fruit & vegetable washng machine
- Sorting/ inspection conveyor
- Screw fedder
- Fruit Mill Crusher
- Hopper tyre pump
- Twin pulper
- Pulpr
- Steam Jacketted Kettle
- Steam Jacketted Kettle
- Transfer pump
- Homogenizer
- Overhead filling tank
- Baby steam Boiler
- Rotary Bottle Washer
- Double head Penumatic Filler
- Crown corking Machine
- Steam boiler

Induction sealer