Oil Extraction Mill

Chapter I

1.1. Introduction

Groundnut is the major oil seed crop in India and it plays a major role in bridging the vegetable oil deficit in the country. Groundnut is called as the 'King' of oilseeds. It is also called the wonder nut and poor men's cashew nut. India is known for largest producers of oilseeds in the World and occupies an important position in the Indian agricultural economy. It is estimated that nine oilseeds namely groundnut, rapeseed-mustard, soybean, sunflower, safflower, sesame, Niger, castor and linseed, accounted for an area of 23.44 million hectares with the production of 25.14 MT.

It is one of the most important food and cash crops of our country. While being a valuable source of all the nutrients, it is a low-priced commodity. Groundnut is one of the most important cash crops of our country. It is a low-priced commodity but a valuable source of all the nutrients. Groundnut is grown on 26.4 million ha worldwide with a total production of 37.1 million metric t and an average productivity of 1.4 MT/ha. Over 100 countries worldwide grow groundnut. Developing countries constitute 97% of the global area and 94% of the global production of this crop.

Groundnut is a species in the legume family. Itis known by many other local names such as earthnuts, peanuts, goober peas, monkey nuts, pygmy nuts and pig nuts. Despite its name and appearance, the peanut is not a nut, but rather a legume. They have a rich nutty flavor, sweet taste, crunchy texture and over and above a relatively longer shelf life. Soil conditions in some producing regions are ideally suited for dry, clean and spotless Groundnuts in Shell.

1.2 Groundnut Production Scenario (Production Scenario in Odisha)

Groundnut is important oilseed in Orissa. It is grown in all the parts of Orissa. The groundnut seed have high oil content. The groundnut oil produced can be directly sold or can be refined and sold into the market. Groundnut contains 44-50% of oil content in seeds. And the oil extracted is used as edible oil in it pure or hydrogenated form. The ground nut oil is also used for manufacturing margarine, medical emulsions, wool and silk, artificial leather, soap and toilet requisites. And its residues after oil extraction is used an important and nutrient rich cattle field.

Productivity of groundnut is high in Orissa due to favorable climatic conditions and there is a further scope of increase. So ICAR is looking forward to make Odessa as a groundnut production hub. In last five years the productivity of groundnut has been decrease by an average of 8% leading to increase in the cost price.

The consumption of edible oil in India has grown around 17.5 million in 2012-13. And 70% of the total groundnut produced is used for oil production. The groundnut oil is traditionally used as edible oil and demand is high. The demand of groundnut oil is having around 7% of annual growth rate.

The groundnut oil has a huge market as the production of groundnut has decreased and the demand of oil is more and increasing at considerable rate.

Table 1 Groundnut production in Odisha

Year	Area ('000 ha)	Production ('000 tones)	Yield (kg/ha)
2010-11	247.69	416.11	1680
2011-12	255.14	435.42	1707
2012-13	263.41	467.30	1774
2013-14	267.68	478.33	1787

Chapter II

2.1 Raw material Specification

The quality of the end products is by large dependent on the quality of raw material being used in the preparation of end products. In any case the brought in material should be free from fungus and insect attack, live insects obnoxious smell, rodent contamination, excreta non edible oil seeds, artificial coloration. All other impurities have been given some permissible limit, classified into grades by Ag market and NAFED given in the table below. Therefore, any raw material brought to the facility which falling under the "special" and "good" grade only should be used for further processing.

Table 2 Raw Material Grade Specification

Categories	Grade designation (*Agmark*)			(*NAFED*)
	Special	***Good***	***General***	**Maximum limits of tolerance (% by weight per quintal**
Foreign Matter per cent by weight (maximum)	*0.5*	*1*	*2*	*2*
Immature, shriveled and dead seeds, per cent by weight (maximum)	*1*	*2*	*3*	*3*
Damaged & Discolored seeds per cent by weight (maximum)	*Nil*	*1*	*2*	*2*
Mixture of other varieties/ types per cent by weight (maximum)	*5*	*10*	*15*	*10*
Moisture content per cent by weight (maximum)	*5*	*6*	*7*	*7*

Source: Agmarknet

Besides Agmarket grades there exist NAFED specifications as well, either of these can be used to determine the quality of raw material brought into the facility, these are given below.

Table 3 Maximum Tolerance Limit of Special Characteristics

Special characteristics	Maximum limits of tolerance (% by weight per quintal)
Foreign matter	2
Shriveled and immature	3
Damaged and discolored	2
Admixture of other varieties	10
Moisture content	7

Source: NAFED

The final payments to the producer/farmers will depend of the final assessment of the brought in material as per the specifications given above and the oil content of the samples drawn from the lots.

Chapter III

3 Project Details

The Processing Unit for oil expeller will be established with a production capacity of 3 MT per day. The same plant can be used to process all varieties of pulses like; Arhar, Moong, Urd and Gram etc. The land requirement for the facility will be approximately 1 acre.

3.1 Land and Site

The land development will do based on the requirements of the oil expeller. The facility will be set up in an area of 0.74 acres having the capacity of 900MT/annum.

3.2 Infrastructure and Facilities

The proposed facility has been designed to process 3 MT of groundnut per day. The facility will layout will consists of a loading unloading area, raw material receiving section, Plant and machine room section, finished product storage section, value added product section .

Following section will elaborates on the land and building of the proposed processing plant.

- **Building- (30X27X5)m**

  The entire building will be constructed using conventional building material like cement, concrete, bricks etc. The building will be RCC based and will be constructed in an area of 408 m^2. The building shall be consisting of a parking area, loading/unloading area, raw material receiving section, plant and machinery section, finished produce storage sections, value added produce production section, toilets, DG room etc. Component wise detail of each section of the building is given below.

  - **Parking area:** In order to facilitate parking of vehicles for subsequent loading and unloading an area of 34X 27 m has been specially demarcated at the front portion of the building.
  - **Loading and unloading area:** A two meter wide platform has been provided immediately after the parking for easy docking and undocking of trucks and to facilitate easy movement of raw material from inside and outside of the building. The facility can also be used for holding the produce but for a very short while.

- **Raw Material receiving section (12 X 9) m:** The produce from the loading and unloading area will be directed to the raw material receiving section. This section will be used for holding the produce and for storing of inventory. An area of 108 m^2 has been demarcated for this section of the building
- **Plant and Machinery area (30X16) m:** This section of the building will ideally be demarcated into two areas one portion will be housing, the machinery required for preliminary processing (grading, sorting, and decortications) and the other will be housing the machinery for expelling the oil in the expeller. The processing of groundnut seed consist of following stages: Groundnut decortications (if pods), oil extraction, clarification and filtration (refining) and packaging. The oil cakes obtained can be stored and further used as animal feed. An area of 108 m^2has been demarcated for this. The produce from here (groundnut oil and oil cake) shall be sent to the packaging section for packaging and the cake will be sold.
- **Finished product and storage section (18X27) m:** This section of the building has been designed for storage of final marketable produce received from the expeller section. Two types of storage section will be needed one for storing the oilseeds and another one for storage of oil cakes that can be further used as animal feed. And it should be design so as to avoid fungal wastage and damage of oilseeds. An area of 108 m^2 has been demarcated for the purpose.
- **Drying section (8X8) m**: Drying section should be there to remove excess water residues in oil seed to avoid aflatoxin fungal growth and also cleaning process like removal of leaves stones and other residues. It can be done near the storage section.
- **Utility section**: Utility section consists of the provisions like water, electricity, labour, transportation facility and sewage system. Provision for toilet and DG room has been made outside the building area. The area allotted for toilet is 9 m^2while for DG room it is (5X 2) m i.e. 10 m^2

3.3 Process Description and Technology

The proposed facility has been designed for the production of edible groundnut oil. The produce after harvesting is procured based on the quality of produce and production requirement. The plant layout will be divided into different sections based on operations.

The section will be:

1. Cleaning section
2. Processing Section
3. Storage section

3.3.1 Cleaning Section

Peanuts are received at processing facilities in their raw state after harvesting. Batches of harvested peanuts will contain whole peanuts in the shell, some shelled peanuts, and foreign objects (e.g., leaves, nodes, weed seed, etc.). The peanuts are then cleaned using screens and air to remove any trash. The sample on the left in the photograph below contains foreign objects and waste peanuts. The sample on the right in the photograph below shows raw peanuts after foreign objects and trash has been removed. These products are discarded or sold if there is a market for them. At this stage the peanuts, "in-shell" or "shelled", are still in their raw state. Raw peanuts "in-shell" and raw peanuts "shelled" are not considered "processed food products".

The cleaned raw material then sun dries and stored for further processing.

3.3.2 Processing Section

The processing of groundnut seed consist of following stages: Groundnut decortications (if pods), oil extraction, clarification and filtration (refining) and packaging. The processing section will be handling the capacity of 3MT of input per day. The line will consist of following machineries:

- **Decorticator and Roaster:** The decorticator is used if the groundnut pods are brought. The decorticator will be of capacity 350 kg/hr. After cleaning, the peanuts are shelled and then blanched by heating to 190^{o} F with dry heat. The blanching process swells the nut, cracks the skin, and allows for easy removal of the skin. By-products of the blanching process will contain peanuts, skins, and peanut meal.

  Machinery Specification

  Decorticator without Grader System of 2 HP having size 24" and capacity of 300-350 kg/hr. The costing is given in financial section

- **Expeller**: the roasting of groundnuts is needed for removing the husk. The milling section is meant for extraction of oil from the ground seeds. It will handle approximately 3MT of input per day (assuming 40-42% oil content). Oil will be the main product and the by product will be the

oil cake. It is expected that out of 3 MT of input 1.2 tons of oil and 1.8 tons of cake shall be obtained.

Table 4 Specifications of Oil Expeller

	Chamber size	Crushing capacity	Required electric motor	Weight
Oil Expeller	33"x 6"	300 kg /hr	80 HP	1500 kgs.

- **Refining and Packaging**: It will receive the unclear oil from expeller. The refiner will clarify and filter oil. The packaging unit will have the two packaging type Tin Packaging and bottle packaging. The bottle packaging will be of 1 liter.

Table 5 Specifications of Packaging Machine

Technical specification bottle filling machine	
Filling heads	2/4/6/8/10 heads
Output min	40-60 BPM depending upon the no. of heads and nature of flow of liquid
Air	8-10 cfm (customer scope)
Filling system	Piston filling with pneumatic and L port ball valve
Fill range	200 mL,500 mL and 1000 mL with half of change parts
Tank storage capacity	Overhead tank with 100 to 120 liter capacity
Machine construction	Stainless steel

Secondary Packaging oil

Sesame oil after being packed in bottles will be secondary packed to ensure easy handling and avoid physical damage to the primary packaging during handling and transportation. A shrink wrapping tunnel is proposed for this purpose. The technical specification of the shrink wrap tunnel proposed to be installed in the facility is given below.

- **Storage section:**

Storage section will be divided into two storage foe processed products and storage of raw material. The part of storage should be separately maintains for oil cake storage to avoid contamination.

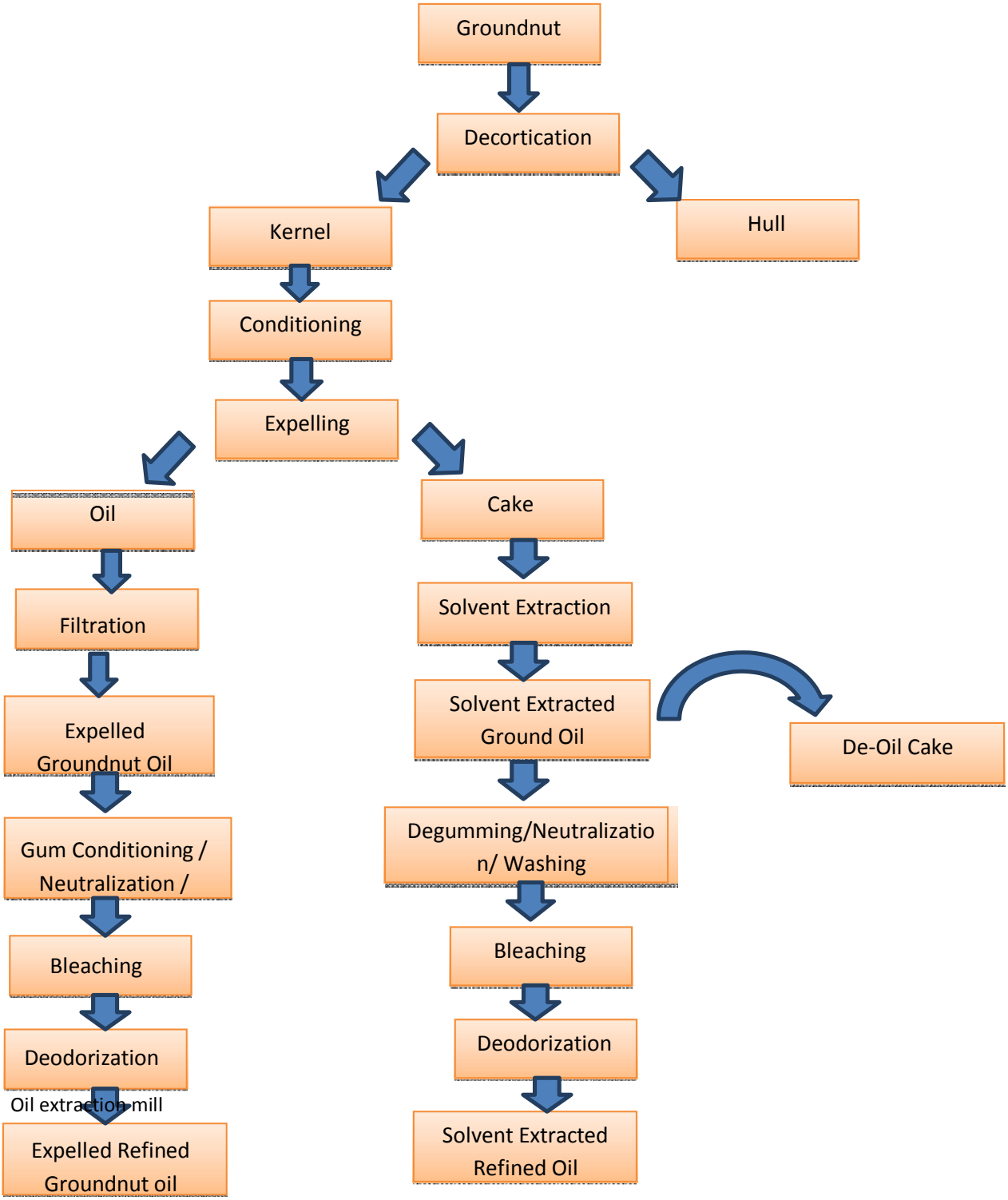
3.4 Products

The products obtained will be refined groundnut oil, husks and kernels, oil cakes. By-products that are not fit for human consumption are often bagged and discarded or sold.

Table 6 Products Obtained

Product	Percentage
Groundnut oil	43%
Oil Cake	57%

Ground oil extraction flow chart



3.5 Throughput

After the raw material is received at the entry gate it is sorted, graded, and de hulled referred to a preliminary processing. Studies show that approx. 16% of weight loss happens when the groundnut is decorticated. The proposed facility has been designed to process 3.6MT of de hulled raw material per day. Out of this 3 MT will be used for extraction of oil in the expeller along with the cake obtained from the expeller. Therefore, keeping this factor into consideration we need to input approximately 3.6 MT of sesame seeds into the preliminary processing facility so as to obtain MT of output for processing in the plant. The Plant is expected to remain operational for 300 days for 10 hours/day.

Because agriculture is a seasonal subject therefore it is proposed that an inventory of around 30 days should be maintained additionally for each month of operations.

Based on the above factors we assess that approx. **109 MT** of de hulled sesame seed inventory is required to be maintained for each month of operation and an annual stock of **900 MT** of de hulled sesame seeds are required in order to keep the entire plant operational throughout the year.

Table 7: Throughput operation

Throughput assessment	
Total processing plant capacity (TPD)	3.6
No. of hours of operations	10
Monthly stock required (=6 MT/day X 30 days)	109 MT
No of days to operate in a year	300
Qty. required for a year (MT) (= 300 days X 5 MT/day)	900 MT

3.6 Manpower requirement

The proposed processing facility will be operational in hierarchal fashion with a proper line of command. There will be a two tier structure in place for effective Operations and Management of the facility. The facility will therefore consist of an operational staff at Unit level to take care of day to day operations and maintenance of the facility. While some other critical functions such as Marketing, Administration, and Finance and overall strategic oversight will be handled by the top level of the hierarchy i.e. the Plant manager who shall also be in charges of the entire plant operations and supervision of the members down the line through indirect reporting.

Table 8: Manpower Requirement

Manpower Requirement	Nos
Manager Operations cum Plant Incharge	1
Operators	1
Manager Marketing	1
Store Incharge	1
Accounts & Admin	1
Quality - Executive	1
Skilled labour	2
Security	1

Chapter IV

4 Financials

4.1 Project cost

The Project cost for the proposed facility has been carried based on the quotations received from the suppliers. The total project cost for setting up of processing plant at the proposed site has been estimated at **Rs 387.58 Lakhs** (including contingencies). Component wise breakup of the cost is given below:

Table 9: Project cost (Rs. Lakh)

Particulars	Cost
Land	10.00
Site Development	22.02
Building	219.40
Plant & Machinery	106.21
Misc. Fixed Assets	4.20
Preoperative Expenses	20.75
Security Deposits	5.00
Total	**387.58**

- **Land and site development:** The total cost of land and site development at the proposed location is 10.79 Lakhs (excluding contingencies). This include cost incurred towards Land development 0.79 Lakhs. General Civil work include Boundary wall of Rs 2.75 Lakhs, Gate Rs 1.05 Lakhs, Drainage Rs 4.20 Lakhs, Parking Rs 0.63 Lakhs and Internal Road Rs 12.60 Lakhs which sums to Rs 32.02 Lakhs.

Table 10: Land and site development cost (Rs. Lakh)

Particulars	Unit Basis	Qty	Unit Rate	Cost	Contingencies Invt.	Total PH Cost
Land	Acres	1.00	1,000,000	10.00		10.00
Cost of Development						
Land Development	LS	1.00	75000	0.75	0.04	0.79
General Civil Work						
Boundary Wall	RMT	262.00	1000	2.62	0.13	2.75
Gate	LS	1.00	100000	1.00	0.05	1.05
Drainage	RMT	200.00	2000	4.00	0.20	4.20

Parking	SQM	75	800	0.60	0.03	0.63
Internal Roads	RMT	200.00	6,000	12.00	0.60	12.60
Sub-Total				**30.97**	**1.05**	**32.02**

- **Technical Building**

  The total cost of setting up of building of the basic infrastructure for the processing unit is 219.40 Lakhs (including contingencies).

Table 11: Building and civil work cost (Rs. Lakh)

Particulars	Unit Basis	Qty	Unit Rate	Cost	Contingencies	Total Per Head Cost
Plant section including loading and unloading bay	SQM	1970	10,000	197.00	9.85	206.85
Toilet cum wash room		10	8,000	0.80	0.04	0.84
DG sets room		10	4,000	0.40	0.02	0.42
Security room		10	8,000	0.80	0.04	0.84
General Civil Works						
Electricfication & Plumbing	5%			10	0.50	10.45
SUB-TOTAL				**208.95**	**10.45**	**219.40**

- **Plant and Machinery**

  The total cost required for setting up of plant and machinery for the said processing plant is estimated to be around Rs 106.21 Lakhs as per the quotations provided by the suppliers. The breakup of the cost can be seen from the table given below. The miscellaneous cost in the table given below includes the cost towards freight and insurance cost.

Table 12: Plant and machinery cost (Rs. Lakhs)

Particulars	Unit Basis	Qty	Unit Rate	Cost	Contingencies Invt.	Total Per Head Cost
Seed cleaner	APQ	1	1,005,000	10.05	0.50	10.55
Decorticator	APQ	1	50,000	0.50	0.03	0.53
Expellor with storage (two expellers)	APQ	2	2,142,500	42.85	2.14	44.99
Refinery section	APQ	1	2,301,000	23.01	1.15	24.16
Tin packing machines of 15 lt	APQ	1	236,000	2.36	0.12	2.48
Pet bottle packing machines(250ml-1500ml)	APQ	1	750,000	7.50	0.38	7.88
Machines Instalation charges(3 %)	APQ			2.59	0.13	2.72
Misc Cost(Freight & Insurance)	APQ			1.73	0.09	1.81

DG Set(150KVA)	APQ	1	1,000,000	10.00	0.50	10.50
Electronics Weighing scale(100 Kg)	APQ	1	50,000	0.50	0.03	0.53
Electronics Weighing scale(3 kg)	APQ	1	7,000	0.07	0.00	0.07
SUB-TOTAL				**101.15**	**5.06**	**106.21**

- **Miscellaneous fixed assets**

  The total cost for miscellaneous fixed assets is estimated at Rs. 4.20 Lakhs (including contingencies). The details are given in table below.

Table 13: Miscellaneous fixed assets cost (Rs. Lakh)

Particulars	Unit Basis	Qty	Unit Rate	Cost	Contingencies Invt.	Total Per Head Cost
Furniture & Fixture	LS	1	200,000	2.00	0.10	2.10
Computers & Communication	LS	1	100,000	1.00	0.05	1.05
Miscellaneous Expenses & Fire Fighting	LS	1	100,000	1.00	0.05	1.05
Sub-Total				**4.00**	**0.20**	**4.20**

- **Engineering, consultancy and preliminary and preoperative expenses**

  The total cost estimated for the Engineering, consultancy and preliminary and pre-operative expenses is around Rs. 20.75 Lakhs.

Table 14: Eng. Consultancy and Pre-operative cost (Rs. Lakhs)

Particulars	Unit Basis	Qty	Unit Rate	Cost	Total Per Head Cost
DPR	LS	1	100,000	1.00	1.00
IDC	LS	1	20	19.75	19.75
Sub- Total				**20.75**	**20.75**

- **Contingency**

  The total cost for contingency has been estimated at 5% rate and it is estimated to be around Rs 16.76 Lakhs.

4.2 Revenue

The projected revenue estimated as given below:

Table 15: Estimated Revenue

Revenue Heads	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Capacity Utiliztion	60%	70%	80%	90%	90%	100%	100%	100%	100%	100%
Revenue(In Rs Lakhs)	373.82	436.12	498.42	560.73	560.73	623.03	623.03	623.03	623.03	623.03
Total	**373.82**	**436.12**	**498.42**	**560.73**	**560.73**	**623.03**	**623.03**	**623.03**	**623.03**	**623.03**

4.3 Profitability Statement

The profitability of the project is indicated by various financial tools like IRR, Break Even Point and Payback period which comes out to be 28.27%, 24.77(% of total sale), 0.23 years respectively.

Table 16: Profitability Indicators

Key Indicators	Envisaged (As Per 4th Year)
Net Profit After Tax	93.40
Internal Rate Of Return (%)	28.27
Break Even Point(% Of Total Sale)	24.77
Pay Back Period (Years)	0.23

The Profitability Statement will be as per given below:

Table 17: Profitability Statement

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Net Profit	88.65	102.72	115.25	127.30	126.83	138.87	134.03
Depreciation	20.32	20.32	20.32	20.32	20.32	20.32	20.32
Preliminary Exp.W/O	6.44	6.44	6.44	6.44	-	-	-
Total	**115.41**	**129.48**	**142.01**	**154.05**	**147.15**	**159.19**	**154.35**
Deployment							
Decrease In Term Loan	-	23.51	47.02	47.02	47.02	47.02	47.02

Interest Payment (Wc)	45.42	45.42	40.48	33.90	27.32	20.73	14.15
Total	**45.42**	**68.93**	**87.51**	**80.92**	**74.34**	**67.76**	**61.17**
Opening Balance	15.48	85.46	146.01	200.51	273.64	346.45	437.88
Surplus/Deficit	69.98	60.54	54.50	73.13	72.81	91.43	93.18
Closing Balance	85.46	146.01	200.51	273.64	346.45	437.88	531.06