PM Formalization of

Micro Food Processing Enterprises Scheme

DETAILED PROJECT REPORT

FOR

TAPIOCA CHIPS PROCESSING

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	2nd year	77.22
	3rd year	93.22
	4th year	109.21
18	Average DSCR	2.16
	Benefit Cost Ratio	2.00
	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 TAPIOCA PRODUCTION, CLUSTERS, POST-HARVEST MANAGEMENT AND VALUE ADDITION IN INDIA

1.1 INTRODUCTION

Cassava (Manihot esculenta Cralztz) is a starchy root crop which is an essential food eaten mainly by developing countries. The root tuber and leaves are edible and serve as source of nutritional food for about 500 million people and more worldwide. The root tuber is called as Tapioca.

Tapioca is a starch extracted from the storage roots of the cassava plant (*Manihot esculenta*, also known as manioc), a species native to the north region central-west region of Brazil, and certain parts of West Africa but whose use is now spread throughout South America. The plant was brought by the Portuguese to much of West Indies, Africa and Asia. It is a perennial shrub adapted to the hot conditions of tropical lowlands. Cassava copes better with poor soils than many other food plants.

Although tapioca is a staple food for millions of people in tropical countries, it provides only carbohydrate food value, and is low in protein, vitamins and minerals. In other countries, it is used as a thickening agent in various manufactured foods. Sago (saboodana) is the processed edible starch extracted from tapioca marketed in the form of small globules or pearls. The production of sago is mainly carried out using small scale industries. On the average, the yield of sago is 200 kg of per tone of tapioca tubers. Sago is of course very popular because it is convenient, nutritional, economical and commonly used during festive season all over India.

1.2 ORIGIN, DISTRIBUTION AND PRODUCTION OF TAPIOCA

Cassava has many names across many continents. The English word is **cassava**, but in South American in the area around Brazil it is called **madioca**. In Africa where French is spoken it is called **manioc**. In Spanish-speaking countries it is called **yuca**. Here in Asia we call it **tapioca**.

The origins of cassava are many, but the principle origin is in the tropical areas of the American continents, especially in South America. The countries such as Guatemala, Mexico, Peru, and Honduras planted cassava three to five thousand years before the plant was distributed across the Americas and elsewhere. In the 15th century, slave traders and the Portuguese brought cassava to the African continent.

Cassava (*Manihot esculenta* Crantz) is considered as the king of tropical tuber crops as it occupies a significant position in the global agricultural economy and trade amongst the tuber crops. Cassava is the most important starchy root crop grown in the tropics and is mainly cultivated in southern peninsular India. Introduced during seventeenth century by Portuguese, the crop played a significant role to overcome food shortage among the low income group of people in Kerala. Underground tuber is rich in starch and mainly consumed after cooking. Processed products like chips, sago and vermicelli made of tapioca are also popular in the country. Being easily digestible, it forms an important ingredient in poultry and cattle-feeds. It is also widely used for production of industrial alcohol, starch and glucose (Lakshmi *et al.* 2000).

Cassava is known to be originated from North-Eastern Brazil. Portuguese distributed the crop from Brazil to countries like Indonesia, Singapore, Malaysia and India. The stem is woody and variously branched. Two distinct types are present - one without branching at the top and the other with spreading nature (Srinivas *et al.* 2005). Nigeria is the major growing country in world accounting for 50% of area and production. In India crop is cultivated in southern peninsular region, particularly Kerala, Tamil Nadu and Andhra Pradesh contributing 93 % of area and 98 % of production in the Cassava reached Asia around the 17th century,

when the Spanish brought it from Mexico for planting in Philippines. In the 18th century, the Dutch brought cassava into Indonesia.

No matter how many tens of hundreds of names cassava may have, the importance is that it is a cash crop that generates a tremendous amount of revenue for Thailand. Thailand is currently the largest producer and exporter of tapioca flour in the world.

Cassava was first commercially planted in the South of Thailand, where it was planted between rows of natural rubber trees. Much of it is planted in the province of Songkhla, so many factories were established there to produce tapioca starch and tapioca pearl for export to Singapore and Malaysia. However, the amount of planted cassava gradually decreased due to the encroachment of the rubber trees as they fully grew. Planting area was then shifted to the East, such as Chonburi and Rayong. As market demand increased, planting area extended to other provinces, especially in the Northeast.

The cassava plant has either red or green branches with blue spindles on them. The root of the green-branched variant requires treatment to remove linamarin, a cyanogenic glycoside occurring naturally in the plant, which otherwise may be converted into cyanide. Konzo (also called mantakassa) is a paralytic disease associated with several weeks of almost exclusive consumption of insufficiently processed bitter cassava.

In the north and northeast of Brazil, traditional community-based production of tapioca is a by-product of manioc flour production from cassava roots. In this process, the manioc (after treatment to remove toxicity) is ground to a pulp with a small hand- or diesel-powered mill. This masa is then squeezed to dry it out. The wet masa is placed in a long woven tube called a *tipiti*. The top of the tube is secured while a large branch or lever is inserted into a loop at the bottom and used to stretch the entire implement vertically, squeezing a starch-rich liquid out through the weave and ends. This liquid is collected and the (microscopic) starch grains in it are allowed to settle to the bottom of the

container. The supernatant liquid is then poured off, leaving behind a wet starch sediment that needs to be dried and results in the fine-grained tapioca starch powder similar in appearance to corn starch.

Commercially, the starch is processed into several forms: hot soluble powder, meal, pre-cooked fine/coarse flakes, rectangular sticks, and spherical "pearls".Pearls are the most widely available shape; sizes range from about 1 mm to 8 mm in diameter, with 2–3 mm being the most common.

Cassava is an important crop in terms of food security and income generation in the tropics (Legg *et al.* 2014). Nigeria is having the largest area under cassava (22.25 %) among all the cassava growing countries in the world with an annual output of 38.18 Million Tonnes. Congo Dem. Rep. occupies second position in cassava area producing 10 % of the world production. Brazil occupies the third position in terms of area and second rank in terms of production in the world (Edison *et al.* 1999).

India ranks first in the world for productivity of cassava with 27.92 t/ha as against the world average 10.76 t/ha. However, India ranks fourth in Asia and 14th in the world for area and third in Asia and 7th in the world for the production of cassava roots. However India accounts for just 1.30 % of world production area. Although it is cultivated in India in 13 states, it is concentrated in the southern peninsular region of the country and to a certain extent in northeast region of the country. The crop is concentrated in the southern states of Kerala, Tamil Nadu and Andhra Pradesh owing to the favourable climate and efficient utilization.

1.3 VARIETIES

There are different varieties of Tapioca growing nationwide. Varieties of tapiocas growing nationwide are listed below:

- Co 2
- Co 3
- Co (TP) 4
- MVD 1

- H 165
- H 226
- Sree Vishakam (H. 1687)
- Sree Sahaya (H.2304),
- Sree Prakash (S. 856)
- Sree Vijaya,
- Sree Jaya
- Sree Pekha
- Sree Prabha
- Co (Tp) 5,
- H-97
- H-165
- H-226
- Sree Harsha

1.4 HEALTH BENEFITS AND NUTRITIONAL INFORMATION

Nutritional value:

One medium baked tapioca (173 grams), including the skin, provides:

- **Calories:** 358
- **Fat:** 0 grams
- **Protein:** 0.2 grams
- **Total Carbs:** 36.6 grams
- **Dietary Fiber:** 0.9 grams
- **Sugar:** 3.4 g
- **Calcium:** 20 mg, 2 % of Daily value

- **Iron:** 1.58 mg, 9 % of Daily value
- **Potassium:** 11 mg,
- **Magnesium:** 1 mg
- **Phosphorus:** 7 mg
- **Sodium:** 1 mg

Cassava tubers have low protein content (0.7% to 1.3% fresh weight (Ngiki et al., 2014)). The protein content of cassava flour, peels and leaves is also low at approximately 3.6%, 5.5% and 21% respectively (Iyayi and Losel, 2001). The protein content of cassava could be improved by addition of protein sources into the diet, or alternatively fermenting the cassava prior to adding it into the diet. Antai and Mbongo (1994) found that fermenting cassava peels using pure cultures of Saccharomyces cerevisiae increased protein content from 2.4% in non-fermented cassava to 14.1% in fermented products.

Lipid content

Cassava is very low in lipids containing about 0.1% lipids, compared with maize which has approximately 6%. Hudson and Ogunsua (1974) found that flour from cassava roots contains approximately 2.5% lipids, but only half of this is extractable with conventional solvent systems, and the fatty acids in cassava are primarily saturated. It had low levels of vitamin A, B1, B2 and niacin but high levels of vitamin C.

Carbohydrate content

Cassava contains highly digestible starch compared cassava starch to maize starch and found that cassava starch contains 17% amylose and 83% amylopectin, compared with maize starch which has 28% amylose and 72% amylopectin. The comparatively higher amylopectin level means that the digestible starch may be higher in cassava compared with other common starch sources fed to poultry. Resistant starch refers to starch and starch degradation products that escape digestion in the small intestine.

Cassava chips contain approximately 40.91% resistant starch compared with maize which has 47.55% (Promthong et al., 2005), and raw cassava contains approximately 75.38% resistant starch (Onyango et al., 2006). Amylose becomes a resistant starch by crystallisation, as a result of chain elongation by double helical formation between amylose molecules. These elongated chains become folded and form tightly packed structures which are stabilised by hydrogen bonds.

CONSTITUENTS AND HEALTH BENEFITS OF TAPIOCA

Tapioca also have many potential health benefits.

Health benefits:

1. Helps in Weight Gain

Tapioca is a vegetarian food and a rich source of the purest and simplest forms of carbohydrates and starches. This aids in building essential fat tissues to protect internal organs, as well as ensures uniform lipid distribution across the body and is hence very useful for those who are underweight.

2. Ideal for Restricted Diets

Being naturally gluten-free, nut-free and grain-free, tapioca is a perfect ingredient that can be routinely added in the diet of people suffering from food allergies and gluten sensitivity. Gluten is a protein intrinsically present in some whole grains such as wheat, barley and rye which triggers a severe reaction in some people whose bodies are averse to this component

3. Promotes Strong Muscle Growth

Tapioca abounds in essential amino acids and is a good source of vegetarian protein, both of which are crucial for many enzymatic reactions in cells and tissues in the body, to maintain

proper functioning of all the organs. Moreover, it adds muscle mass and improves the tensile strength of connective tissues, thereby fostering muscular development.

4. Regulates Proper Digestive Function

As tapioca is an unprocessed food, the simple sugars and starches it contains will promptly be assimilated in the body and broken down in the stomach, to provide a source of energy. Furthermore, tapioca also helps in eliminating blockages in the gut passage upon digestion and hence prevents constipation and irritable bowel syndrome.

5. Combats Neural Tube Defects

Tapioca can be taken by expecting mothers, as it has profuse amounts of folate, that plays a vital role in the normal development of the foetus, avoiding any chances of neural tube defects and other birth abnormalities in the newborn. Folate also enhances red blood cell synthesis, required for transporting nutrients to vital organs in the body.

1.5 CULTIVATION, BEARING & POST HARVEST MANAGEMENT:-

Cassava, (*Manihot esculenta*), also called **manioc, mandioca,** or **yuca**, tuberous edible plant of the spurge family (Euphorbiaceae) from the American tropics. It is cultivated throughout the tropical world for its tuberous roots, from which cassava flour, breads, tapioca, a laundry starch, and an alcoholic beverage are derived. Cassava probably was first cultivated by the Maya in Yucatán. A cyanide-producing sugar derivative occurs in varying amounts in most varieties. Indigenous peoples developed a complex refining system to remove the poison by grating, pressing, and heating the tubers. The poison (hydrocyanic acid) has been used for darts and arrows.

Cassava is a perennial plant with conspicuous, almost palmate (fan-shaped) leaves resembling those of the related castor-oil plant but more deeply parted into five to nine lobes. The fleshy roots are reminiscent of dahlia tubers. Different varieties range from low herbs to branching shrubs and slender unbranched trees. Some are adapted to dry areas of alkaline soil and others to acid mud banks along rivers.

The cassava root is long and tapered, with a firm, homogeneous flesh encased in a detachable rind, about 1 mm thick, rough and brown on the outside. Commercial cultivars can be 5 to 10 centimetres (2 to 4 inches) in diameter at the top, and around 15 to 30 cm (6 to 12 in) long. A woody vascular bundle runs along the root's axis. The flesh can be chalk-white or yellowish. Cassava roots are very rich in starch and contain small amounts of calcium (16 mg/100 g), phosphorus (27 mg/100 g), and vitamin C (20.6 mg/100 g). However, they are poor in protein and other nutrients. In contrast, cassava leaves are a good source of protein (rich in lysine), but deficient in the amino acid methionine and possibly tryptophan.

Cultivation and Bearing:-

Climate & Soil

Any well drained soil preferably red lateritic loam with a pH range of 5.5 -7.0 is best suited for tapioca cultivation. It thrives best in tropical, warm humid climate with well distributed rainfall of over 100 cm per annum. This crop can be cultivated upto an elevation of 1000 m.

Season and planting

Plant throughout the year under irrigation. Plant during April for rainfed crop. Select healthy mosaic free vigorous plants for taking planting materials. Prepare setts of 15 cm

long with 8 – 10 nodes from the middle portion of the stem. Avoid mechanical damage while preparation and handling of setts. The cut end should be uniform. Dip the setts in Carbendazim 1 g in one l of water for 15 minutes before planting. Plant the setts vertically with buds pointing upward on the sides of ridges and furrows. 17,000 setts are needed for planting one ha. For rainfed conditions, treat the setts with a mixture of potassium chloride @ 5 g/lit and micronutrients viz., ZnSO4 and FeSO4 each @ 0.5%for 20 minutes.Dip the setts for 20 minutes in Azospirillum and phosphobacteria each at 30 g/l.

Preparation of field

Plough the field 4 – 5 times to get a fine tilth. The soil depth should be atleast 30 cm and form ridges and furrows at the following spacing.

Planting

Plant the setts vertically with buds pointing upward on the sides of ridges and furrows at following spacings.
Irrigated: 75 x 75 cm (17,777 setts) and 90 x 90 cm (12,345 setts)
Rainfed: 60 x 60 cm (27,777 setts)
Under Kanyakumari conditions: 90 x 90 cm (12,345 setts)

Irrigation

First irrigation is given at the time of planting. Life irrigation is given on the 3rd day followed by once in 7 – 10 days upto 3rd month and once in 20 – 30 days upto 8th month.

Spacing: 60 x 90cm in paired row system.

Propagation of Tapioca:

Basic requirements:

Cassava thrives in tropical and subtropical regions of the world as it requires warm temperatures for optimal growth. The plants require at least 8 months of warm weather, thriving in regions with warm, moist climates with regular rainfall. Cassava can be grown in many types of soil, producing even in poor soil but but will be optimally productive in well-draining, sandy clay loam with a pH between 5.5 and 6.5. Cassava is drought resistant but will not tolerate water-logging. Root production is maximized when temperatures are between 25 and 32°C (77–90°F). Cassava should be planted in full sun and is very sensitive to shading, which leads to low yields.

Cutting

Cassava is propagated from stem cuttings as the tubers do not produce buds. Stem cuttings should only be taken from plants which are free from disease, are at least 10 months old and havee borne tubers. The cuttings should be taken from hardened stems leaving at least 30 cm (11.8 in) of stem intact in the ground. The stem can be severed using a sharp knife, secateurs or saw and each cutting should have 1-2 nodes and be approximately 20 cm (7.9 in) long.

Presprouting:

It is a good idea to dip the stem cuttings in an appropriate fungicide prior to planting to help prevent the development of diseases. The cuttings can then either be planted directly into a nursery bed or presprouted in trays or polyethylene bags. To presprout the stems, plant in a cell tray or bag which is filled with good quality soil. Plant one stem in each cell or bag by pushing it into the soil in the direction in which it was growing on the mother plant (oldest part of stem first). The trays should be kept in partial shade until the stems begin to sprout. If planting stem cuttings in a nursery bed (best for cuttings taken from higher up the stems where the wood is not mature), select a site with good quality soil in partial shade and prepare a bed at least 1 m (3.3 ft) wide. The stems can be planted horizontally in a nursery bed and this encourages the growth of multiple stems. Space the cuttings 10 x 10 cm (4 x 4 in) grid. Stem cutting should be watered immediately after planting and on a regular basis

thereafter. Aim to keep the soil moist but not wet. Stems should begin to sprout 7-10 days after planting.

Transplanting:

Plants propagated from stem cuttings are ready to be transplanted after approximately 4-6 weeks. Prepare the field for planting by cultivating the soil and removing weeds. Space transplants 75–100 cm (2.5–3.2 ft) apart in rows spaced 1–-5 m (3.2–16.4 ft) apart. Fertilize the plants as appropriate. Manure or poultry droppings can be used. Cultivate the soil to remove weeds and break up the soil around the plants.

Harvesting: Cassava is ready to harvest about a year after planting depending on the variety being grown. Some early maturing varieties may be ready to harvest in around nine months. In colder regions, cassava tubers can remain in the ground for up to 2 years before harvesting but can become fibrous so this is not recommended where cassava is being grown for consumption. Cassava tubers are harvested by digging. The roots should be dug up carefully to prevent damage.

Post-harvest management:-

There are some vegetable handling management after harvesting to avoid post-harvest losses. Following are Post-harvesting handling practices:

1. Follow the practice of Dehaulming [cutting of haulms / aerial parts by sickle or killing by chemicals (e.g. Gramoxone) or destroying by machines] when the crop attains 80-90 days and when the aerial part of the plant turns yellow.
2. Always harvest in dry weather.
3. Stop irrigation about two weeks before dehaulming.
4. Avoid bruising and skinning of tubers otherwise tubers become susceptible to rot diseases.
5. Harvest the crop after 10-15 days of haulm cutting.

6. Always dry the harvested tuber quickly to remove excess moisture from the surface of tubers for improving their keeping quality.
7. Always dry the harvested tuber in storage shed.
8. Do not store the tubers immediately if they are exposed to rain after harvest.
9. Always follow the curing process at 25 degree centigrade with a 95 per cent relative humidity,
10. For optimum suberization, curing is essential for healing the wounds of tubers resulted from cutting and bruising during harvesting.
11. All the damaged and diseased tubers should be removed during sorting.

1.6 PROCESSING & VALUE ADDITION:-

Tapioca is a starchy, granular foodstuff prepared from tapioca roots and used as a vegetable, in bread or as a thickening agent in liquid foods, notably puddings. 'Tapioca' is a Brazilian word, which translates as 'juice of tapioca'. In processing, heat ruptures the starch grains, converting them to small, irregular masses that are further baked into flake tapioca. A pellet form, known as pearl tapioca, is made by forcing the moist starch through sieves. Granulated tapioca, marketed in various-sized grains and sometimes called 'manioca,' is produced by grinding flake tapioca. When cooked, tapioca swells into a pale, translucent jelly.

Tuber crops (with 5.4 % energy) are the second most important group of crop plants providing food energy to humans after cereals (49%). Of them, the tropical tuber crops (TTCs) contribute 3.9 % of human energy for an average consumption of 28.6 kg percapita per year (76 kcal per capita per day).Three of the TTCs - cassava, sweet potato and yam - rank among the top 15 crop plants of the world in area under cultivation. Cassava and yams are presently among the major crops that show the highest rates of increase in area under cultivation. This may be attributed to their resilience to climate changes (Nayar, 2014)

They are widely grown and consumed as staple food in many part of Africa, Latin America, the pacific island and Asia. Fig.2.1 shows the production of different tuber crops in the world under different continent level (FAOSTAT, 2017). Although china is the largest producer of sweet potato, accounting for more than 80% of the world supply, only 40% of the production is used for human consumption and industrial uses, while the rest goes as animal feed. In India, tuber crops are cultivated mainly in the southern, Eastern and North-Eastern states, where they play a vital role in alleviating the hunger of a majority a majority of population. Cassava and sweet potato are still the major tuber crops of India and cassava production is concentrated mainly in the southern states of Kerala, Tamil Nadu, and Andhra Pradesh. This is mainly used as a food or feed in Kerala, while almost exclusively an industrial crop in the other two states (Rawel *et al.* 2003).

The tapioca has been widely grown and consumed in the country. A variety of processed products can be achieved that enhances the market value, marketability, and desirability of the product. Since the tapiocas are mostly water (about 78%) and the solids present are also mostly indigestible (60-80%), processing like boiling, baking, microwaving, frying i.e. processes involving heat that breaks down the starch are performed prior to consumption. Tapiocas are eaten like tapioca chips, baked, boiled, mashed, sago and using flour to make a cake, pancake, etc. Cooked or processed tapiocas are more digestible than raw tapiocas since raw tapiocas contain starch in β-crystalline structure that is resistant to amylase digestion. Due to the loss of water-soluble vitamins and minerals, tapiocas are preferred not to peeled or cut during boiling where maximum loss is recorded as compared to other processing like baking, roasting, and frying.

There is also a lot of opportunities, in value addition, that remain underexploited. This is partly because of little production of processor.

1. Tapioca crisps: Crisps have been dubbed as the “King of Snack Food.” Now, there are already many companies or factories that make crisps.

2. Factory-made chips: It involves processes of washing, sorting, pressuring, slicing and freezing. A consumer would only need to boil the pack of chips, picked from a supermarket shelf, to reminisce the simpler days.

3. Sago: Sago (Saboodana) is a processed edible starch produced from tapioca starch marketed in the form of small globules or pearls. Sago is a traditional, convenient and ready to cook food consumed in many parts of the India. Sago production is carried out by many small scale industries

4. Canned tapiocas: Topiocas are canned after undergoing pressure cooking to sort of sterilize them. Canning is also a great win for kitchens because the tapiocas are bought half-ready for serving.

5. Tapioca flour: Tapioca flour is made by crushing and grinding finely whole cooked or raw tapiocas. It can be used to make (bake) bread, cake and other meals food you can come up with.

6. Tapioca starch: Another product that comes from grinding Tapiocas is starch. Tapioca is the 2nd most common source of plant starch, after maize. We saw that starch is a raw material for many different industries. Further, starch can also be used as a biodegradable alternative in the making of disposable utensils.

7. Animal feed: Beside tapioca itself, the waste products from processing of the crop like peels can be used to feed livestock. Tapioca animal feed is a supplement to what farmers feed their animals.

8. Alcohol: You probably already know that vodka is made by fermenting and distilling tapioca starch. Entrepreneurship along the lines of alcoholic beverages is not just about opening another pub.

2. MODEL TAPIOCA CHIPS 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 ideal locations for establishment of exclusive tapioca chips processing unit are in the production clusters of tapioca growing states/Areas such as The major tapioca producing states are Tamil Nadu, Kerala, Andhra Pradesh, Nagaland, Meghalaya, Assam, Karnataka, Madhya Pradesh, and Arunachal Pradesh where adequate quantities of surplus raw materials can be available for processing.

2.2 INSTALLED CAPACITY OF THE TAPIOCA CHIPS PROCESSING UNIT

The maximum installed capacity of the Tapioca chips manufacturing unit in the present model project is proposed as 150 tonns/annum or 500 kg/day Tapioca chips. The unit is assumed to operate 300 days/annum @ 8-10 hrs/day. The 1styear 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 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 Tapioca chips manufacturing project, the unit requires 741.25 kg/day,

875.87 kg/day, 1010.62 kg/day & 1212.75 Kg/day Tapioca vegetable at 55, 65, 75 & 90 percent capacity utilization, respectively. The Tapioca must be harvested from plant; and then stored below 6°C temperature.

2.4 MANUFACTURING PROCESS OF THE TAPIOCA CHIPS

PREPARATION OF TAPIOCA CHIPS:

1. For preparation of Tapioca chips, Tapiocas are weighed, and washed.
2. Tapiocas are peeled and slices in Tapioca peeler and slicer respectively.
3. Blanching of sliced tapiocas is done. Most vegetables and some fruits are blanched before drying to inhibit enzyme activity and to help preserve the color. The material is cut into appropriate sized pieces and blanched in blanching unit for 15 minutes.
4. After blanching, drying of tapioca slices take place in Tray dryer.
5. After drying, frying slices in deep fat frying kettle.
6. Cooling down slices and packaged.

The typical Procedure for manufacturing of Tapioca chips is as below:

Flow chart for Tapioca chips:

Receiving of Tapioca vegetables

Washing of tapiocas

Peeling and slicing (1.5-2 mm slices) of tapiocas

*Blanching (80ºC for 15 min)

Drying of tapioca slices

Frying of dried tapioca slices

Cooling

Packaging

2.5 MARKET DEMAND AND SUPPLY FOR TAPIOCA CHIPS

The tapioca market is projected to record a CAGR of 1.0% during the forecast period (2019-2024). Tapioca is a major food crop that is grown in over 100 countries across the world. Tapiocas are used for a variety of purposes. In fact, less than 50% of tapiocas grown worldwide are consumed fresh. The rest is processed into tapioca food products and food ingredients, fed to cattle, pigs, and chickens, processed into starch for industrial use, and re-used as seed tubers for growing the next season's tapioca crop. Therefore, increased demand in the food processing industry acts as a major driving force behind the growth of the tapioca market.

The increasing young population, globally, disposable incomes and changing lifestyles are promoting higher consumption of tapioca chips. These chips are served as appetizers, side dish, or as snacks. Innovation or new product offering is considered as an opportunity for this market. The introduction of healthier alternatives, like the low-fat and low-sodium chips, in the emerging markets also supports the growth of this industry. There are many tapioca chip substitutes available in the market, and this could be a major threat and also hamper the consumer loyalty, which can further inhibit the tapioca chips market growth.

2.6 MARKETING STRATEGY FOR TAPIOCA CHIPS

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

2.7 DETAILED PROJECT ASSUMPTIONS

This model DPR for Tapioca chips 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 Vegetable processing unit by adding new chips 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. Tapioca cost considered @ Rs.15/-per kg.
    2. 1 kg Tapioca will produce 95% recovery.
    3. 1 Batch size is approximately 100 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 Tapioca chips Unit	150	MT/annum
Utilization of capacity	1st Year Implementation, 55% in second, 65% in third, 75% in fourth year, 90% in fifth years onwards respectively.	
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	15	
Average sale prices per Kg	270	Rs/kg
Pulp extraction	95	

TAPIOCA CHIPS	2.7 Kg Tapioca for 1 kg Tapioca chips	

2.8 FIXED CAPITAL INVESTMENT

2.8.1 MACHINERY AND EQUIPMENT

Sr No.	Equipment	Quantity	Capacity	Area (in feet)	Price (Rs. In Lacs)
1	Cold store sq. meter	1	9000 Kg	20*30*12	10
2	Washing tank	1	500 liter	3 ft dia	0.4
3	Tapioca peeler	1	500 kg/hr	3*5	2.5
4	Vegetable cutter/slicer	1	500 kg/hr	3*5	1.2
5	Blanching kettle Gas operated	1	300 Liter	4*3	1
6	Dryer	1	120 kg /batch	4*6	2.2
7	Deep fat frying kettle Gas Operated	1	100 liter	3*4	0.5
8	Continuous sealing machine with nitrogen flush	1	Suitable	4*3	0.5
9	Weighing balance	1	Suitable		0.06
10	Accessories	1	Suitable		0.5
					18.86

2.8.2 OTHER COSTS:-

Utilities and Fittings:-

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

Other Fixed Assests:

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

Pre-operative expenses

Pre-operative Expenses	
Legal expenses, Start-up expenses, Establishment cost, consultancy fees, trials and others.	0.9 LAC
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 37.03 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	Year 2 (55%)	Year 3 (65%)	Year 4 (75%)
Raw material stock	7 days	3.11	3.68	5.01
Work in progress	15 days	6.22	7.35	10.03
Packing material	15 days	1.13	1.33	1.81
Finished goods' stock	15 days	8.38	9.90	13.50
Receivables	30 days	16.76	19.81	27.01

Working expenses	30 days	1.18	1.39	1.89
Total current assets		36.77	43.46	59.26
Trade creditors		0.00	0.00	0.00
Working capital gap		36.77	43.46	59.26
Margin money (25%)		9.19	10.87	14.82
Bank finance		27.58	32.60	44.45

2.10TOTAL PROJECT COST AND MEANS OF FINANCES

Particulars	Amount in Lakhs
i. Land and building (20 x 32 x 12 ft - LxBxH)	5.18
ii. Plant and machinery	18.61
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	9.19
Total project cost (i to vii)	36.78
Means Of finance	
i. Subsidy	9.99
ii. Promoters Contribution	8.88
iii. Term Loan (@49%)	18.14

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
Semi skilled	2	7600	15200	182400
Helper	1	5500	5500	66000
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
A	Total Installed Capacity (MT)	405 MT Tapioca/Annum	82.5	97.5	112.5	135
	Capacity utilization (%)	Under Const.	55%	65%	75%	90%
B	**Expenditure (Rs. in Lakh)**	0				
	Tapioca (Av. Price @ Rs.15/Kg)	0.00	33.35	39.41	45.48	54.57
	Oil @ Rs. 130/kg	0.00	34.65	40.95	47.25	56.70
	Other materials (Rs. 3/kg)	0.00	0.05	0.06	0.07	0.09
	Packaging materials (Rs 12 per Kg)	0.00	12.38	14.63	16.88	20.25
	Utilities (Electricity, Fuel)	0.00	1.06	1.25	1.44	1.73
	Salaries (1st yr only manager's salary)	2.16	7.28	7.28	7.28	7.28
	Repair & maintenance	0.00	0.70	0.80	0.90	0.90
	Insurance	0.30	0.30	0.30	0.30	0.30
	Miscellaneous expenses	0.50	2.30	2.30	2.30	2.30
	Total Expenditure	**2.96**	**92.07**	**106.98**	**121.90**	**144.12**
C	**Total Sales Revenue (Rs. in Lakh)**	**0.00**	**222.75**	**263.25**	**303.75**	**303.75**
	Sale of Tapioca Chips (Av. Sale Price @ Rs.320/kg)	0.00	222.75	263.25	303.75	303.75
D	**PBDIT (Total exp.-Total sales rev.) (Rs. in Lakh)/Cash Inflows**	**-2.96**	**130.68**	**156.27**	**181.85**	**159.63**
	Depreciation on civil works @ 5% per annum	0.26	0.25	0.23	0.22	0.21
	Depreciation on machinery @ 10% per annum	1.86	1.67	1.51	1.36	1.22
	Depreciation on other fixed assets @ 15% per annum	0.12	0.10	0.09	0.07	0.06
	Interest on term loan @ 12%	1.87	1.81	1.74	1.66	1.57

	Interest on working capital @ 12%	0.00	3.31	3.91	5.33	5.33
E	Profit after depreciation and Interest (Rs. in Lakh)	**-7.07**	**126.85**	**152.70**	**178.54**	**156.56**
F	Tax (assumed 30%) (Rs. in Lakh)	**0.00**	**38.05**	**45.81**	**53.56**	**46.97**
G	Profit after depreciation, Interest & Tax (Rs. in Lakh)	**-7.07**	**88.79**	**106.89**	**124.98**	**109.59**
H	Surplus available for repayment (PBDIT-Interest on working capital-Tax) (Rs. in Lakh)	1.87	1.81	1.74	1.66	1.57
I	Coverage available (Rs. in Lakh)	1.87	1.81	1.74	1.66	1.57
J	Total Debt Outgo (Rs. in Lakh)	0.63	0.69	0.76	0.84	0.93
K	Debt Service Coverage Ratio (DSCR)	3.00	2.62	2.28	1.97	1.69
	Average DSCR	2.16				
L	Cash accruals (PBDIT- Interest-Tax) (Rs. in Lakh)	-4.83	90.82	108.72	126.63	111.09
M	Payback Period	2.5 Years				
	(on Rs. 37.03 Lakhs initial investment)					

2.13 REPAYMENT SCHEDULE

Year	Beginning	PMT	Interest	Principal	Ending Balance
1	1,814,640.77	251,725.48	188,722.64	63,002.84	1,751,637.92
2	1,751,637.92	251,725.48	182,170.34	69,555.14	1,682,082.78
3	1,682,082.78	251,725.48	174,936.61	76,788.87	1,605,293.91
4	1,605,293.91	251,725.48	166,950.57	84,774.92	1,520,518.99
5	1,520,518.99	251,725.48	158,133.97	93,591.51	1,426,927.48
6	1,426,927.48	251,725.48	148,400.46	103,325.03	1,323,602.45
7	1,323,602.45	251,725.48	137,654.66	114,070.83	1,209,531.63

8	1,209,531.63	251,725.48	125,791.29	125,934.20	1,083,597.43
9	1,083,597.43	251,725.48	112,694.13	139,031.35	944,566.08
10	944,566.08	251,725.48	98,234.87	153,490.61	791,075.47
11	791,075.47	251,725.48	82,271.85	169,453.64	621,621.83
12	621,621.83	251,725.48	64,648.67	187,076.81	434,545.02
13	434,545.02	251,725.48	45,192.68	206,532.80	228,012.21
14	228,012.21	251,725.48	23,713.27	228,012.21	(0.00)
		3,524,156.78	1,709,516.01	1,814,640.77	(1,814,640.77)

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	5.18	4.92	4.67	4.44	4.22	4.01	3.81	3.62
Depreciation	0.26	0.25	0.23	0.22	0.21	0.20	0.19	0.18
Depreciated value	4.92	4.67	4.44	4.22	4.01	3.81	3.62	3.44
Plant & Machinery	18.86	16.97	15.28	13.75	12.37	11.14	10.02	9.02
Depreciation	1.89	1.70	1.53	1.37	1.24	1.11	1.00	0.90
Depreciated value	16.97	15.28	13.75	12.37	11.14	10.02	9.02	8.12
Other Fixed	0.80	0.68	0.58	0.49	0.42	0.35	0.30	0.26

Assets								
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	24.84	22.58	20.53	18.68	17.01	15.50	14.13	12.89
Depreciation	2.27	2.05	1.85	1.67	1.51	1.37	1.24	1.12
Depreciated value	22.58	20.53	18.68	17.01	15.50	14.13	12.89	11.77

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
Capital cost (Rs. in Lakh)	37.03	0.00	0.00	0.00	0.00		
Recurring cost (Rs. in Lakh)	2.96	92.07	106.98	121.90	144.12		
Total cost (Rs. in Lakh)	39.99	92.07	106.98	121.90	144.12		505.07
Benefit (Rs. in Lakh)	0.00	206.25	243.75	281.25	281.25		
Total Depreciated value of all assets (Rs. in Lakh)						11.77	
Total benefits (Rs. in Lakh)	0.00	206.25	243.75	281.25	281.25	11.77	1012.50
Benefit-Cost Ratio (BCR): (Highly Profitable project)	**2.005**						
Net Present Worth (NPW):	507.43						

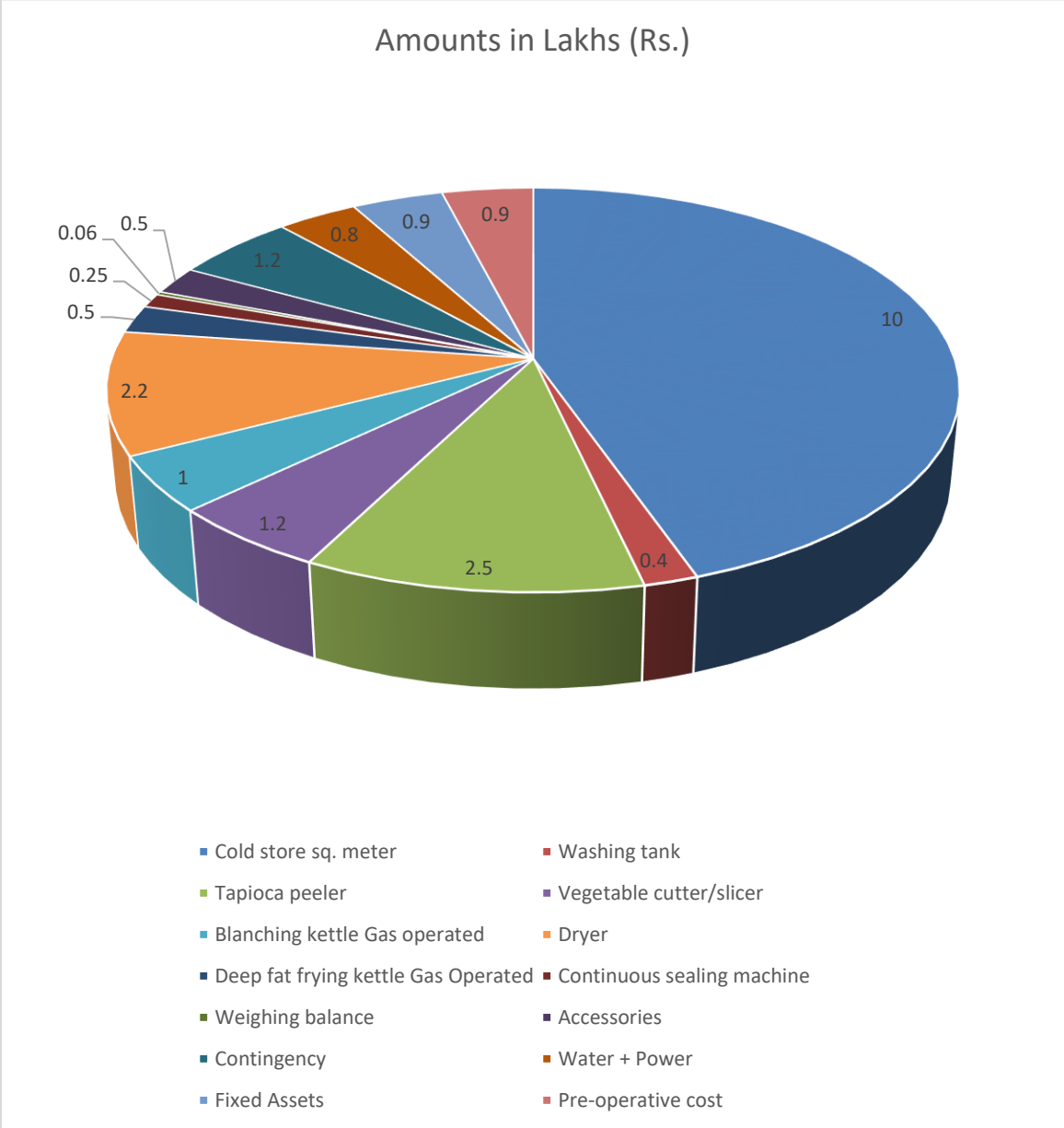
2.16 BREAK EVEN ANALYSIS

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.

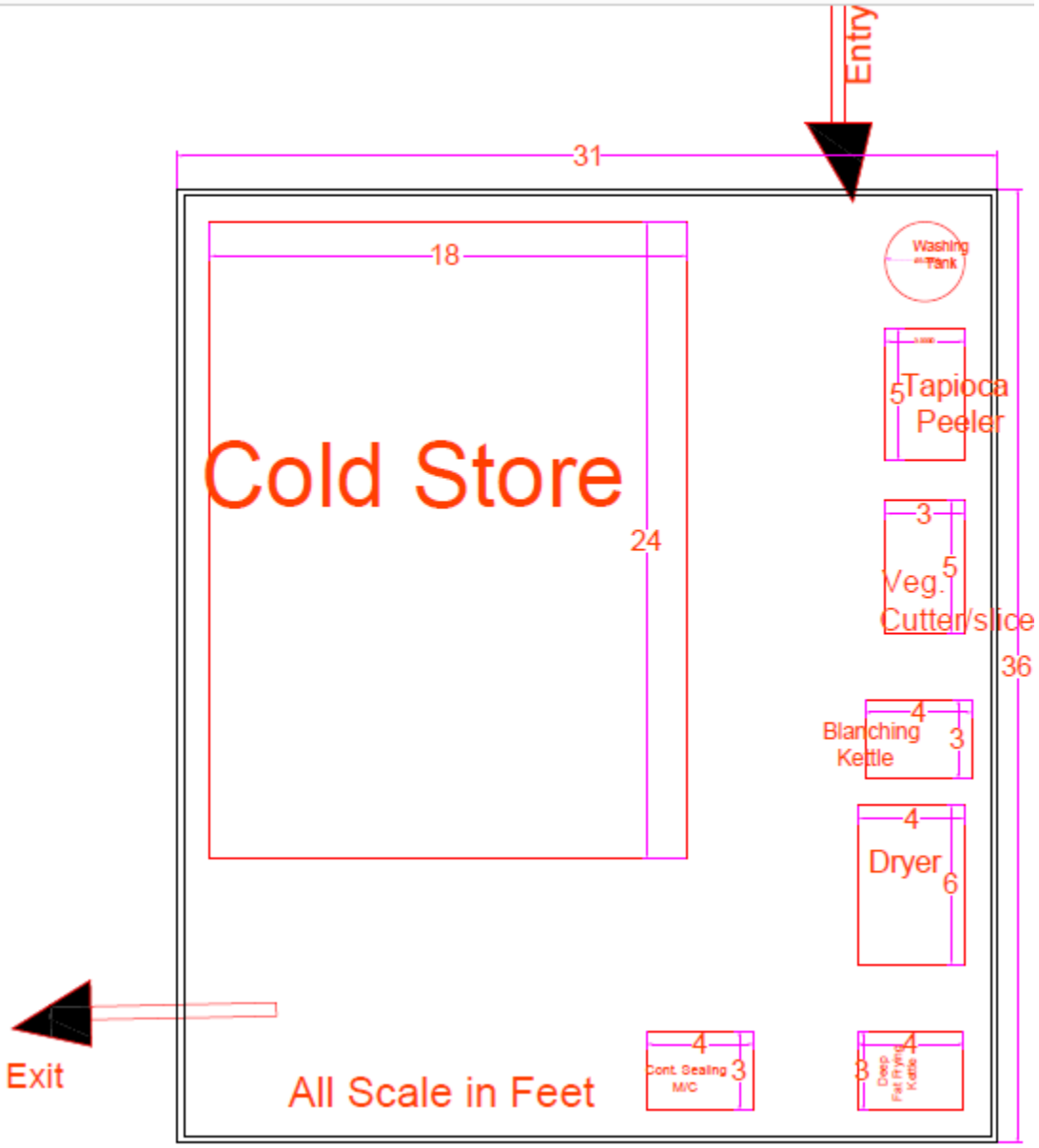
Particulars	1st Year	2nd year	3 rd year	4th year	5th year
Capacity utilization (%)	Under Const.	55%	65%	75%	90%
Production MT/Annum		82.5	97.5	112.5	135
Fixed Cost (Rs. in Lakh)					
Permanent staff salaries	7.284	7.284	7.284	7.284	7.284
Depreciation on building @ 5% per annum	0.26	0.25	0.23	0.22	0.21
Depreciation on machinery @ 10% per annum	1.89	1.70	1.53	1.37	1.24
Depreciation on other fixed assets @ 15% per annum	0.12	0.10	0.09	0.07	0.06
Interest on term loan	1.89	1.82	1.75	1.67	1.58
Insurance	0.3	0.3	0.3	0.3	0.3
Total Fixed Cost (Rs. in Lakh)	**11.7362264**	**11.4512**	**11.1814736**	**10.9242**	**10.6763**
Sales Revenue (Rs. in Lakh)	**0**	**206.25**	**243.75**	**281.25**	**281.25**
Variable Cost (Rs. in Lakh)					
Tapioca vegetable(Av. Price @ Rs. 15/Kg)	0.00	33.35	39.41	45.48	54.57
Oil @ 130 per kg	0.00	34.65	40.95	47.25	56.70
Other ingredients @3/Kg	0.00	0.05	0.06	0.07	0.09
Packaging materials	0.00	12.38	14.63	16.88	20.25
Casual staff salaries	0.00	5.78	5.78	5.78	5.78
Utilities (Electricity, Fuel)	0.00	1.06	1.25	1.44	1.73

Repair & maintenance	0.00	0.70	0.80	0.90	0.90
Miscellaneous expenses	0.50	2.00	2.00	2.00	2.00
Interest on working capital @ 12%	0.00	3.31	3.91	5.33	5.33
Total Variable Cost (Rs. in Lakh)	**0.50**	**93.28**	**108.80**	**125.13**	**147.36**
Break Even Point (BEP)					
as % of sale	-	12.00	10.00	8.00	8.00
Break Even Point (BEP) in terms of sales value (Rs. in Lakhs)	-	24.75	24.38	22.50	22.50

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



2.18 TYPICAL TAPIOCA CHIPS MANUFACTURING UNIT LAYOUT



2.19 MACHINERY SUPPLIERS

There are many machinery suppliers available within India for Vegetables based chips processing machineries and equipment. Some of the suppliers are:

1. Bajaj Process pack Limited, Noida, India
2. Shriyan Enterprises. Mumbai, India
3. Jwala Technocrats, Boiser, Maharashtra, 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.

Contact Us

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