MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

PMFME
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NIFTEM
THANJAVUR

PM Formalisation of
Micro Food Processing Enterprises Scheme

DETAILED PROJECT REPORT FOR
PROCESSING OF BANANA CHIPS

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Contents

Sr. No.	Topic	Page
	The Project at a Glance	3
1	General Overview of Banana production, Clusters, PHM and value addition in India	
	1.1 Introduction	4
	1.2 Origin, Distribution and Production of Banana	5
	1.3 Varieties	7
	1.4 Health benefits and Nutritional Importance	8
	1.5 Cultivation, Bearing & Post-Harvest Managements	11
	1.6 Processing and Value Addition in India	15
2	Model Banana chips processing under FME Scheme	
	2.1 Location of Proposed project and land	19
	2.2 Installed capacity of Banana chips processing plant	19
	2.3 Raw Material requirement for The Unit	19
	2.4 Manufacturing Process	20
	2.5 Market Demand &supply for banana chips	23
	2.6 Marketing strategy for Banana products	24
	2.7 Detailed Project Assumptions	24
	2.8 Fixed capital Investments	
	2.8.1 Plants and Machinery	26
	2.8.2 Other Costs	26
	2.9 Working Capital Requirements	27
	2.10 Total Project Cost & means of finances	28
	2.11 Manpower Requirements	28
	2.12 Expenditure, Revenue and Profitability Analysis	29
	2.13 Repayment Schedule	30
	2.14 Assets depreciation	31
	2.15 Financial Assessment of project	32
	2.16 Break even analysis	33
	2.17 Pie chart	35
	2.18 Plant Layout	36
	2.19 Machinery suppliers	36
3	Limitations of Model DPR & Guidelines for Entrepreneurs	
	3.1 Limitations of Model DPR	39
	3.2 Guidelines for Entrepreneurs	39

Project At a Glance		
1	Name of the Project	Banana chips
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, 3rd, 4th ,5th & 6th years' onwards respectively
11	Raw materials	Banana Fruit
12	Major product outputs	Banana chips
13	Total project cost (Lakhs)	32.79
	Land development, building & civil construction	5.18
	Machinery and equipment	17.41
	Utilities (Power & water facilities)	0.8
	Miscellaneous fixed assets	0.9
	Pre-operative expenses	0.90
	Contingencies	1.20
	Working capital margin	6.40
14	Working capital Management (In Lakhs)	
	Second Year	19.20
	Third Year	22.69
	Fourth Year	30.94
15	Means of Finance	
	Subsidy grant by MoFPI (max 10 lakhs)	10.00
	Promoter's contribution (min 20%)	7.87
	Term loan (45%)	4.92
16	Debt-equity ratio	1.90 : 1
17	Profit after Depreciation, Interest & Tax	
	2nd year	48.92
	3rd year	55.60
	4th year	65.74
18	Average DSCR	2.16
	Benefit Cost Ratio	1.98
	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 BANANA PRODUCTION, CLUSTERS, POST-HARVEST MANAGEMENT AND VALUE ADDITION IN INDIA

1.1 INTRODUCTION

India is known as the second largest fruits and vegetables producer in the world followed by China. India, during 2017-18 has produced about 97358 thousand MT fruits and 184394 thousand MT vegetables in about 6506 Thousand Ha and 10259 Thousand Ha respectively (Horticulture statistics At a glance, 2018, MoA & FW Gol). IN spite of this, the per capita availability of fruit in India is 107 gm/day which is below the recommended 120 gm/day.

India's share of global exports of fresh fruits and processed fruit products is also quite meager compared to other major fruit producers of the world (Bung, 2012). Market Outlook India is the world's largest banana producer with an annual output of 24.8 million tonnes. Banana exports by country totaled US$11.8 billion in 2016. Banana is a globally important fruit crop with 97.5 million tons of production. In India it supports livelihood of millions of people with total annual production of 16.91 million tons from 490.70 thousand ha. With national average of 33.5 T/ha. Banana contributes 37% to total fruit production in India.

Unfortunately, fruits and vegetables being perishable in nature get wasted to the tune of 20-30 % in the supply chain due to improper handling, transportation and poor post-harvest management; and only 2 % of them are processed in to value added products and the rest is consumed fresh.

Therefore, processing of fruits and vegetables offers immense scope for wastage minimization and value addition; thus can generate significant income and employment in Indian agrarian economy. In India Banana is one the important fruit crops cultivated in different areas and has huge potential for value addition and entrepreneurship development.

Banana (*Musa sp*.) is one of the widely consumed fruit all over the world. It is a rich source of various nutritional constituents includes iron, phosphorous, potassium, calcium and vitamins. India is the largest producer of banana in the world and it contributes 25.7 % to the world's banana production. India grows 32 million metric tons of banana and it covers 13% of the total farmland in the country. Over 90% banana are domestically used and 10% are subjected to processing. It is a highly perishable fruit owing to its high moisture content and climacteric nature. Though India is the major producers of banana there is a significant loss in the food value of banana due to improper postharvest management practices. Appropriate food processing techniques can be used to convert them from perishable to semi-perishable product with the shelf stability of 3-6months. The processing of banana adds value to the product where farmer or trader can get better price.

1.2 ORIGIN, DISTRIBUTION AND PRODUCTION OF BANANA

Banana is a fruit that grows near tropical rainforests. All parts of the plant, including the fruit, leaves, "false stem," stem, flowers, and roots, can be used as medicine. In North America, most of the available bananas are from one specific variety. However, there are many varieties available around the world. Bananas have been grown as crops for thousands of years. Banana is the oldest and commonest fruit known to the mankind. It is one of the important fruits, and constitutes second largest fruit industry in India. It is nutritious palatable and easily digestible fruit. It is available throughout the year. Banana is rich in carbohydrates, minerals such as calcium, potassium, Mg, Na and

phosphorous. Other than fresh fruits, it can be consumed as processed in various forms like chips, powder, flakes, etc. Banana pseudostem is chopped and used as cattle feed. Also, the leaves are used as plate. The botanical names of banana are *Musa cavendish* and *Musa paradisiaca*, which belongs to the family *Musaceae.*

Generally, it is agreed that **bananas originated** in Southeast Asia and the South Pacific around 8000 to 5000 BC. **Bananas** are believed to have been the world's first cultivated fruit. From Southeast Asia, the fruit was brought west by Arab conquerors and then carried to the New World by explorers and missionaries. A **banana** is an elongated, edible fruit – botanically a berry – produced by several kinds of large herbaceous flowering plants in the genus *Musa*. In some countries, bananas used for cooking may be called "plantains", distinguishing them from **dessert bananas**. The fruit is variable in size, color, and firmness, but is usually elongated and curved, with soft flesh rich in starch covered with a rind, which may be green, yellow, red, purple, or brown when ripe. The fruits grow in clusters hanging from the top of the plant. Almost all modern edible seedless (parthenocarp) bananas come from two wild species – *Musa acuminata* and *Musa balbisiana*. The scientific names of most cultivated bananas are *Musa acuminata*, *Musa balbisiana*, and *Musa* × *paradisiaca* for the hybrid *Musa acuminata* × *M. balbisiana*, depending on their genomic constitution. The old scientific name for this hybrid, *Musa sapientum*, is no longer used. *Musa* species are native to tropical Indomalaya and Australia, and are likely to have been first domesticated in Papua New Guinea.They are grown in 135 countries, primarily for their fruit, and to a lesser extent to make fiber, banana wine, and banana beer and as ornamental plants. The world's largest producers of bananas in 2017 were India and China, which together accounted for approximately 38% of total production.

Worldwide, there is no sharp distinction between "bananas" and "plantains". Especially in the Americas and Europe, "banana" usually refers to soft, sweet, dessert bananas, particularly those of the Cavendish group, which are the main exports from banana-growing countries.

Andhra Pradesh, Gujarat, Maharashtra, Tamilnadu, Uttar Pradesh, Karnataka, Madhya Pradesh, Bihar, west Bengal and Kerala are the leaders of Banana Production in India. And they are in descending order of Production data wise.

1.3 VARIETIES

Ayrinka Poovan	No male flowers, so whole axis covered with fruits.
	15 months crop duration
	Variety of Rasthali
Njalipoovan	Shade loving variety
	Very sweet fruits
	Very thin peels
	Poor keeping quality
	Suitable for intercropping with coconuts
	Grown in Kerala
Kathali	Small-sized, very sweet fruits
	Popular in Kerala
Karpooravalli	Tall and robust
	Suitable for growing in low soil input areas
	Suitable for growth in drought affected areas
Cavendish	Ripe fruits are green in color
	Poor keeping quality
	Dwarf stature of plants make it less susceptible to damages by wind
Robusta	Ripe bananas are green in color
	Another dwarf variety
Nendran	Distinct neck with a thick skin
	Skin turns buff yellow on ripening
	Starchy even after ripening

Monthan	Stocky, bold, knobbed fruits with pale green color
	Cultivated for leaves
	Tolerant to salt
Red Banana	Red colored skin
	Fruit size is large
	Skin turns dark brown or deep red on ripening
Palayam Kodan	Very soft when fully ripe
	Cooling effect under humid weather conditions

1.4 HEALTH BENEFITS AND NUTRITIONAL INFORMATION

Nutritional value:

The nutrition facts for 1 medium-sized banana (100 grams) are:

- **Calories:** 89
- **Water:** 75%
- **Protein:** 1.1 grams
- **Carbs:** 22.8 grams
- **Sugar:** 12.2 grams

- **Fiber:** 2.6 grams
- **Fat:** 0.3 grams

Bananas are a good source of several vitamins and minerals, especially potassium, vitamin B6, and vitamin C.

- **Potassium.** Bananas are a good source of potassium. A diet high in potassium can lower blood pressure in people with elevated levels and benefits heart health.
- **Vitamin B6.** Bananas are high in vitamin B6. One medium-sized banana can provide up to 33% of the Daily Value (DV) of this vitamin.
- **Vitamin C.** Like most fruit, bananas are a good source of vitamin C.

CONSTITUENTS AND HEALTH BENEFITS OF BANANAS

Health benefits:

- **High Fiber Content:** Banana is loaded with fiber, both soluble and insoluble. The soluble fiber has the tendency to slow down digestion and keep you feeling full for a longer time. Which is why bananas are often included in a breakfast meal so that you can start about your day without having to worry about the next meal.

- **Heart Health:** High fibre foods are said to be good for the heart. According to a study done by University of Leeds in UK, increasing the consumption of fibre-rich foods such as bananas can lower the risk of both cardiovascular disease (CVD) and coronary heart disease (CHD).

- **Ease in Digestion:** According to Ayurveda, banana has a sweet and sour taste. The sweet taste is said to bring about a sense of heaviness but the sour taste is known to

stimulate *agni* (the digestive juices), thereby supporting digestion and helping in building up metabolism.

- **Powerhouse of Nutrients:** Banana is a heavyweight when it comes to nutrition. It is loaded with essential vitamins and minerals such as potassium, calcium, manganese, magnesium, iron, folate, niacin, riboflavin, and B6. These all contribute to the proper functioning of the body and keeping you healthy.

- **High Source of Potassium**: The high content of potassium in bananas makes it a super fruit. This mineral is known for its numerous health benefiting properties - it helps in regulating heartbeat, blood pressure, and keeps the brain alert. So make sure you add bananas to your daily to keep your heart and brain healthy, plus for more stabled blood pressure.

- **Blood Pressure**: It is a known fact that salt is the culprit when it comes to high blood pressure. Bananas have low salt content and high potassium content, and these properties contribute to making it an ideal for those undergoing this condition. But make sure you consult your nutritionist or doctor before you add it o your diet.

- **Helps Fight Anaemia:** Due to the high iron content in bananas, they are good for those suffering from anaemia. Anaemia is a condition where there is a decrease in the number of red blood cells or haemoglobin in the blood. This leads to fatigue, shortness of breath, and paleness. But, as we always say that moderation is the key.

1.5 CULTIVATION, BEARING & POST HARVEST MANAGEMENT:-

The banana plant is the largest herbaceous flowering plant. All the above-ground parts of a banana plant grow from a structure usually called a "corm". Plants are normally tall and fairly sturdy, and are often mistaken for trees, but what appears to be a trunk is actually a "false stem" or pseudostem. Bananas grow in a wide variety of soils, as long as the soil is at least 60 centimetres (2.0 ft) deep, has good drainage and is not compacted. The leaves of banana plants are composed of a "stalk" (petiole) and a blade (lamina). The base of the petiole widens to form a sheath; the tightly packed sheaths make up the pseudostem, which is all that supports the plant. The edges of the sheath meet when it is first produced, making it tubular. As new growth occurs in the centre of the pseudostem the edges are forced apart. Cultivated banana plants vary in height depending on the variety and growing conditions. Most are around 5 m (16 ft) tall, with a range from 'Dwarf Cavendish' plants at around 3 m (10 ft) to 'Gros Michel' at 7 m (23 ft) or more. Leaves are spirally arranged and may grow 2.7 metres (8.9 ft) long and 60 cm (2.0 ft) wide. They are easily torn by the wind, resulting in the familiar frond look.

When a banana plant is mature, the corm stops producing new leaves and begins to form a flower spike or inflorescence. A stem develops which grows up inside the pseudostem, carrying the immature inflorescence until eventually it emerges at the top. Each pseudostem normally produces a single inflorescence, also known as the "banana heart". (More are sometimes produced; an exceptional plant in the Philippines produced five. After fruiting, the pseudostem dies, but offshoots will normally have developed from the base, so that the plant as a whole is perennial. In the plantation system of cultivation, only one of the offshoots will be allowed to develop in order to maintain spacing. The inflorescence contains many bracts (sometimes incorrectly referred to as petals) between rows of flowers. The female flowers (which can develop into fruit) appear in rows further up the stem (closer to the leaves) from the

rows of male flowers. The ovary is inferior, meaning that the tiny petals and other flower parts appear at the tip of the ovary.

The banana fruits develop from the banana heart, in a large hanging cluster, made up of tiers (called "hands"), with up to 20 fruit to a tier. The hanging cluster is known as a bunch, comprising 3–20 tiers, or commercially as a "banana stem", and can weigh 30–50 kilograms (66–110 lb). Individual banana fruits (commonly known as a banana or "finger") average 125 grams (4 1⁄2 oz), of which approximately 75% is water and 25% dry matter (nutrient table, lower right).

The fruit has been described as a "leathery berry". There is a protective outer layer (a peel or skin) with numerous long, thin strings (the phloem bundles), which run lengthwise between the skin and the edible inner portion. The inner part of the common yellow dessert variety can be split lengthwise into three sections that correspond to the inner portions of the three carpels by manually deforming the unopened fruit. In cultivated varieties, the seeds are diminished nearly to non-existence; their remnants are tiny black specks in the interior of the fruit.

Cultivation and Bearing:-

Banana grows at an altitude of 1200 meters from sea level in a warm and humid climate. 20^0C- 35^0C is the most favorable temperature range along with a high level of humidity for banana farming in India. The growth gets retarded below 20^0C and above 35^0C. They take longer time to mature in cooler climates while the growth and yield is reduced at lower humidity and temperature. An average annual rainfall of 1700 mm distributed evenly throughout the year favors good growth and satisfactory yield.

Tissue culture banana cultivation gives more freedom as tissue culture banana varieties can be planted any time of the year as per the market demands. However, the temperature at the time of banana plantation must be moderate- neither too high nor too low.

The planting schedule depends on:

- Type of land
- Cultivation practice being followed
- Duration of the cultivar (long or short)

For successful banana plantation, good porous, fertile soil with rich organic content is necessary since it is a heavy feeder. In addition, they have a restricted root zone therefore; drainage and depth of the soil are two important factors that must be considered. In addition to having a good drainage capacity, the soil must be able to retain moisture and have a pH of 6.5-7.5. The nitrogen content of the soil must be high along with adequate levels of potash and phosphorus.

Black loamy soil of Maharashtra, clayey heavy soil along the Cauvery delta region, the alluvial soil of the Gangetic plains, sandy loam of Kerala and red laterite soil in the hilly regions of Kerala are ideal for banana plantation. Needless to say, these areas are well-known for banana cultivation.

For the entire life cycle of banana it needs 900-1200mm of water. This is generally met through rainfall and whatever extra is needed it is provided through irrigation. It is important to maintain the moisture level at optimum during all growth stages and also drain out the excess water from the root zone. This is important from the point of view of growth and productivity of banana tree. Irrigation is done once a week when the climate is cool and once in every 3 days under hot conditions. Drip irrigation, trench irrigation and flood are some of the common irrigation systems followed for cultivation of banana. Each of them have their own merits and demerits. However, the most economical and popular one is drip irrigation. This is because they ensure water being dispensed at the root zone.

The land is tilled and ploughed so as to break down the soil clods. Stones, rocks and other debris must be removed. The land must be a fine tilth.

Sometimes the fields are ploughed thoroughly till the soil becomes a fine tilth. Pits measuring upto 1.5 feet in depth are dug and exposed to sun for 2-3 days. This process helps in controlling weeds. Some farmers pack the pits with farm yard manure, phorate and neem cake, irrigate the field and then leave it as such for 3-4 days. This step helps the manure to get mixed with soil and also settle the loose soil. In places where there is high humidity but temperature can fall upto 5^0C, the distance is kept t 2.1 X 1.5 m.

Farmers practice high density banana cultivation wherein upto 2000 plants can be accommodated in one acre. Here is a table showing the variety and number of plants per acre:

Post-harvest management:-

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

- Fruits are graded according to their size and color. All the diseased, deformed, bruised and unripe fruits are sorted out.
- Do not leave harvested fruit out in the hot sun;
- Do not pick cold, wet fruit. When wet turgid fruit is handled the oil
- Wear cotton gloves when harvesting. This reduces chances of getting injured.
- Use picking bags. This reduces damage as a result of abrasion on
- Wooden or metal picking bins and allows fruit to be gently lowered into
- Bulk harvesting bins;
- Do not leave stems on fruit or damage buttons by “plugging”;
- Use clean, smooth harvesting bins;
- Make sure packing line equipment is cleaned regularly. This reduces dirt and wax buildup which can cause fruit abrasion;
- Reduce packing line abrasion by using foam, rubber and smooth belts to Cushion fruit;

- Remove old and rotten fruit regularly from the packing shed and surrounds;
- Treat harvested fruit with a registered fungicide within 24hrs of harvest;

The general practice is to wash the harvested fruits with chlorine or sanitizing solution. If the fruits have to be transported over longer distances, then they are packed in wooden boxes else baskets made of bamboos. The boxes or baskets have to be ventilated and the fruits should be wrapped in tissue paper or newspaper for protection.

1.6 PROCESSING & VALUE ADDITION:-

Asia produces about 40% of the banana out of global annual production of 45 million metric tons. With the available technologies, post-harvest losses can be reduced to half and simultaneously value addition can be made for this produce. An attempt is made to pool the knowledge of post-harvest handling to improve the shelf life, processing and by-products utilization of banana crop for producing value added products from it. The harvesting methods, techniques for prolonging the shelf life of fruit using chemical dips, low-temperature methods, controlled atmosphere storage; sub atmospheric-pressure storage, etc. are discussed.

The fresh fruits have limited shelf life; therefore, it is necessary to process fresh fruits in to different value added products to increase its availability over an extended period and to stabilize the price during the glut season. The processed products have good potential for internal as well as external trade. Seasonal losses in surplus banana fruits can be avoided by processing into different value added products that make them more attractive to the buyer and/or more readily usable to the consumer. Banana being rich in taste can be used for preparation of natural biscuits (Cookies). Ripened banana is an excellent raw material for preparation of Banana Chips, Cookies (Biscuits), Wine, Vinegar, Paste, Banana Figs, catsup Banana Pulp, Puree,

Concentrate Banana Flour (Powder). In view of changing consumer attitude, demand and emergence of new market, it has become imperative to develop products that have nutritional as well as health benefits.

The banana is a versatile fruit for preparing several processed foods through simple processing methods. Processing techniques of several products such as pulp, juice, canned slices, jams, deep-fat-fried chips (crisps), toffee, fig, fruit bars, brandy, etc. are presented. Apart from these, value addition techniques for utilization of by-products are also emphasized.

In this context, banana has excellent digestive and nutritive value, pleasant flavour, high palatability and availability in abundance at very very cheap rates. Banana is a very popular fruit in India and it is available throughout the year except few months. The nutritive value of the fruit is very high and thus it is an ideal crop for processing and value addition.

It is consumed in large quantities either fresh or in such prepared foods such as Banana Chips, Cookies (Biscuits), Wine, Vinegar, Paste, Banana Figs, catsup, Banana Pulp, Puree, Banana Flour (Powder).

In current days dried fruits or candied fruits are running fast in the market. Amongst the aforesaid usages Chips (Banana Chips) is the mostly liked by the people.

Value added products from banana fruit:

- **Flour:** Flour can be produced from bananas to different degrees of fineness. The product is like wheat flour but cheaper to produce, due to availability of the fruit. Typically, it's produced from green banana pulp. The pulp is dried then

ground to produce flour. The funny thing is that the entire process can be done by hand – that wouldn't make sense for business purposes practically speaking.

- **Pastries:** Banana flour is a product by itself. It can also make other products there is a market for. Don't you just love capitalism? It works. The flour can make bread, cakes, pancakes, cookies and all other pastries people have come up with. If you can work it into a dough, banana flour fits.

- **Crisps/chips:** The banana fruit is sliced and fried into crisps just as potatoes are. Banana chips are deep-fried or dried slices of bananas (fruits of herbaceous plants of the genus Musa of the soft, sweet "dessert banana" variety). They can be covered with sugar or honey and have a sweet taste, or they can be fried in oil and spices and have a salty or spicy taste. Banana chips are commonly found in India and Indonesia (as kripik). Variants of banana chips may be covered with chocolate instead

- **Banana Puree**: Bananas for puree production ideally should be harvested at the point of maturity. Ripened bananas at color index 6 and 7 are selected and washed thoroughly to remove adhering dirt and any chemical residue that may be present. Bananas are then blanched with either food grade steam or boiling water until a center temperature of 93°C is reached. A medium size, unpeeled banana requires 10 to 15 minutes to attain this temperature. Blanched bananas are then cooled and peeled. The puree is then obtained by passing peeled blanched bananas in communition machines. Banana puree has an attractive color, fine texture and retain its fruity flavor. Banana puree developed must be further treated to ensure their preservation until the moment of final utilization and processing. The puree can be frozen, canned or aseptically packed. The puree is used for beverage industry, baby foods, snack foods, jam and sauces.

- **Banana Jam:** Banana with sweet taste, fine flavor and texture can be processed into excellent jam. The processing of the product is basically similar to that of other fruit jam. Banana puree having total soluble solid and pH value in the range of 24-26° Brix and 4.4-4.6 respectively are the main ingredients used in the processing of banana jam. The proportion of banana puree, sugar, pectin and citric acid used in the processing of banana jam should be given special emphasis in order to produce a clear and fine texture jam. Banana jam has a good shelf-life. Machinery to be installed and used: Pulper, Juice Extractors, Mixer/Grinders, Cap Sealing Machines, Slicers, Bottle Washing Machine

- **Banana Sauce:** Banana sauce is a ready-to-eat to sauce. It is used for moistening, flavour control and as a garnish to make food more delicious. The sauce has a strong banana taste and flavour and a dull yellow-red colour. The total soluble solid content varies from 39-40°Brix depending on the variety of bananas. It has a shelf-life of one year when stored in bottles.

- **Banana Drink:** Banana puree is used extensively in the processing of straight banana drink. This banana drink needs no dilution before consumption. The product is pasteurized at 90°C to destroy microorganisms, molds and yeasts before bottling. It can also be canned or aseptically packed. The drink has the total soluble solid content of 12-13°Brix and pH of 4.0. The drink may or may not be sweetened. The sweetening agent used can either be sucrose or a combination of sucrose and HFGS. In the enzymatic treated banana drink, pectinase and amylase are added after the acidification process to produce a clear drink.

2. MODEL BANANA 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 Banana Chips processing unit are in the production clusters of Banana growing states such as Andhra Pradesh, Gujarat, Maharashtra, Tamil Nadu, Uttar Pradesh, Karnataka, Madhya Pradesh, Bihar, west Bengal and Kerala where adequate quantities of surplus raw materials can be available for processing.

2.2 INSTALLED CAPACITY OF THE BANANA CHIPS PROCESSING UNIT

The maximum installed capacity of the Banana chips manufacturing unit in the present model project is proposed as 150 tonns/annum or 500 kg/day Banana 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 & 6th year onwards 100 percent capacity utilization is assumed in this model project.

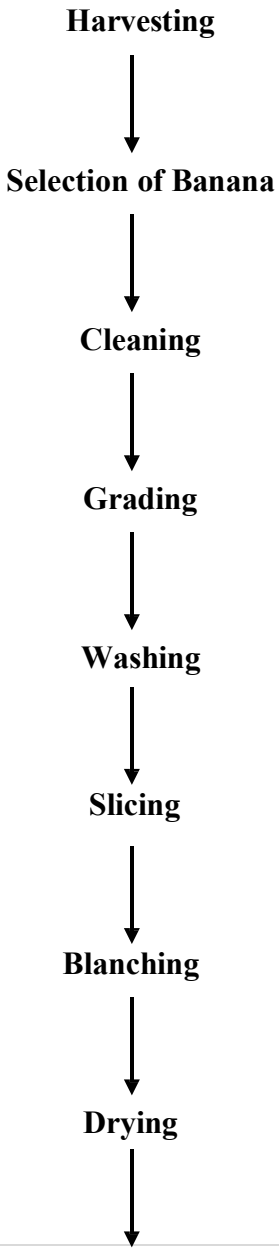
2.3 RAW MATERIAL REQUIREMENTS FOR THE UNIT

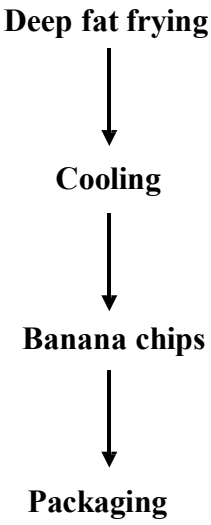
A sustainable food processing unit must ensure maximum capacity utilization and thus requires an operation of minimum 280-300 days per year to get reasonable profit. Therefore, ensuring uninterrupted raw materials supply requires maintenance of adequate raw material inventory. The processor must have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

materials which otherwise get spoiled. In the Banana chips manufacturing project, the unit requires 864.3 kg/day, 1021.4 kg/day, 1178.57 kg/day, 1414.28 Kg/day & 1571.43 kg/day Banana fruits at 55, 65, 75, 90 & 100 percent capacity utilization, respectively.

2.4 MANUFACTURING PROCESS OF THE BANANA CHIPS

Flow chart for banana chips:





Selection of Banana

Unripe Banana with bright color and characteristic flavor are selected. The variety and maturity of fruit influence the flavor and keeping quality of its final product. All bananas soften extremely quickly, making them vulnerable to bruising and subsequent rotting. So gently pick the unripened fruits from the tree. The fruits should be harvested in the morning hours.

Sorting

Sorting is the process of grouping according to size, shape, colour and weight. Sorting covers two main separate processing operations:

a. Removal of damaged fruit and any foreign bodies (which might have been left behind after washing).

b. Qualitative sorting based on organoleptic criteria and maturity stage. Mechanical sorting for size is usually not done at the preliminary stage. The most important initial sorting is for variety and maturity.

Washing

Washing and sanitizing the fruits is required to remove the pesticide residues, plant debris and other possible contamination as well as microorganisms responsible for quality loss and decay. Generally immersed in tap water whereas sanitizing agents are added to process water to effectively reduce the microbial loads on the fruit surface. Bananas are seldom washed. Washing with water must be accompanied with brushing, rubbing, and forcing the water against the fruit and into crevices. Detergents are frequently used in the wash or rinse water. Dirt and microorganisms are removed by washing with chlorine dioxide solution. Rinsed with Chlorine dioxide solution (10-100 ppm) solution and again rinsed with water in fruit washing tank. Fluming in cold water reduces contact with the air and reduces bruising of soft fruit and is a retardant to oxidation if an antioxidant is used.

Slicing

Slicing of bananas can be done manually or mechanically. In manual process, it should be done with hands using a serrated knife.

Mechanically, it can be done using a fruit slicer machine. Banana fruits are sliced into thin slices for quick moisture reduction.

Blanching

Blanching is done to preserve a good colour and softens the fruit so that it dries more quickly later on, also it inactivates the enzymes and reduce the number and activity of microbes. The length of time needed to blanch varies with the type of vegetable, the size of the pieces and the number of pieces blanched at any one time. If blanching done for too long, they lose their colour and taste. Blanch the banana s in the boiling water for about 30 to 60 seconds. Then cool slightly by running the cold water over them.

Drying

• Tradition Drying Method: Sun Drying

Drying of bananas takes place by utilizing the heat energy radiated by sun. The sliced bananas are spread on any available space and allowed under sun until it is completely dried.

Other improved drying methods like solar drying, tunnel drying, tent drying and osmotic drying methods are also used.

Frying

Deep fat frying of dried banana slices take place. Deep fat frying replaces the moisture content with oil.

Packaging

The banana chips can be packed using the form fill sealer in plastic or foil bags. It can also be packed in tins and glass containers.

2.5 MARKET DEMAND AND SUPPLY FOR BANANA CHIPS

Banana chips are gaining worldwide popularity owing to their nutritional content. Inside the food industry, the demand for banana chips is increasing from the snacks and ready to cook food sector. Food processing segment is expected to gain higher percentage in market share during the forecast period. Food processing is principally driven by growing urbanization and rapidly surging millennial population clubbed with increasing awareness among consumers regarding organic food products in market. The Fruit based products such as cookies, snacks are part and parcel of consumption pattern both in rural and urban India.

The fruit based foods consumption is picking up due to increasing income and changing food habits. Therefore, demand for fruit based products are prevalent across length and breadth of the country throughout the year. Therefore, any kind of Ready to Serve (RTS) fruit based foods have huge potential across India. Further, Banana being high in calories and low in fats but rich in vital vitamins (Vitamin – B complex, Vitamin-A) minerals (Potassium, Calcium, Magnesium, Phosphorus), dietary fiber, and antioxidants can play a pivotal role to prevent cancers, aging, infections etc.

Therefore, Banana Chips if highlighted properly for all these health benefits can occupy significant food market.

2.6 MARKETING STRATEGY FOR BANANA CHIPS

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

2.7 DETAILED PROJECT ASSUMPTIONS

This model DPR for Banana 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 fruit processing unit by adding new snacks processing 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. Banana cost considered @ Rs.7/-per kg.
    2. 1 kg Banana will produce 70% 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 Banana 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, & 100% in sixth 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	7	
Average sale prices per Kg	170	Rs/kg
Pulp extraction	70	
BANANA CHIPS	3.14 Kg Banana for 1 kg Banana chips	

2.8 FIXED CAPITAL INVESTMENT

2.8.1 MACHINERY AND EQUIPMENT

Sr No.	Equipment	Capacity	Quantity	Price (Rs. In Lacs)
1	Cold store sq. meter	1	9000 Kg	10
2	Washing tank	1	500 liter	0.4
3	Banana cutter/slicer	1	500 kg/hr	2.5
4	Blanching kettle Gas operated	1	300 Liter	1
5	Dryer	1	120 kg /batch	2.2
6	Deep fat frying kettle Gas Operated	1	100 liter	0.5
7	Continuous sealing machine	1	Suitable	0.25
8	Weighing balance	1	Suitable	0.06
9	Accessories	1	Suitable	0.5
			Total	17.41

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, 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 32.79 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	2.29	2.70	3.69
Work in progress	15 days	4.58	5.41	7.37
Packing material	15 days	0.45	0.53	0.73
Finished goods' stock	15 days	5.80	6.85	9.34
Receivables	30 days	11.60	13.70	18.69
Working expenses	30 days	0.89	1.05	1.43
Total current assets		25.60	30.25	41.25

Trade creditors		0.00	0.00	0.00
Working capital gap		25.60	30.25	41.25
Margin money (25%)		6.40	7.56	10.31
Bank finance		19.20	22.69	30.94

2.10 TOTAL 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	17.41
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	6.4
Total project cost (i to vii)	32.79
Means Of finance	
i. Subsidy	10.00
ii. Promoters Contribution	7.87
iii. Term Loan (@10%)	14.92

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**	**4 th Year**	**5th year**	**6th year**
A	Total Installed Capacity (MT)	471 Banana/annum	82.5	97.5	112.5	135	150
	Capacity utilization (%)	Under Const.	55%	65%	75%	90%	100%
B	**Expenditure (Rs. in Lakh)**	0					
	Banana (Av. Price @ Rs.7/Kg)	0.00	18.15	21.45	24.75	29.70	33.00
	Oil @ Rs. 130/kg	0.00	32.18	38.03	43.88	52.65	58.50
	Other materials (Rs. 3/kg)	0.00	0.05	0.06	0.07	0.09	0.10
	Packaging materials (Rs 6 per Kg)	0.00	4.95	11.70	13.50	16.20	18.00
	Utilities (Electricity, Fuel)	0.00	1.04	1.23	1.42	1.70	1.89
	Salaries (1st yr only manager's salary)	2.16	7.28	7.28	7.28	7.28	7.28
	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	**2.96**	**66.95**	**83.15**	**94.40**	**111.12**	**122.27**
C	**Total Sales Revenue (Rs. in Lakh)**	**0.00**	**140.25**	**165.75**	**191.25**	**229.50**	**255.00**
	Sale of Banana Chips (Av. Sale Price @ Rs.170/kg)	0.00	140.25	165.75	191.25	229.50	255.00
D	**PBDIT (Total exp.-Total sales rev.) (Rs. in Lakh)/Cash Inflows**	**-2.96**	**73.30**	**82.60**	**96.85**	**118.38**	**132.73**
	Depreciation on civil works @ 5% per annum	0.26	0.25	0.23	0.22	0.21	0.20
	Depreciation on machinery @ 10% per annum	1.74	1.57	1.41	1.27	1.14	1.03
	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%	1.55	1.50	1.44	1.37	1.30	1.22
	Interest on working capital @ 12%	0.00	2.30	2.72	3.71	3.71	3.71
E	Profit after depreciation and Interest (Rs. in Lakh)	**-6.63**	**69.88**	**79.43**	**93.91**	**115.66**	**130.23**
F	Tax (assumed 30%) (Rs. in Lakh)	**0.00**	**20.97**	**23.83**	**28.17**	**34.70**	**39.07**
G	Profit after depreciation, Interest & Tax (Rs. in Lakh)	**-6.63**	**48.92**	**55.60**	**65.74**	**80.96**	**91.16**
H	Surplus available for repayment (PBDIT-Interest on working capital-Tax) (Rs. in Lakh)	1.55	1.50	1.44	1.37	1.30	1.22
I	Coverage available (Rs. in Lakh)	1.55	1.50	1.44	1.37	1.30	1.22
J	Total Debt Outgo (Rs. in Lakh)	0.52	0.57	0.63	0.70	0.77	0.85
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)	-4.51	50.83	57.33	67.30	82.38	92.44
M	Payback Period	2.0 Years					
	(on Rs. 32.79 Lakhs initial investment)						

2.13 REPAYMENT SCHEDULE

Year	Beginning	PMT	Interest	Principal	Ending Balance
1	1,491,912.11	206,956.83	155,158.86	51,797.97	1,440,114.14
2	1,440,114.14	206,956.83	149,771.87	57,184.96	1,382,929.18
3	1,382,929.18	206,956.83	143,824.64	63,132.19	1,319,796.99
4	1,319,796.99	206,956.83	137,258.89	69,697.94	1,250,099.05
5	1,250,099.05	206,956.83	130,010.30	76,946.53	1,173,152.52
6	1,173,152.52	206,956.83	122,007.86	84,948.97	1,088,203.55

7	1,088,203.55	206,956.83	113,173.17	93,783.66	994,419.89
8	994,419.89	206,956.83	103,419.67	103,537.16	890,882.73
9	890,882.73	206,956.83	92,651.80	114,305.02	776,577.71
10	776,577.71	206,956.83	80,764.08	126,192.75	650,384.96
11	650,384.96	206,956.83	67,640.04	139,316.79	511,068.17
12	511,068.17	206,956.83	53,151.09	153,805.74	357,262.43
13	357,262.43	206,956.83	37,155.29	169,801.54	187,460.90
14	187,460.90	206,956.83	19,495.93	187,460.90	(0.00)
		2,897,395.60	1,405,483.49	1,491,912.11	(1,491,912.11)

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	17.41	15.67	14.10	12.69	11.42	10.28	9.25	8.33
Depreciation	1.74	1.57	1.41	1.27	1.14	1.03	0.93	0.83
Depreciated value	15.67	14.10	12.69	11.42	10.28	9.25	8.33	7.49

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	23.39	21.27	19.36	17.62	16.06	14.64	13.36	12.20
Depreciation	2.12	1.91	1.73	1.56	1.42	1.28	1.16	1.05
Depreciated value	21.27	19.36	17.62	16.06	14.64	13.36	12.20	11.15

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)	32.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Recurring cost (Rs. in Lakh)	2.96	66.95	83.15	94.40	111.12	122.27	122.27	122.27	
Total cost (Rs. in Lakh)	35.75	66.95	83.15	94.40	111.12	122.27	122.27	122.27	758.20
Benefit (Rs. in Lakh)	0.00	140.25	165.75	191.25	229.50	255.00	255.00	255.00	
Total Depreciated value of all assets (Rs. in Lakh)								11.15	
Total benefits (Rs. in Lakh)	0.00	140.25	165.75	191.25	229.50	255.00	255.00	266.15	1502.90
Benefit-Cost Ratio (BCR): (Highly Profitable project)	**1.982**								
Net Present Worth (NPW):	744.70								

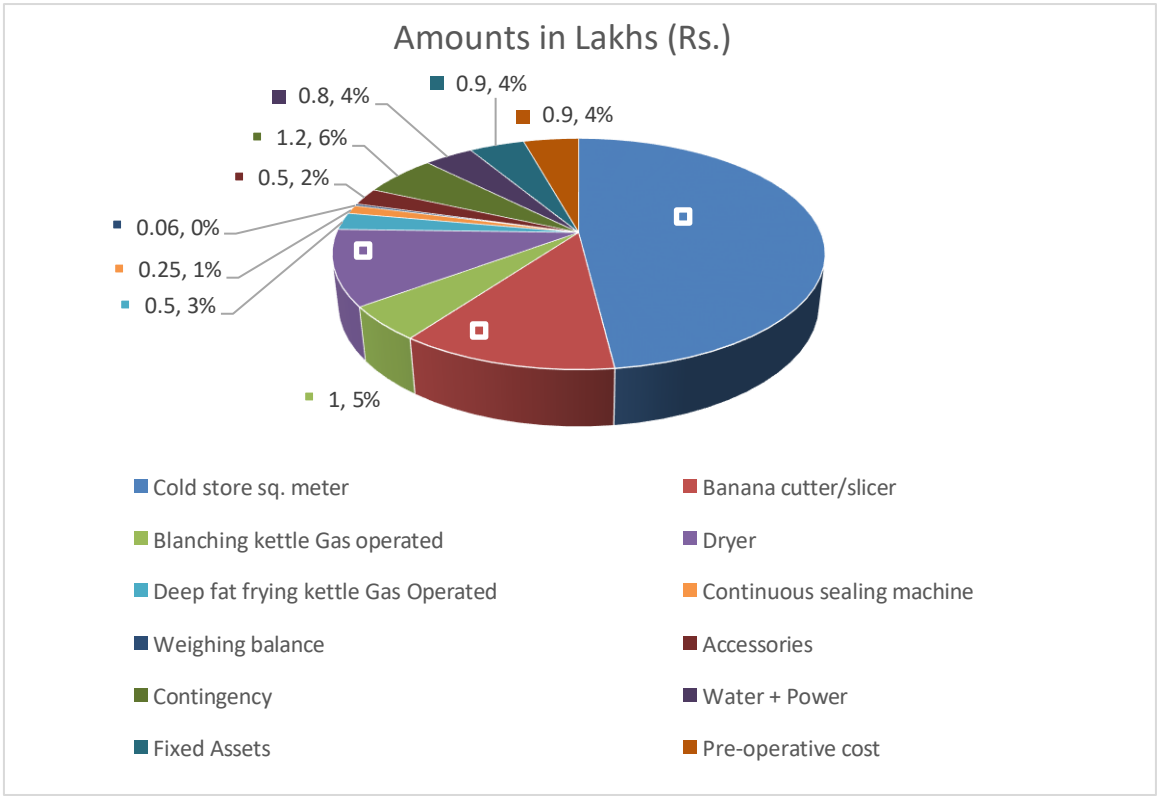
2.16 BREAK EVEN ANALYSIS

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.

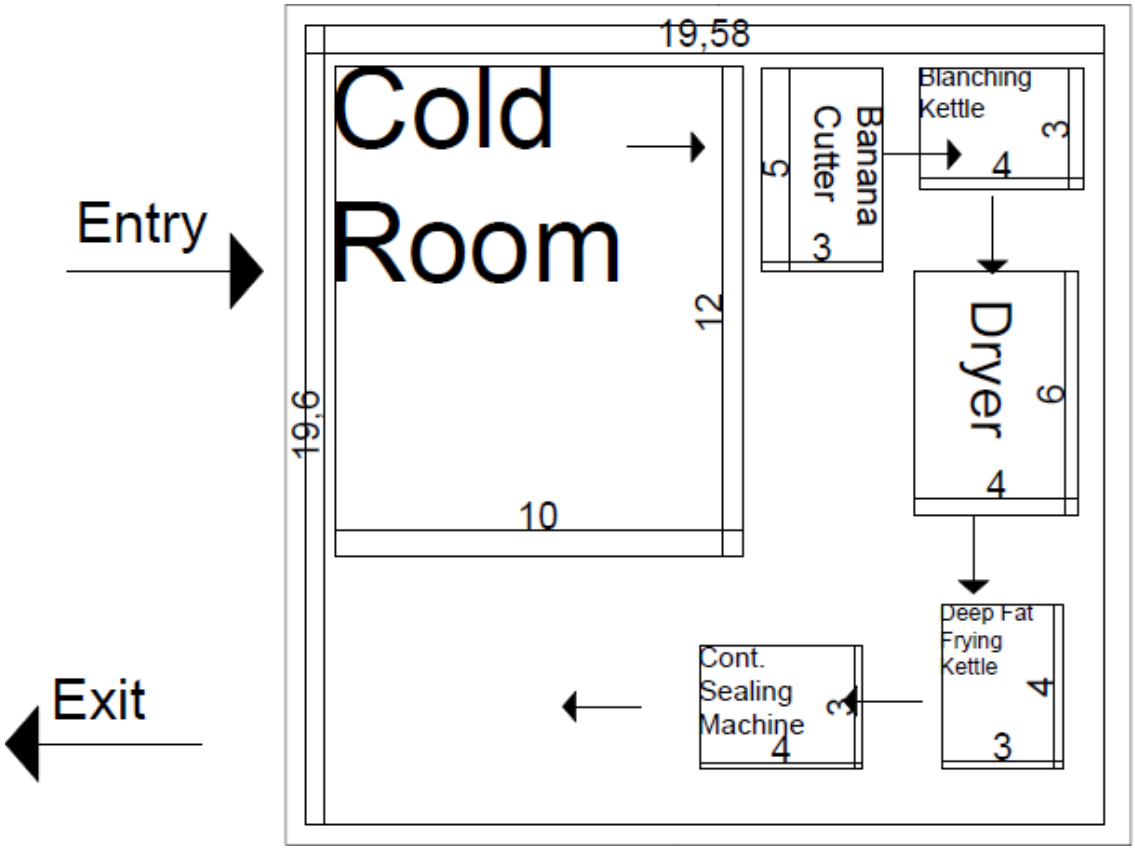
Particulars	**1st Year**	**2nd year**	**3 rd year**	**4th year**	**5th year**	**6th year**	**7th year**	**8th year**
Capacity utilization (%)	Under Const.	55%	65%	75%	90%	100%	100%	100%
Production MT/Annum		82.5	97.5	112.5	135	150	150	150
Fixed Cost (Rs. in Lakh)								
Permanent staff salaries	7.284	7.284	7.284	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	0.20	0.19	0.18
Depreciation on machinery @ 10% per annum	1.74	1.57	1.41	1.27	1.14	1.03	0.93	0.83
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	1.55	1.50	1.44	1.37	1.30	1.22	1.13	1.03
Insurance	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total Fixed Cost (Rs. in Lakh)	**11.256**	**10.997**	**10.753**	**10.522**	**10.300**	**10.086**	**9.877**	**9.670**
Sales Revenue (Rs. in Lakh)	**0**	**140.25**	**165.75**	**191.25**	**229.5**	**255**	**255**	**255**
Variable Cost (Rs. in Lakh)								
Banana Fruit(Av. Price @ Rs. 7/Kg)	0.00	18.15	21.45	24.75	29.70	33.00	33.00	33.00
Oil @ 130 per kg	0.00	32.18	38.03	43.88	52.65	58.50	58.50	58.50
Other ingredients @3/Kg	0.00	0.05	0.06	0.07	0.09	0.10	0.10	0.10
Packaging materials	0.00	4.95	5.85	6.75	8.10	9.00	9.00	9.00
Casual staff salaries	0.00	5.78	5.78	5.78	5.78	5.78	5.78	5.78
Utilities (Electricity, Fuel)	0.00	1.04	1.23	1.42	1.70	1.89	1.89	1.89

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	2.30	2.72	3.71	3.71	3.71	3.71	3.71
Total Variable Cost (Rs. in Lakh)	**0.50**	**67.16**	**77.92**	**89.26**	**104.64**	**114.89**	**114.89**	**114.89**
Break Even Point (BEP)								
as % of sale	-	12.00	10.00	8.00	8.00	7.00	7.00	6.00
Break Even Point (BEP) in terms of sales value (Rs. in Lakhs)	-	16.83	16.58	15.30	18.36	17.85	17.85	15.30

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



2.18 TYPICAL BANANA CHIPS MANUFACTURING UNIT LAYOUT



2.19 MACHINERY SUPPLIERS

S.no	Name of the company	Machineries
1.	MMM Buxabhoy& Co 140 Sarang Street 1st Floor, Near Crawford Market, Mumbai, India. Tel: +91 22 2344 2902 Fax: +91 22 2345 2532 Email: yusufs@vsnl.com; mmmb@vsnl.com;	Packaging and labelling machines

2.	Acufil Machines S. F. No. 120/2, Kalapatty Post Office, Coimbatore - 641 035, Tamil Nadu, India. Tel: +91 422 2666108/2669909 Fax: +91 422 2666255 Email : acufilmachines@yahoo.co.in	Dryer; Packaging and labelling machines

4.	Planters Energy network (PEN) No 5, Power House, 3rd Street, N R T Nagar, Theni 625531, Tamil Nadu, India Tel: +91 4546 255272 Fax: +91 4546 25527	Dryer
5.	Premium Engineers Pvt Ltd Plot No 2009, Phase IV, GIDC Vatva, Ahmedabad 382445, India. Tel: +91 7925830836 Fax: +91 7925830965	Dryer;
6.	Central Institute of Agricultural Engineering, Nabi Bagh Berasia Road, Bhopal 462 038 Madhya Pradesh, India. Tel: +91 755 2737191 Fax: +91 755 2734016	Slicing machinery; Cleaning machinery;
7.	Gardners Corporation 158 Golf Links, New Delhi 110003, India. Tel: +91 11 3344287/3363640 Fax: +91 11 3717179	Slicing machinery; Cleaning machinery; Packaging and labelling machines

8.	Rajan Universal Exports Post Bag no 250, 162 Linghi Chetty Street, Chennai 600 001, India. Tel: +91 44 25341711/25340731/25340751 Fax: +9144 25342323	Cleaning machinery;
9.	Gurdeep Packaging Machines Harichand Mill compound, LBS Marg, Vikhroli, Mumbai 400 079, India. Tel: +91 22 2578 3521/577 5846/579 5982 Fax: +91 22 2577 2846	Packaging and labelling machines
10.	Rank and Company A-p6/3, Wazirpur Industrial Estate, Delhi – 110 052, India. Tel: +91 11 7456101/ 27456102 Fax: +91 11 7234126/7433905 E-mail: R ank@poboxes.com	Dryers

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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