

PM Formalization of Micro Food Processing Enterprises Scheme

DETAILED PROJECT REPORT FOR TAMARIND SAUCE PROCESSING



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Contents

Sr. No.	Topic	Page
	The Project at a Glance	3
1	General Overview of Tamarind production, Clusters, PHM and value addition in India	
	1.1 Introduction	4
	1.2 Origin, Distribution and Production of Tamarind	5
	1.3 Varieties	7
	1.4 Health benefits and Nutritional Importance	8
	1.5 Cultivation, Bearing & Post-Harvest Managements	12
	1.6 Processing and Value Addition in India	14
2	Model tamarind sauce processing under FME Scheme	
	2.1 Location of Proposed project and land	18
	2.2 Installed capacity of tamarind sauce processing plant	18
	2.3 Raw Material requirement for The Unit	18
	2.4 Manufacturing Process	19
	2.5 Market Demand & supply for tamarind sauce	22
	2.6 Marketing strategy for Tamarind products	23
	2.7 Detailed Project Assumptions	23
	2.8 Fixed capital Investments	
	2.8.1 Plants and Machinery	24
	2.8.2 Other Costs	25
	2.9 Working Capital Requirements	26
	2.10 Total Project Cost & means of finances	27
	2.11 Manpower Requirements	27
	2.12 Expenditure, Revenue and Profitability Analysis	28
	2.13 Repayment Schedule	29
	2.14 Assets depreciation	30
	2.15 Financial Assessment of project	31
	2.16 Break even analysis	32
	2.17 Pie chart	34
	2.18 Plant Layout	35
	2.19 Machinery suppliers	35
3	Limitations of Model DPR & Guidelines for Entrepreneurs	
	3.1 Limitations of Model DPR	36
	3.2 Guidelines for Entrepreneurs	36

Project At a Glance

1	Name of the Project	Tamarind sauce
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 partnership)	
7	No of shareholders (if company/FPC)	
8	Technical advisor	
9	Marketing advisor/partners	
10	Proposed project capacity	150 MT/annum (55, 65, 75,90 & 100% capacity utilization in the 2nd, 3 rd , 4 th , 5 th & 6 th years' onwards respectively
11	Raw materials	Tamarind
12	Major product outputs	Tamarind sauce
13	Total project cost (Lakhs)	17.65
	Land development, building & civil construction	4
	Machinery and equipment	4.73
	Utilities (Power & water facilities)	0.8
	Miscellaneous fixed assets	0.9
	Pre-operative expenses	0.90
	Contingencies	1.20
	Working capital margin	5.12
14	Working capital Management (In Lakhs)	
	Second Year	15.37
	Third Year	18.17
	Fourth Year	24.77
15	Means of Finance	
	Subsidy grant by MoFPI (max 10 lakhs)	9.88
	Promoter's contribution (min 20%)	3.53
	Term loan (45%)	4.23
16	Debt-equity ratio	1.2 : 1
17	Profit after Depreciation, Interest & Tax	
	2nd year	25.84
	3rd year	31.92
	4th year	37.99
18	Average DSCR	2.16
	Benefit Cost Ratio	1.92
	Term Loan Payment	7 Years with 1 year grace period
	Pay Back Period for investment	2 Years

Note: All the data/contents of this DPR are taken from the available information on IIFPT site.

1 GENERAL OVERVIEW OF TAMARIND PRODUCTION, CLUSTERS, POST-HARVEST MANAGEMENT AND VALUE ADDITION IN INDIA

1.1 INTRODUCTION

Tamarind (*Tamarindus indica*) is a leguminous tree (family Fabaceae) bearing edible fruit that is indigenous to tropical Africa. The genus *Tamarindus* is monotypic, meaning that it contains only this species.

The tamarind tree produces brown, pod-like fruits that contain a sweet, tangy pulp, which is used in cuisines around the world. The pulp is also used in traditional medicine and as a metal polish. The tree's wood can be used for woodworking and tamarind seed oil can be extracted from the seeds. Tamarind's tender young leaves are used in Indian cuisine. Because tamarind has multiple uses, it is cultivated around the world in tropical and subtropical zones.

Tamarind pulp is used in numerous culinary preparations; the usage in daily cooking is more prevalent in Southern part of India. It is also a raw material for the preparation of wine like beverages. The tamarind kernel powder is found to be extensively used for its sizing properties, in textile, confectionary, cosmetics and pharmaceutical industries. The testa is used in dyeing and tanning industry. The tender leaves and flowers are used as vegetables. In medicine, it is used as appetizing, laxative, healing and anti-helminthic.

It is also used against fluorosis. Fruit pulp used as snack, preservative, and to prepare several culinary dishes, chutney, tamarind juice concentrate, pulp powder, pectin, jams, syrups, candy, and for making souring porridge, tartaric acid,

alcohol, summer refreshing drink, seasoning, and flavoring. The ripe fruit of tamarind tree is used as a condiment. It is a moderate size to large, evergreen tree, up to 24 metres high and 7 metres in girth. Bark is brown or dark gray, longitudinally and horizontally fissured. Leaves are paripinnate up to 15 cm long, leaflets are 10-20 pairs, oblong, 8-30 mm. Flowers are small, yellowish with pink stripes, pods are 7.5-20 cm long, 2.5 cm broad, 1 cm thick, more or less constricted between seeds, slightly curved, brownish coloured. Seeds are 3-12 oblong compressed, 1.5 cm, dark brown shining. Endocarp is light brownish, sweetish or acidic, edible pulp, traversed by branched ligneous strands. The outer cover of the pod is fragile and easily separable.

1.2 ORIGIN, DISTRIBUTION AND PRODUCTION OF TAMARIND

Tamarind is botanically known as *Tamarindus indica* L. and belongs to the family Leguminaceas (Caesalpiaceae). Tamarind however originated from dry savanna region of tropical Africa. India is the largest producer of tamarind fruits, and one of the only nations growing tamarinds on a commercial scale. No oversight body makes it difficult to know precise figures of production. In southern part of India, tamarind is a basic ingredient in diet and different recipes. In India it is known as Imli. The word tamarind is originated from the Arabic word ‘Tamar-u’l-Hind’ because the dark brown pulp of the fruit was thought to resemble dried dates. It was therefore called the Tamere-hindi or ‘Date of India. It is called Indian date because of the colour of its dry pulp. In Indian state of Tamil Nadu, it is being extensively cultivated in Dharmapuri, Morappur, Krishnagiri, Anjatti and Hosur areas. It is widely cultivated in Karnataka, Madhya Pradesh, Andhra Pradesh and Telangana as well. In India it is rarely cultivated and majority of the trees are grown in the backyard and homestead. Tamarind production on a micro level is a bit of an oddity in India—few in the villages gather tamarinds because they’re likely the low priced, low-demand sour variety. Furthermore, the disorganized nature of the market makes it difficult to effectively price and distribute tamarinds outside of the villages.

As stated by the spice board of India, the tamarind area was 74.20 (000' ha), production was 309.44 (000' MT) and the productivity was 4.0 (MT/ha) in 2017-18. India is the chief producer and consumer of tamarind in the world. It is estimated that, India produces about 3,00,000 MT of fruits and export tamarind products, worth about Rs.50.0 Crores per annum. About 258.70 (000'MT) to 272.85 (000'MT) of tamarind is allotted for value addition products to processed and lot of labor is engaged in this processing in India. Even though, traditional processing is widespread, its commercial uses are unknown and underdeveloped.

Area and production of Tamarind in India

S. No	States/UTs	2014-15		2015-16		2016-17 (Provisional)	
		A	P	A	P	A	P
1	Karnataka	16.80	87.00	14.90	72.15	15.00	70.50
2	Tamil Nadu	15.65	48.81	15.91	49.66	15.40	48.10
3	Kerala	11.24	37.30	11.24	37.30	11.00	38.30
4	Andhra Pradesh	4.58	11.45	4.83	11.10	4.80	13.90
5	Telangana	0.44	5.32	0.24	12.49	2.00	12.50
6	Maharashtra	5.70	11.40	5.70	11.40	0.70	7.20
7	Mizoram	0.01	0.03	0.01	0.03		
8	Others	0.06	0.35	0.06	0.28	0.10	0.30
	Total	54.48	201.66	52.89	194.41	49.00	190.80

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

State-wise productivity

S.No.	States/UTs	2014-15	2015-16	2016-17 (Provisional)
1	Maharashtra	2.00	2.00	10.29
2	Telangana	12.09	52.04	6.25
3	Karnataka	5.18	4.84	4.70
4	Kerala	3.32	3.32	3.48
5	Tamil Nadu	3.12	3.12	3.12
6	Andhra Pradesh	2.50	2.30	2.90
7	Mizoram	3.00	3.00	Not available
8	Others	5.83	4.67	3.00
	Total	3.70	3.68	3.89

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

1.3 VARIETIES

In India basically most cultivated trees are sexually propagated and are not uniform. Hardly there is any big orchard of tamarind. Some varieties of tamarind grown in India are:

1. PKM-1:

It's a clonal selection of any seedling type. It usually fruits early and yields about 263 kg pods per year per tree.

2. Urigam:

Pod size is long with sweet pulp.

3. Pratisthan:

Variety is developed from Maharashtra with acidic-sweet pulp.

4. Yogeshwari:

The variety is high yielding type with red coloured pulp.

5. Raktichinch:

absolute red coloured pulped fruit.

6. Makhanwaan, Secthong, Manila sweet:

Sweet varieties

7. Cumbum:

High yielding variety.

8. Jagdish:

Sweet sour high yielding variety from Maharashtra

9. DTS I and DTS II:

High yielding regular varieties released from Dharwad, Karnataka.

10. Goma Prateek:

This variety is released from CIAH which have short juvenile period of 3-4 years.

1.4 HEALTH BENEFITS AND NUTRITIONAL INFORMATION

Tamarind is an enormous source of nutrients and medicinal property. Tamarind is a prominent source of dietary antioxidants and abundant in total phenolics.

Nutritional value:

Constituent	Dry pulp (range in %)	Raw fruit (%)
Energy (from 100g)	115-216 kcal	239 kcal
Moisture	15-30	-
Proteins	2 to 9.10	2.8
Fats/oil/lipids, crude	0.5 to 3.10	0.6
Carbohydrates, total	56.7 to 82.6	62.5
Invert sugar	-	30-41
Fibre, crude	2.2 to 18.3	5.1
Cholesterol	0	0
Tartaric acid, total	56.7 to 82.6	8-23.8
Reducing sugars	25-45	-
Total ash	2.10-3.3	-
Pectin	2-4	> 4
Cellulosic residue	19.40	-
Albuminoids	3-4	-
Total available carbohydrates	41.77	-
Alcohol insoluble sugars	22.7	-
Water insoluble sugars	20.50	-
Non-reducing sugars	16.52	-
Total sugars	41.20 to 58.7	-
Starch	5.7	> 6
Tannin (mg)	600	-
Ascorbic acid (mg)	3 to 9	0.7 to 3.5
Vitamin A (IU)	15	30,000

Beta carotene equivalent (µg)	10-60	18
Thiamine (mg)	0.18 to 0.22	0.43
Riboflavin (mg)	0.07-0.09	-
Vitamin E (mg)		0.1
Vitamin K (µg)		2.8
Niacin (mg)	0.6 to 0.7	1.94
Folates (µg)	-	14
Pantothenic acid (mg)	-	0.14
Pyridoxine (mg)	-	0.07
Sodium (mg)	24	28
Potassium (mg)	116 to 375	628
Calcium (mg)	35 to 170	74
Copper (mg)	21.8	0.86
Iron (mg)	1.3 to 10.9	2.8
Magnesium (mg)	72	92
Phosphorous (mg)	54 to 160	113
Selenium (µg)		1.3
Zinc(mg)	1.1	0.10

CONSTITUENTS AND HEALTH BENEFITS OF TAMARIND

Various plant parts of tamarind including seed and leaves are highly nutritious, though fruit pulp is the prime part of this review. The biochemical components of medicinal value and phytochemicals of a preservative role controlling various human or animal infections or diseases are summarized below

Health benefits:

1. Tamarind fruit is anti-helminthic (expels worms), antimicrobial, antiseptic, antiviral, sunscreen and astringent and to promote wound healing, asthma, bacterial skin infections, boils, chest pain, cholesterol metabolism disorders, colds, colic, conjunctivitis, constipation (chronic or acute), diabetes, diarrhea, dry eyes, dysentery, eye inflammation, fever, gallbladder disorders, gastrointestinal disorders, gingivitis, hemorrhoids, indigestion, jaundice, keratitis, leprosy, liver disorders, iron deficiency, nausea and vomiting (pregnancy related- generally eat raw unripe sour fruits), saliva production, skin disinfection/ sterilization, sore throat, sores, sprains, swelling (joints) and urinary stones.

2. Fruit pulp is used as cooling agent during fever, as pain reliever, to protect skin damage from Sun's ultraviolet rays, muscle relaxation via calcium channel blockage, decreases plasma fluoride concentration and reduces fluoride induced liver and kidney damages, regulatory effect on neutrophils due to presence of polyphenols to treat bile disorders and constipation. Tamarind fruit extract is an effective drinking water cleaning agent for fluorine, nickel and lead toxicities. Fruit pulp is laxative and carminative and its extract is antimicrobial in action for many secondary bacterial infections of human. The purified xyloglucan from tamarind were in use for eye surgery and fruit extracts enhancing bioavailability of ibuprofen as a promising achievement in medical history.

3. A raw or partially ripe fruit is used as an anti-scorbutic, heal inflammations, to treat asthma, cough, sore throat by hydrolysis of phospholipids, due to the presence of polyphenols and flavonoids.

4. Antibacterial activity was observed against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella paratyphi*, *Salmonella typhi*, *Bacillus subtilis*, *Burkholderia pseudomallei*, *Klebsiella pneumonia* due to presence of lupeol content. Potential antifungal activity was observed against *Aspergillus niger*, *Candida albicans*. The fungicidal activity observed was mainly due to the brown odorless liquid bitter principle ‘tamarindienal’, identified as 5-hydroxy 2-oxo-hexa3,5-dienal identified in the tamarind pulp. Extracts from tamarind fruit pulp showing anti-malarial and molluscicidal activity against *Bulinus truncatus* snails due to the activity of saponins.

1.5 CULTIVATION, BEARING & POST HARVEST MANAGEMENT:-

Tamarind is a perennial herb with subterranean rhizomes and 50-140 aerial leafy shoots. Each shoot has height of 1.7 to 2.6 mtr and possess 9 to 13 leaves in each tiller. Leaves are glabrous on both sides with a prominent mid-rib. Inflorescence is a condensed spike with yellowish perianth. Each spike has 10-15 fruits. Fruit is round or oval shape, capsule with reddish brown colour. Each capsule is trilocular with many seeds.

Cultivation and Bearing:-

Tamarind requires semi-arid, tropical conditions in which to grow. States and regions growing the fruit include Bihar, Orissa, Karnataka, Andhra Pradesh, Madhya Pradesh, Kerala, Uttar Pradesh, Maharashtra, Tamil Nadu, and the lower Himalayas. India is the largest producer of fruits, and one of the only nations growing tamarinds on a commercial scale. Often in competition with Thailand, India exports some of its production ships to the US, Europe, and other parts of Western Asia. Only a fraction of the yearly tamarind yield gets distributed as fresh fruit; most of it goes to plants to

make ready-made pulp; a key ingredient in several Indian chutneys and curries. Tamarind production on a micro level is a bit of an oddity in India—few in the villages gather tamarinds because they're likely the low-priced, low-demand sour variety. Furthermore, the disorganized nature of the market makes it difficult to effectively price and distribute tamarinds outside of the villages. Tamarind season depends on the region. The south gets tamarinds first and the season slowly extends to the north. Karnataka and Andhra Pradesh yield tamarinds in January; Maharashtra in February; and northern states like Madhya Pradesh and Uttar Pradesh in late February.

HARVESTING

Tamarinds may be left on the tree for as long as 6 months after maturity so that the moisture content will be reduced to 20% or lower. Fruits for immediate processing are often harvested by pulling the pod away from the stalk which is left with the long, longitudinal fibers attached. In India, harvesters may merely shake the branches to cause mature fruits to fall and they leave the remainder to fall naturally when ripe. Pickers are not allowed to knock the fruits off with poles as this would damage developing leaves and flowers. To keep the fruit intact for marketing fresh, the stalks must be clipped from the branches so as not to damage the shell.

YIELD

A mature tree may annually produce 330 to 500 lbs (150-225 kg) of fruits, of which the pulp may constitute 30 to 55%, the shells and fiber, 11 to 30 %, and the seeds, 33 to 40%.

POST-HARVEST MANAGEMENT

After harvest pods are spread on ground and cut for 6-7 days. The shell and seeds as well as the fibrous material are removed and the pulp is collected, the pulp can be

stored for a period of 6-12 months after properly drying in the sun. Many times trees or entire plantation is auctioned to the traders who manage harvesting as well as marketing. To preserve tamarinds for future use, they may be merely shelled, layered with sugar in boxes or pressed into tight balls and covered with cloth and kept in a cool, dry place. For shipment to processors, tamarinds may be shelled, layered with sugar in barrels and covered with boiling syrup. East Indians shell the fruits and sprinkle them lightly with salt as a preservative. In Java, the salted pulp is rolled into balls, steamed and sun-dried, then exposed to dew for a week before being packed in stone jars. In India, the pulp, with or without seeds and fibers may be mixed with salt (10%), pounded into blocks, wrapped in palm leaf matting, and packed in burlap sacks for marketing. To store for long periods, the blocks of pulp may be first steamed or sundried for several days.

1.6 PROCESSING & VALUE ADDITION:-

Tamarind pulp is used in numerous culinary preparations; the usage in daily cooking is more prevalent in Southern part of India. It is also a raw material for the preparation of wine like beverages. The tamarind kernel powder is found to be extensively used for its sizing properties, in textile, confectionary, cosmetics and pharmaceutical industries. The testa is used in dyeing and tanning industry. The tender leaves and flowers are used as vegetables. In medicine, it is used as appetizing, laxative, healing and anti-helminthic. It is also used against fluorosis. Fruit pulp used as snack, preservative, and to prepare several culinary dishes, chutney, tamarind juice concentrate, pulp powder, pectin, jams, syrups, candy, and for making souring porridge, tartaric acid, alcohol, summer refreshing drink, seasoning, and flavoring. The ripe fruit of tamarind tree is used as a condiment. It is a moderate size to large, evergreen tree, up to 24 metres high and 7 metres in girth. Bark is brown or dark gray, longitudinally and horizontally fissured. Leaves are paripinnate up to 15 cm long, leaflets are 10-20 pairs, oblong, 8-30 mm. Flowers are small, yellowish with pink stripes, pods are 7.5-20 cm long, 2.5 cm

broad, 1 cm thick, more or less constricted between seeds, slightly curved, brownish coloured. Seeds are 3-12 oblong compressed, 1.5 cm, dark brown shining. Endocarp is light brownish, sweetish or acidic, edible pulp, traversed by branched ligneous strands. The outer cover of the pod is fragile and easily separable

Tamarind is an enormous source of nutrients and medicinal property. Tamarind proves out to be a prominent source of dietary antioxidants and abundant in total phenolic. This is the reason why it can be widely used for domestic and industrial purposes. The shelf life of tamarind is as low as 1 month and hence it can be preserved by optimum processing and value addition. The value-added products include concentrated pulp, juice, concentrate, powder, pickles and paste.

Jellose:

Jellose is incomplete pectin which is extracted from tamarind seed devoid of galacturonic acid. Jellose is prepared by adding huge amount of concentrated tamarind kernel powder to boiling water. Then citric and tartaric acid is added to it at a concentration of 0.2% each. It is stirred in boiling water for 30-40 minutes. The solution is kept over-night and filtered properly. The paste thus formed is dried in drum drier. The mixtures thus formed have 5% viscosity and is slightly thicker than corn starch. The product thus formed is an important ingredient and can replace corn starch industrially.

Tamarind kernel powder (TKP):

White coloured tamarind kernel is obtained by crushing tamarind seed and extracting white coloured kernel. The paste prepared from TKP is a good adhesive. After being boiled with water. The defatted TKP have a good shelf life and does not become rancid after contact with air.

Dried fruit block:

Tamarind has a considerable amount of weight in its shell. Tamarind export and long-distance transport need convenience which is attained by creating tamarind fruit bars / blocks of large size. Either seeded or deseeded tamarind pulp is dried and compressed for commercial transport to distant places. The resultant fruit block is usually sold per kg or per quintal rate in distant places.

Toffees and Candies:

Tamarind candy is one of the most liked products by consumers because of its natural sour-sweet blend. Candies are prepared after boiling tamarind pulp with sufficient amount of sugar and cooking it with very less amount of water.

Puree or Paste:

Tamarind puree/ paste is prepared after separating seeds and fibres from tamarind pulp by using little amount of water coupled with little heating. The paste thus prepared has a TSS of more than 68°B.

Tamarind Sauce:

Tamarind sauce is prepared by boiling tamarind pulp in sufficient sugar and acid. Tamarind sauce is brownish-black coloured and is of delicious texture.

Tamarind jam:

Tamarind jam is prepared by boiling tamarind pulp with sufficient amount of sugar for 10 minutes. The seeds are separated and sufficient amount of sugar is ensured so as to maintain sugar-acid-pectin ratio. The jam prepared from tamarind has a shelf life of up to 9-12 months.

Tamarind pulp powder (TPP):

Tamarind pulp powder is prepared after drying and dehydrating the pulp. TPP is known to be dense enough to hold a TSS of 18.6-25.0°B and acidity of 8.7-11%. The TPP produces an excellent beverage after mixing with water and contain a perfect acidity and

sour-sweet blend. TPP is also prepared by dehydrating puree and extracting fine powder for use as chief acidulant. TPP is a natural resource of tartaric acid of 8-18 per cent, starch, minerals like calcium and potassium [35].

Tamarind Pickle:

Tamarind pickle is prepared from matured and ripened fruit without its shells, fibres and seed. Tamarind pickle is prepared by mixture of spices and salt. The pickles thus prepared have a life of 1-1.2 years. The pickle has a hot spicy sour sweet taste. Fruits are harvested and pulp is extracted.

Tamarind chutney:

Tamarind chutney is a low duration processed product which is prepared from green immature fruits. The fruits have sufficient nutrient and is rich in antioxidants. Generally, tamarind chutney is cooked with spices and salts and is consumed with south Indian dishes like idly and dosa.

Fruit juice concentrate:

Fruit juice concentrate is prepared by squeezing the ripe fruits after soaking in water and removing fibrous material. It is a dense juice which has its own preservative property.

Tamarind beverage:

It is diluted form of tamarind fruit concentrate. Tamarind pulp is extracted from seeds, fibres and shell and around 1 litre water is mixed with 1.5-2.0 g tamarind pulp. Spices like ginger, clove and pepper is added to it. Slight amount of sugar is also added to it. The mixture is stirred properly and is separated with a muslin cloth. The juice thus prepared can be stored up to 2-3 months in sterilized bottles after pasteurization at 95°C for 8-10 minutes. The nutritional quality is not hampered in this method.

2. MODEL TAMARIND SAUCE PROCESSING UNDER FME SCHEME

2.1 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 major tamarind growing regions in India are Karnataka, Madhya Pradesh, Andhra Pradesh, Maharashtra, Tamil Nadu, Kerala, Mizoram and Telangana as well.

2.2 INSTALLED CAPACITY OF THE TAMARIND SAUCE PROCESSING UNIT

The maximum installed capacity of the tamarind sauce manufacturing unit in the present model project is proposed as **150** tonns/annum or **500 kg/day** tamarind sauce. 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 55 percent capacity, 3rd year 65 percent capacity, 4th year 75 percent capacity, 5th year 90 percent capacity & 6th year onwards 100 percent capacity utilization is assumed in this model project.

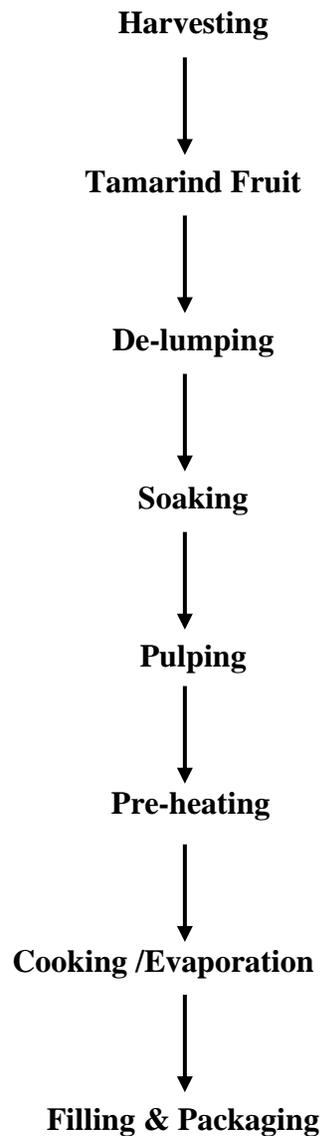
2.3 RAW MATERIAL REQUIREMENTS FOR THE UNIT

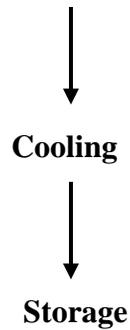
A sustainable food processing unit must ensure maximum capacity utilization and thus requires an operation of minimum 280-300 days per year to get reasonable profit. Therefore, ensuring uninterrupted raw materials supply requires maintenance of adequate raw material inventory. The processor must have linkage with producer organizations preferably FPCs through legal contract to get adequate quantity and quality of raw materials which otherwise get spoiled. In the Tamarind sauce manufacturing project, the

unit requires **137.5 kg/day, 162.5 kg/day, 187.5 kg/day, 225 Kg/day & 250 kg/day** Tamarind at 55, 65, 75, 90 & 100 percent capacity utilization, respectively.

2.4 MANUFACTURING PROCESS OF THE TAMARIND SAUCE

Flow chart for tamarind sauce:





Fruit Selection

Fresh mature but unripe tamarind fruits are usually selected and fruits that are ripe, over-ripe, infected or damaged are to be discarded. The fruits are rinsed well in clean water. The pods are cracked by hand and pulp separated from the broken shells. The fibers are peeled and removed; shell pieces and seeds are also removed from the pulp.

De-lumping and soaking

The Tamarind is de-lumped manually for proper soaking. Then the tamarind is soaked for 3-4 hr at 55°C in 1000 litre capacity tanks. Water is used in the ratio of 1:2.

Pulping

Pulp extraction process involves 3 stages of operations as follows

- a. De-stoner is used for removing seeds and large size fibers & extracting pulp from soaked tamarind. It has 6mm sieve size
- b. Pulper (with 2mm sieve size) - In pulper, there is rotating body, below it there is a sieve of size 2mm; the particle which have lesser than 3mm penetrates through the filter. The remaining unwanted waste such as seed, fibre and skin are separated automatically.
- c. Finisher/ refiner - The Finisher is similar to pulper but there is a sieve of 1mm.

Pre-heating

The pulp is heated by indirect contact of steam at 85+/-2 °C. Pre-heating process also pasteurizes the pulp by inactivating bacterial activity. Tubular heat exchanger is

particularly suited to the thermal treatment of products with a high viscosity range as well as products containing solids, pulps or fibrous products

Cooking/ Evaporation

Evaporation of the pulp along with other ingredients is preferably done in large open pan, in low heat. An open pan is best as it allows moisture to evaporate more quickly. Sugar should be added and heat should be low to dissolve it, before increasing the heat to boil the mixture. The pulp is then mixed with other ingredients and continuous stirring/ scraping should be done. The end stage of boiling – using a refractometer and the desired end stage for sauce/ puree is 25° brix.

Sugar, salt and spices are the additives used in tamarind sauce making. Sugar is added at the rate of 1 kg per kg pulp, while salt is usually at the level of 30g per kg pulp.

Spice usage can be a customised formula. This needs to be standardized. Spices used should be clean and in good condition. Some need to be roasted before use. The common spices used are Cumin, Cloves, Mace, Black pepper, Cinnamon, dry ginger powder, red chilli powder, etc. A basic standard spice mix includes red chilli powder, roasted cumin powder and dry ginger powder.

Preservative such as Sodium Benzoate and Pottassium metabisulphite can be added to sauces to help preserve the products after the bottle has been opened.

Filling & Packaging

If glass jars are used for packaging, then they need to be hot-filled with the sauce. If the glass jars are cold, there is the risk of breaking when the hot liquid is added. Glass jars with screw-on lids are preferable. Alternatively plastic jars covered with foil lids can also be used or the sauce can be cooled and filled into polyethylene bags or pouches which are heat sealed.

The containers must be sterilized properly to avoid spoilage due to microbial contamination. Glass bottles need to be sterilized using boiling water and PET containers using chlorinated water.

Pasteurization

This step is optional and is done only for glass containers. This can ensure/ enhance the shelf life of the packed sauce. The glass containers are placed in a water bath that is at the same temperature as the bottles. The water must cover the jars. Then the bottles are pasteurized in boiling water for 45 minutes from the time that the water starts to boil. Then the bottles are removed the water bath from the heat and are gradually cooled by adding cold water to slowly cool the water bath. The bottles may also be cooled by leaving in the water bath until the following day. Then they are dried and labeled.

2.5 MARKET DEMAND AND SUPPLY FOR TAMARIND SAUCE

Currently, India is the major producer of Tamarind. The production in India is concentrated in the drier south Indian states and the produce is collected by the villagers and sold in the open market. Since ancient times, India has been exporting processed tamarind pulp to the western countries, mainly Europe and the Arab countries and the United States of America. India is the only country to produce tamarind as fruit of commercial crop. It has been marketed widely about 5.50 million tonnes within the country and about 70,000 tonnes exports annually. India is the world's top producer, exporting several thousands of tonnes of seed, seed powder and fruit pulp each year. Tamarind, which comes under the fruit category in the US, is largely cultivated in Karnataka, Tamil Nadu and Kerala.

Tamarind has potential to grow even in barren lands. Tamarind can grow, flower and fruit profusely even as an avenue tree. It is a major crop for agro-

forestry system in India. The tree has a very big life span and hence can be very economical once planted. Tartaric acid is the main constituent which serves as an acidulant and hence utilized in preparation of various Indian dishes. The best part of the fruit tree is that it can grow and sustain even in harsh semi-arid climate. It can grow in barren land as well.

2.6 MARKETING STRATEGY FOR TAMARIND SAUCE

The increasing urbanization and income offers huge scope for marketing of minor forest fruit based products. Urban organized platforms such as departmental stores, malls, super markets can be attractive platforms to sell well packaged and branded tamarind products.

2.7 DETAILED PROJECT ASSUMPTIONS

This model DPR for Tamarind sauce unit is basically prepared as a template based on certain assumptions that may vary with capacity, location, raw materials availability etc. An entrepreneur can use this model DPR format and modify as per requirement and suitability. The assumptions made in preparation of this particular DPR are given in This DPR assumes expansion of existing minor forest product processing unit by adding new sauce manufacturing line. Therefore, land and civil infrastructures are assumed as already available with the entrepreneurs.

- Herewith in this DPR, we have considered the assumptions as listed below in the tables of different costs, which may vary as per region, seasons and machinery designs and supplier.
 1. Tamarind cost considered @ Rs.30/-per kg.
 2. 1 kg Tamarind will produce 55% recovery.
 3. 1 Batch size is approximately 500 kg.
 4. No. of hours per day are approximately 8-10 hours.
 5. Batch yield is 95%.

Detailed Project Assumptions		
Parameter	Assumption	
Capacity of the Tamarind sauce mfg. Unit	150	MT/annum
Utilization of capacity	1st Year Implementation, 70% in second, 80% in third and 90% in fourth year onwards	
Working days per year	300	days
Working hours per day	10	hours
Interest on term and working capital loan	12%	
Repayment period	Seven year with one year grace period is considered.	
Average prices of raw material	30	
Average sale prices per Kg	100	Rs/kg
Pulp extraction	55	
Tamarind Sauce	1 Kg Tamarind Sauce from 0.5 kg Tamarind fruit	

2.8 FIXED CAPITAL INVESTMENT

2.8.1 MACHINERY AND EQUIPMENT

Sr No.	Equipment	Capacity	Quantity	Price (Rs. In Lacs)
1	Washing tank	1	500 liter	0.4
2	Soaking Tank	1	100 liter	0.4
3	Deseeding machine	1	Suitable	1.2

4	Pulping machine	1	Suitable	0.6
5	Pre-Heating Kettle	1	200 liter	0.6
6	Gas operated Cooking Kettle with scrapper	1	200 liter	0.6
7	Continuous sealing machine	1	Suitable	0.25
8	Batch coding machine	1	Suitable	0.12
9	Weighing balance	1	Suitable	0.06
10	Accessories	1	Suitable	0.5
			Total	4.73

2.8.2 OTHER COSTS:-

Utilities and Fittings:-

Utilities and Fittings	
1.Water	Rs. 0.8Lacs total
2.Power	

Other Fixed Assests:

Other Fixed Assets	
1. Furniture & Fixtures	Rs. 0.9 lac total
2. Plastic tray capacity	
3. Electrical fittings	

Pre-operative expenses

Pre-operative Expenses	
Legal expenses, Start-up expenses, Establishment cost, consultancy fees,	0.9 LAC

trials and others.	
Total preoperative expenses	0.9 LAC

Contingency cost to be added as approx.1.2 Lac.

So total startup cost at own land & Premise may be somewhat similar to 17.65 lacs. This is according to survey done at X location India. This may vary on location, situation and design change over.

2.9 WORKING CAPITAL REQUIREMENTS

Particulars	Period (Days)	Year 2 (55%)	Year 3 (65%)	Year 4 (75%)
Raw material stock	15 days	2.50	2.95	4.03
Work in progress	15 days	5.00	5.91	8.05
Packing material	15 days	0.90	1.06	1.45
Finished goods' stock	15 days	3.78	4.47	6.09
Receivables	30 days	7.56	8.93	12.18
Working expenses	30 days	0.76	0.90	1.23
Total current assets		20.50	24.22	33.03
Trade creditors		0.00	0.00	0.00
Working capital gap		20.50	24.22	33.03
Margin money (25%)		5.12	6.06	8.26
Bank finance		15.37	18.17	24.77

2.10 TOTAL PROJECT COST AND MEANS OF FINANCES

Particulars	Amount in Lakhs
i. Land and building (20 x 32 x 12 ft - LxBxH)	4
ii. Plant and machinery	4.73
iii. Utilities & Fittings	0.8
iv. Other Fixed assets	0.9
v. Pre-operative expenses	0.90
vi. Contingencies	1.20
vii. Working capital margin	5.12
Total project cost (i to vii)	17.65
Means Of finance	
i. Subsidy	9.89
ii. Promoters Contribution	3.53
iii. Term Loan (@10%)	4.24

2.11 MANPOWER REQUIREMENTS

Total Monthly Salary (Rs.)	No	Wages	Total Monthly	Total Annualy
Supervisor (can be the owner)	1	18000	18000	216000
Technician	1	14000	14000	168000
Helper	1	5500	5500	66000
Semi-skilled	2	7600	15200	182400
Sales man	1	8000	8000	96000
			60700	728400

2.12 EXPENDITURE, REVENUE AND PROFITABILITY ANALYSIS

	Particulars	1st Year	2nd Year	3rd Year	4th Year	5th year	6th year
A	Total Installed Capacity (MT)	75 MT Tamarind/Annum	82.5	97.5	112.5	135	150
	Capacity utilization (%)	Under Const.	55%	65%	75%	90%	100%
B	Expenditure (Rs. in Lakh)	0					
	Tamarind(Av. Price @ Rs. 30/Kg)	0.00	12.38	14.63	16.88	20.25	22.50
	Sugar @ Rs. 35/kg	0.00	5.78	6.83	7.88	9.45	10.50
	Salt @ Rs. 3/Kg	0.00	0.07	0.09	0.10	0.12	0.14
	Other materials @ 500/kg	0.00	6.19	7.31	8.44	10.13	11.25
	Packaging materials	0.00	9.90	11.70	13.50	16.20	18.00
	Utilities (Electricity, Fuel)	0.00	0.39	0.46	0.54	0.64	0.71
	Salaries (1st yr only manager's salary)	1.80	6.43	6.43	6.43	6.43	6.43
	Repair & maintenance	0.00	0.70	0.80	0.90	0.90	0.90
	Insurance	0.30	0.30	0.30	0.30	0.30	0.30
	Miscellaneous expenses	0.50	2.30	2.30	2.30	2.30	2.30
	Total Expenditure	2.60	44.44	50.85	57.26	66.72	73.03
C	Total Sales Revenue (Rs. in Lakh)	0.00	82.50	97.50	112.50	135.00	150.00
	Sale of Tamarind sauce (Av. Sale Price @ Rs.120/kg)	0.00	82.50	97.50	112.50	135.00	150.00
D	PBDIT (Total exp.-Total sales rev.) (Rs. in Lakh)/Cash Inflows	-2.60	38.06	46.65	55.24	68.28	76.97
	Depreciation on civil works @ 5% per annum	0.20	0.19	0.18	0.17	0.16	0.15
	Depreciation on machinery @ 10% per annum	0.47	0.43	0.38	0.34	0.31	0.28
	Depreciation on other fixed assets @ 15% per annum	0.12	0.10	0.09	0.07	0.06	0.05

	Interest on term loan @ 12%	0.44	0.43	0.41	0.39	0.37	0.35
	Interest on working capital @ 12%	0.00	1.84	2.18	2.97	2.97	2.97
E	Profit after depreciation and Interest (Rs. in Lakh)	-3.83	36.92	45.60	54.26	67.37	76.14
F	Tax (assumed 30%) (Rs. in Lakh)	0.00	11.08	13.68	16.28	20.21	22.84
G	Profit after depreciation, Interest & Tax (Rs. in Lakh)	-3.83	25.84	31.92	37.99	47.16	53.30
H	Surplus available for repayment (PBDIT-Interest on working capital-Tax) (Rs. in Lakh)	0.44	0.43	0.41	0.39	0.37	0.35
I	Coverage available (Rs. in Lakh)	0.44	0.43	0.41	0.39	0.37	0.35
J	Total Debt Outgo (Rs. in Lakh)	0.15	0.16	0.18	0.20	0.22	0.24
K	Debt Service Coverage Ratio (DSCR)	3.00	2.62	2.28	1.97	1.69	1.44
	Average DSCR	2.16					
L	Cash accruals (PBDIT- Interest-Tax) (Rs. in Lakh)	-3.04	26.56	32.57	38.58	47.70	53.78
M	Payback Period	2.5 Years					
	(on Rs. 17.65 Lakhs initial investment)						

2.13 REPAYMENT SCHEDULE

Year	Beginning	PMT	Interest	Principal	Ending Balance
1	423,694.56	58,774.56	44,064.23	14,710.33	408,984.23
2	408,984.23	58,774.56	42,534.36	16,240.20	392,744.03
3	392,744.03	58,774.56	40,845.38	17,929.18	374,814.85
4	374,814.85	58,774.56	38,980.74	19,793.82	355,021.03
5	355,021.03	58,774.56	36,922.19	21,852.38	333,168.65
6	333,168.65	58,774.56	34,649.54	24,125.02	309,043.63

7	309,043.63	58,774.56	32,140.54	26,634.03	282,409.60
8	282,409.60	58,774.56	29,370.60	29,403.97	253,005.63
9	253,005.63	58,774.56	26,312.59	32,461.98	220,543.66
10	220,543.66	58,774.56	22,936.54	35,838.02	184,705.63
11	184,705.63	58,774.56	19,209.39	39,565.18	145,140.46
12	145,140.46	58,774.56	15,094.61	43,679.96	101,460.50
13	101,460.50	58,774.56	10,551.89	48,222.67	53,237.83
14	53,237.83	58,774.56	5,536.73	53,237.83	(0.00)
		822,843.89	399,149.33	423,694.56	(423,694.56)

2.14 ASSET'S DEPRECIATION

Assets' Depreciation (Down Value Method)	Amounts in Lakhs							
Particulars	1st Year	2nd year	3 rd year	4th year	5th year	6th year	7th year	8th year
Civil works	4.00	3.80	3.61	3.43	3.26	3.10	2.94	2.79
Depreciation	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14
Depreciated value	3.80	3.61	3.43	3.26	3.10	2.94	2.79	2.65
Plant & Machinery	4.73	4.26	3.83	3.45	3.10	2.79	2.51	2.26
Depreciation	0.47	0.43	0.38	0.34	0.31	0.28	0.25	0.23
Depreciated value	4.26	3.83	3.45	3.10	2.79	2.51	2.26	2.04

Other Fixed Assets	0.80	0.68	0.58	0.49	0.42	0.35	0.30	0.26
Depreciation	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04
Depreciated value	0.68	0.58	0.49	0.42	0.35	0.30	0.26	0.22
All Assets	9.53	8.74	8.02	7.37	6.78	6.24	5.76	5.31
Depreciation	0.79	0.72	0.65	0.59	0.54	0.49	0.44	0.40
Depreciated value	8.74	8.02	7.37	6.78	6.24	5.76	5.31	4.91

2.15 FINANCIAL ASSESSMENT OF THE PROJECT

Benefit Cost Ratio (BCR) and Net Present Worth (NPW)

Particulars	1st Year	2nd year	3 rd year	4th year	5th year	6th year	7th year	8th year	
Capital cost (Rs. in Lakh)	17.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Recurring cost (Rs. in Lakh)	2.60	44.44	50.85	57.26	66.72	73.03	73.03	73.03	
Total cost (Rs. in Lakh)	20.25	44.44	50.85	57.26	66.72	73.03	73.03	73.03	458.60
Benefit (Rs. in Lakh)	0.00	82.50	97.50	112.50	135.00	150.00	150.00	150.00	
Total Depreciated value of all assets (Rs. in Lakh)								4.91	
Total benefits (Rs. in Lakh)	0.00	82.50	97.50	112.50	135.00	150.00	150.00	154.91	882.41
Benefit-Cost Ratio (BCR): (Highly Profitable project)	1.924								
Net Present Worth (NPW):	423.80								

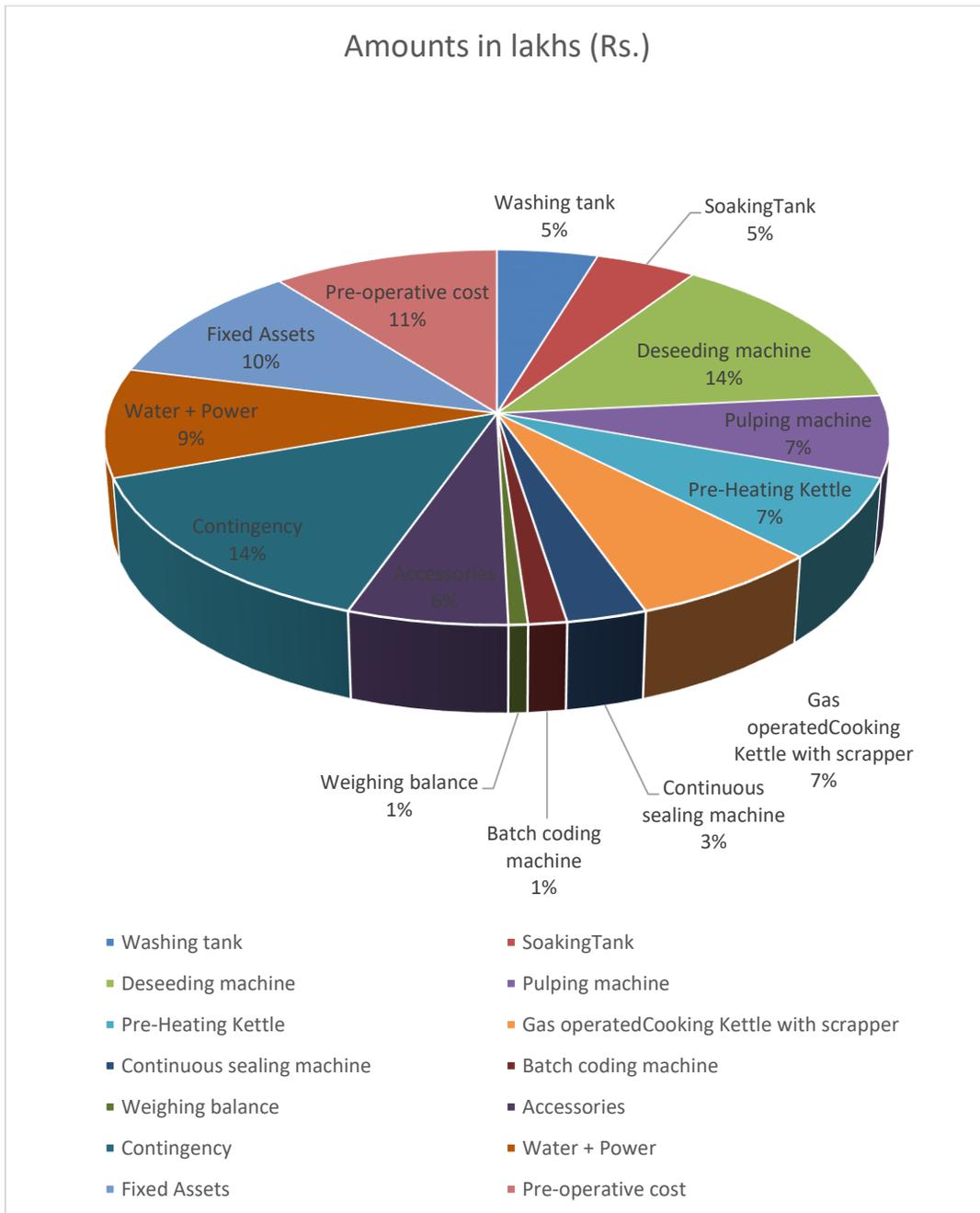
2.16 BREAK EVEN ANALYSIS

Break even analysis indicates costs-volume profit relations in the short run. This is the level at which, the firm is in no loss no profit situation.

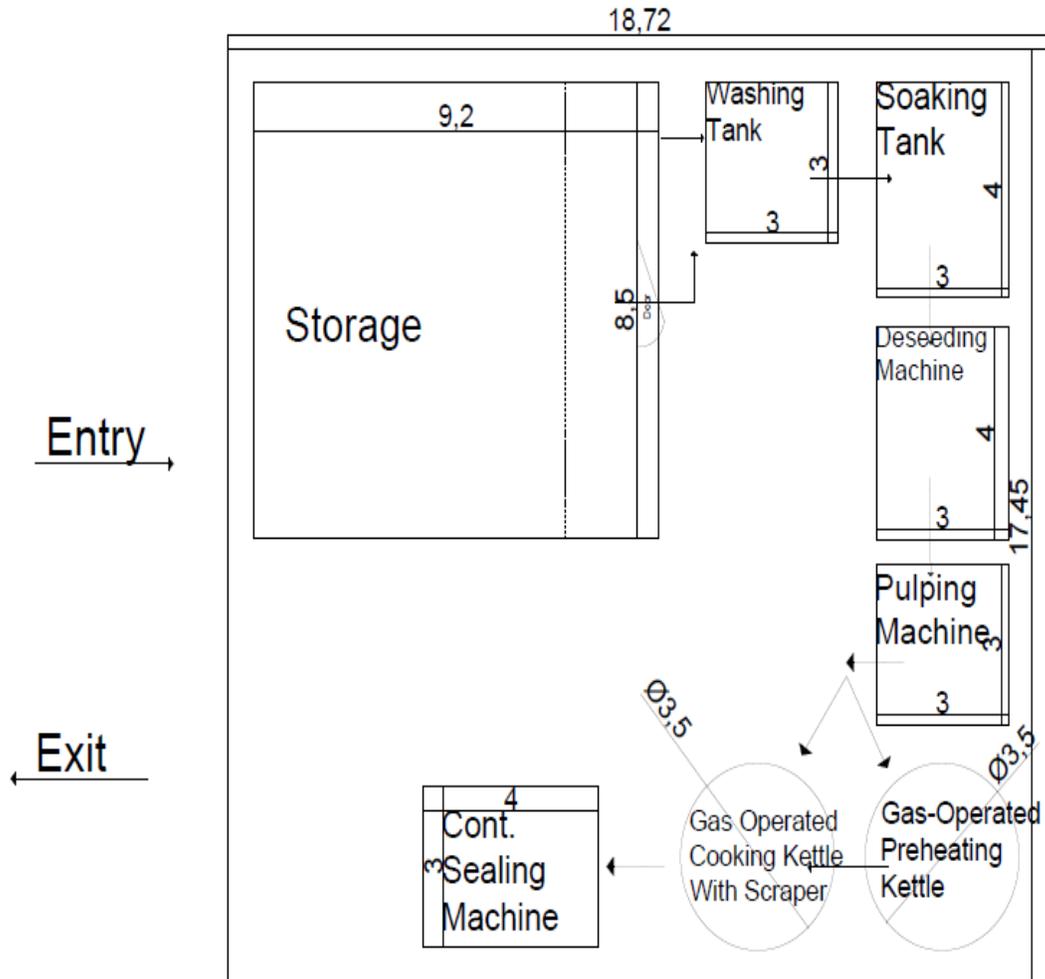
Particulars	1st Year	2nd year	3 rd year	4th year	5th year	6th year	7th year	8th year
Capacity utilization (%)	Under Const.	55%	65%	75%	90%	100%	100%	100%
Production MT/Annum		82.5	97.5	112.5	135	150	150	150
Fixed Cost (Rs. in Lakh)								
Permanent staff salaries	6.432	6.432	6.432	6.432	6.432	6.432	6.432	6.432
Depreciation on building @ 5% per annum	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14
Depreciation on machinery @ 10% per annum	0.47	0.43	0.38	0.34	0.31	0.28	0.25	0.23
Depreciation on other fixed assets @ 15% per annum	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04
Interest on term loan	0.44	0.43	0.41	0.39	0.37	0.35	0.32	0.29
Insurance	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total Fixed Cost (Rs. in Lakh)	7.96	7.87	7.79	7.71	7.63	7.56	7.49	7.43
Sales Revenue (Rs. in Lakh)	0	82.5	97.5	112.5	135	150	150	150
Variable Cost (Rs. in Lakh)								
Tamarind (Av. Price @ Rs.30/Kg)	0.00	12.38	14.63	16.88	20.25	22.50	22.50	22.50
Sugar @ 35 per kg	0.00	5.78	6.83	7.88	9.45	10.50	10.50	10.50
Salt @ 3 per kg	0.00	0.07	0.09	0.10	0.12	0.14	0.14	0.14
Other ingredients	0.00	6.19	7.31	8.44	10.13	11.25	11.25	11.25
Packaging materials	0.00	9.90	11.70	13.50	16.20	18.00	18.00	18.00
Casual staff salaries	0.00	4.93	4.93	4.93	4.93	4.93	4.93	4.93

Utilities (Electricity, Fuel)	0.00	0.39	0.46	0.54	0.64	0.71	0.71	0.71
Repair & maintenance	0.00	0.70	0.80	0.90	0.90	0.90	0.90	0.90
Miscellaneous expenses	0.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Interest on working capital @ 12%	0.00	1.84	2.18	2.97	2.97	2.97	2.97	2.97
Total Variable Cost (Rs. in Lakh)	0.50	44.18	50.93	58.13	67.59	73.90	73.90	73.90

2.17 PIE CHART FOR BETTER UNDERSTANDING OF EXPENSES OF EACH HEAD:



2.18 TYPICAL TAMARIND SAUCE MANUFACTURING UNIT LAYOUT



2.19 MACHINERY SUPPLIERS

There are many machinery suppliers available within India for minor forest products based beverage processing machineries and equipment. Some of the suppliers are:

1. Bajaj Process pack Limited, Noida, India
2. Shriyan Enterprises. Mumbai, India

3. LIMITATIONS OF MODEL DPR & GUIDELINES FOR ENTREPRENEURS

3.1 LIMITATIONS OF THE DPR

- i. This DPR has provided only the basic standard components and methodology to be adopted by an entrepreneur while submitting a proposal under the Formalization of Micro Food Processing Enterprises Scheme of MoFPI.
- ii. This DPR is made to provide general methodological structure not for specific entrepreneur/crops/location. Therefore, information on the entrepreneur, forms and structure (proprietorship/partnership/cooperative/ FPC/joint stock company) of business, background of proposed project, location, raw material base/contract sourcing, entrepreneur's own SWOT analysis, market research, rationale of the project for specific location, community advantage/benefit, employment generation etc are not given in detail.
- iii. The present DPR is based on certain assumptions on cost, prices, interest, capacity utilization, output recovery rate and so on. However, these assumptions in reality may vary across places, markets and situations; thus the resultant calculations will also change accordingly.

3.2 GUIDELINES FOR THE ENTREPRENEURS

- i. The success of any prospective food processing project depends on how closer the assumptions made in the initial stage are with the reality of the targeted market/place/situation. Therefore, the entrepreneurs must do its homework as realistic as possible on the assumed parameters.
- ii. This model DPR must be made more comprehensive by the entrepreneur by including information on the entrepreneur, forms and structure (proprietorship/partnership/cooperative/ FPC/joint stock company) of entrepreneur's business, project location, raw material costing base/contract

sourcing, detailed market research, comprehensive dehydrated product mix based on demand, rationale of the project for specific location, community advantage/benefit from the project, employment generation, production/availability of the raw materials/crops in the targeted area/clusters and many more relevant aspects for acceptance and approval of the competent authority.

- iii. The entrepreneur must be efficient in managing the strategic, financial, operational, material and marketing aspects of a business. In spite of the assumed parameter being closely realistic, a project may become unsustainable if the entrepreneur does not possess the required efficiency in managing different aspects of the business and respond effectively in changing situations.
- iv. The machineries should be purchased after thorough market research and satisfactory demonstration.
- v. The entrepreneur must ensure uninterrupted quality raw materials' supply and maintain optimum inventory levels for smooth operations management.
- vi. The entrepreneur must possess a strategic look to steer the business in upward trajectory.
- vii. The entrepreneur must maintain optimum (not more or less) inventory, current assets. Selecting optimum source of finance, not too high debt-equity ratio, proper capital budgeting and judicious utilization of surplus profit for expansion is must.
- viii. The entrepreneur must explore prospective markets through extensive research, find innovative marketing strategy, and maintain quality, adjust product mix to demand.
- ix. The entrepreneur must provide required documents on land, financial transaction, balance sheet, further project analysis as required by the competent authority for approval.

- x. The entrepreneur must be hopeful and remain positive in attitude while all situations.



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