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Draft Report

FEASIBILITY STUDY
OF A PILOT INDUSTRIAL ESTATE
IN ADDIS ABABA, ETHIOPIA

Under contract with :

UNITED NATION'S INDUSTRIAL
DEVELOPMENT ORGANISATION (UNIDO) AUSTRIA

CONTRACT NO. 85/15

VOLUME - II

National Research Development Corporation of India

Anusandhan Vikas, 20-22, Zamroodpur Community Centre
Kailash Colony Extension, New Delhi-110 048

Telephones : 6419947, 682121 Telex : 031-65094

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21. DOOR LOCKS AND KEYS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

This project envisages manufacture of common door locks and keys. The recommended capacity of the unit is to manufacture about 54000 door locks and keys and 6000 cupboard locks and keys per annum. Total investment required on machinery and equipment is about Birr 62500. The unit requires a built in area of about 250 sq.m. Return on investment would be about 32% and the unit could generate employment to about 25 persons.

1.2 Description and Specification of Product

The door locks are used to lock the doors. Th door may be locked with the help of aldrops and a padlock, but in modern times the door-locks are specially made for locking the doors without padlock. The most common door lock is called Mortice lock. Mortice lock is embedded inside the door panel and is operated by a key and latch. The vertical mortice locks are used in flushedoors and they are taken as door locks for this project. The specifications for these locks are indicated in the table.

Specification :

Materials for various component parts of Mortice Locks (Vertical Type)

Sl. No.	*Components*	*Mild Steel*	*Malle-able Iron*	*Cast Brass*	*Brass Sheet*	*Extru-ded Brass*	*Aluminium Alloy Pressure Die Castings*	*Alumi-nium Alloy Sheet*	*Leaded Tin Bronze*	*Zinc Base Alloy Pres-sure Die Cas-tings*	*Phos-phor-Bron-ze Wire*	*Steel Wire*	*Stain-less Steel*
i)	Body	Yes	-	Yes	Yes	-	Yes	Yes	-	Yes	-	-	-
ii)	Body Cover	Yes	-	Yes	Yes	-	Yes	Yes	-	Yes	-	-	-
iii)	Case Plate	Yes	-	Yes	Yes	-	Yes	Yes	-	-	-	-	-
iv)	Key	Yes	Yes	Yes	-	-	-	-	-	Yes	-	-	-
v)	Follower	-	Yes	Yes	-	-	Yes	-	Yes	Yes	-	-	-
vi)	Face Plate	Yes	-	Yes	Yes	-	-	Yes	-	-	-	-	-
vii)	Striking Plate	Yes	-	Yes	Yes	-	-	Yes	-	-	-	-	-
viii)	Lever	Yes	-	-	Yes	-	-	-	-	-	-	-	-
ix)	Locking bolt and latch bolt	Yes	-	-	-	Yes	-	-	-	-	-	-	-
x)	Lever spring and latch spring	-	-	-	-	-	-	-	-	-	Yes	Yes	-

Note : The clearance for levers while in the operating condition shall not exceed 0.25 mm.

2. MARKET AND PLANT CAPACITY

2.1 Market

Door locks and keys are being imported from Europe and far east to meet the demand. Import figures in the last several years are substantial and hence it is worth considering manufacture of locks and keys locally.

Import data from 1976 upto 1982 are collected and analysed (see table below). The figures are in aggregate. However, it is estimated that 75% of the aggregate are door locks, cup-board and sliding ward locks and keys. Furthermore, to convert the weights into units one set of lock and key is estimated to weigh about 350 to 450 gms.

Import data of locks and keys

Year	*Qty Kgs.*	*Qty. Numbers*	*Value Birrs*	*Unit Price Birr*	*Qty. of * lock and key sets (pcs.)*
1976	29,100	77600	146,700	1.89	58200
1977	81,800	220000	35,600	1.62	165000
1978	197,500	529000	889,200	1.68	396750
1979	150,700	404000	970,000	2.40	303000
1980	197,100	525600	1377,600	2.62	394200
1981	189,600	505600	2075,400	4.11	379200
1982	55,800	148800	462,800	3.11	111600

Source : External Trade Statistics

* 75% of the converted number of lock and key sets.

Supply trend is not smooth nonetheless, using the moving average, growth rate during 1976 to 1981 is estimated to be 10% per annum. Assuming that this growth rate still prevails, the demand for 1985 is estimated to be 185,000 sets of locks and keys.

Similarly the average unit price (C&F) grew at the rate of about 20% per annum. Assuming the same price growth, the average unit price at present is estimated to be Birrs 18.70.

2.2 Demand Forecast

The future demand for door locks and keys heavily depend on the development plans for the construction sector. The Ten Year Indicative Plan assumes an average annual growth rate of 19.4% for building construction. However, this is very ambitious and the time trend growth rate (10% per annum) is considered in forecasting the demand.

Based upon the bove assumption, the demand for 1986, 1990 and 1995 are 204100, 298800, and 481300 sets.

Demand Forecast

Year	*Quantity Pieces*	*30%*
1986	204,100	61,230
1990	298,800	89,640
1995	481,300	144,930

2.3 Plant Capacity

There are various types of door locks and keys. The unit proposed shall have a capacity to manufacture 60,000 sets of door locks and keys per annum, which shall satisfy upto 30% of the current demand.

2.4 Production Programme

The unit is envisaged to operate one shift a day for 270 days a year. It is expected to operate at 50%, and 75% of the installed capacity during the first and second years. Full production could be anticipated from third year onwards.

The product mix is shown in the following Table :

Product Mix

Item No.	*Product*	*Qty. (Pcs.)*	*%*
1.	Door Locks and Keys	54,000	90
2.	Cup-board and similar locks and keys	6,000	10
	Total	60,000	100

It is estimated that at full capacity the annual sales realisation would be 0.46 million Birrs.

2.5 Distribution and Sales

Several public and private enterprises are distributing locks and keys along with other building materials and hardwares. The major consumers are furniture producers. The envisaged products can easily find their sales outlets through the same channels as the imported ones.

3. MATERIALS INPUTS AND UTILITIES

3.1 Raw Materials

The raw materials for the manufacture of Door Locks and keys are mild steel sheet, zinc alloy (Mazak), spring wire and screws, pins, etc. These materials are not locally available and have to be imported. Certain miscellaneous items like, kerosine, diesel oil, paint and packing materials are also required which are locally available.

The raw materials requirement for manufacture of 60,000 locks and keys per annum is given in Table below :

Raw Materials Requirement

Item No.	*Description*	*Price/Kg Birr*	*Quantity Kgs.*
1.	Mild Steel Sheet 14-20G	30.2	20,000
2.	Brass Scrap	10.88	4,000
3.	Mazak (Zinc alloy)	39.1	1,500
4.	Spring Wire	As per Production Programme	
5.	Screws, pins etc.		

3.2 **Utilities**

The utilities requirement are electricity and water supply. The annual consumption of electricity is 180000 KWH and water is 300 M^3. The annual expenditure on the utilities is estimated to be Birrs 21900.

4. TECHNOLOGY AND ENGINEERING

4.1 **Technology**

Though the technology for the manufacture of Door locks and Keys is simple, some special skills are required which can be developed by training. The technical know-how may be obtained from any of the reputed international manufacturers.

4.2 **Description of manufacturing process**

The main components of a mortice lock are as follows :

1. Body Cover
2. Case Plate
3. Fare Plate
4. Striking Plate
5. Latch bolt
6. Locking bolt

7. Levers
8. Latch Spring
9. Follower
10. Key
11. Guide Pins
12. Lever pivot and other pins.

The body cover, case plate, fare plate and striking plate are blanked from mild steel sheet on a power press. The holes are also pierced as per details of locks. The body cover is generally painted and the pins for levers and other purpose are rivetted to it. The face and striking plate are generally nickel plated.

The latch and locking bolt are either made of zinc alloy or they are having brass coated head with mild steel plate. They are either die-casted or sand casted and filed to required shape and size. The zinc alloy bolts are nickel plated before fitting in the lock.

The levers are made of either brass or of mild steel. The brass levers are sand casted, diecasted or they are blanked from brass sheet. Mild steel levers are blanked from sheet and galvanised afterwards.

The latch spring is made of spring wire and it is shaped according to requirement to give the spring action to latch. The follower is generally zinc die casted component. Sometimes it may be made of brass (diecasted or sand casted).

The keys are generally made of zinc alloy and nickel plated. They may also be made of casted brass. The guide pins etc., are turned and rivetted to body of lock or on bolt as per requirement.

All the components of locks are the assembled and the body covers are rivetted or screwed together.

4.3 List of machinery and equipments

For the suggested capacity of manufacturing 54000 door locks and

keys and 6000 cup-board and similar locks and keys per annum, the following are the major equipments required :

Power Press, 40 tons capacity	1
Power Press, 20 tons capacity	2
Hand Press, No. 2 Bed Length 1300 Weight of flywheel : 120 kg.	4
Hand Press, No. 4 Bed Length 413 mm weight of flywheel : 39 Kg.	2
Hand Press, No. 6 Bed Length : 477 mm Weight of flywheel : 70 Kg.	3
Bench drilling machine, 12 mm capacity	2
Bench drilling machine, 4 mm Capacity	2
Bench grinder; wheel diameter 200 mm	1
Electroplating facility	1
Die casting equipment	1
Foundary or shop facilities Spray painting equipment	1

The cost of machinery and equipment as CIF addis basis is estimated to be Birr 62500.

4.4 Building Layout

For housing the equipment, it is estimated that a covered area of 250 sq. mt. will be required. This area includes finished goods store and office.

4.5 Civil Works

The construction cost of the building is about Birrs 150,000.

5. MANPOWER AND TRAINING

5.1 Manpower Requirement

The unit requires 25 employees as given below :

Category	*No. Required*	*Salary/month per person/ Birr*	*Salary/ year/ Birr*
Manager	1	1200	14400
Supervisor	1	900	10800
Skilled Workers	6	250	18000
Semi-skilled Workers	10	150	18000
Unskilled Workers	6	100	7200
Others	1	350	4200
	25		72600

The total anual expenditure on wages and salaries is estimated to be Birrs 72600.

5.2 Training

All production staff should have training in the production technology, maintenance and quality control. The following step-in-step approach is recommended :

- Active participation of the supervisor during the installation of the plant. Others should be employed as helpers in order to become acquainted with the machinery.
- Supervisory staff should get the benefit of class room lecture by the foreign expert.
- Training of all production staff by the foreign expert at the satart-up period.

It may be necessary to get the services of an expert during the start-up of production for a period of four weeks. He should be able to organise production programme and also training of technical personnel. The expenses incurred for above is estimated to be Birr 15000, including travel expenses.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis

Capacity	:	60000 Nos.
No. of Working days/year	:	270
No. of shifts/day	:	One

6.1 Total Investment

The total investment is estimated to be Birr 267500 of which Birrs 232500 would be for fixed capital and the remaining Birr 35000 for working capital. The details are shown in the following table :

Total Capital Investment

Particulars	*FC*	*LC*	*Total Birrs*
Fixed Capital			
Machinery and Equipment	55000	7500	62500
Building and Construction		150000	150000
Office Furniture & Equipment		5000	5000
Pre-Production Expenses		15000	15000
Working Capital	21000	14000	35000
Total	76000	191500	267500

6.2 Production Cost

The annual production cost at full capacity on one shift operation

is estimated to be Birr 374300. Raw material and manpower costs amount to 44 per cent and 19 per cent respectively. The break-up is shown in the following table.

Production Cost

Sl.No.	*Particulars*	*Cost in Birr*
1.	Raw Material	166170
2.	Utilities	21900
3.	Labour & Supervision	72600
4.	Overheads	43600
5.	Consumables	6300
6.	Repair & Maintenance	3100
7.	Sales/Advertising	17800
8.	Depreciation on Plant	6300
9.	Depreciation on Building	7500
10.	Interest Charges	29000
	Total	374300

6.3 Financial Evaluation

The estimated sales realisation at full capacity is Birr 462000. The details are shown below :

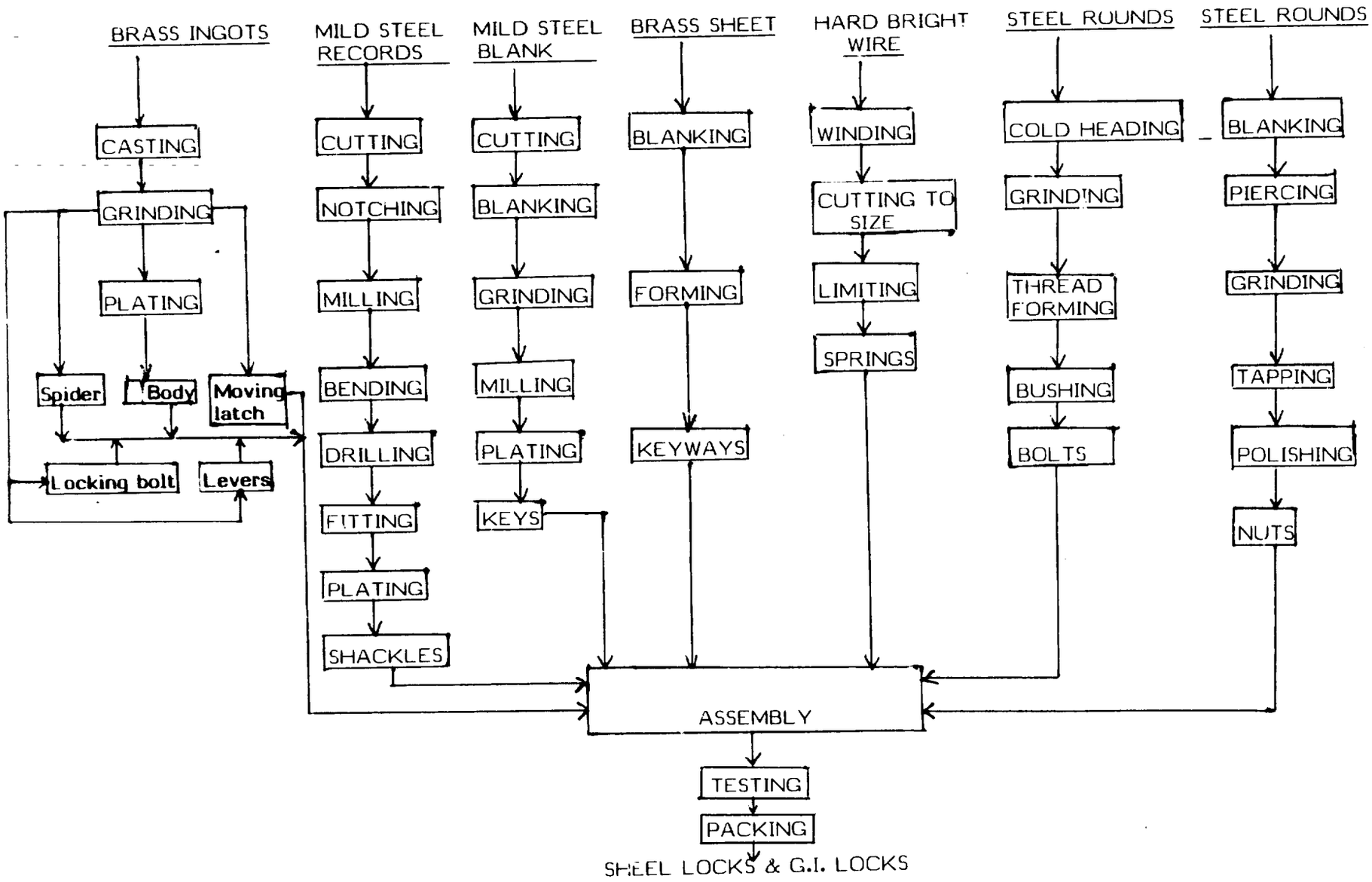
Item No. No.	*Particulars*	*Qty. Pcs.*	*Unit Cost Birr*	*Annual Sales Revenue Birr*
1.	Door locks and keys	54000	8	432000
2.	Cup-Board Locks	6000	5	30000
	Total			462000

Total Sales Realisation	:	462000 Birrs
Net Profit	:	87700 Birrs
Return on Investment	:	32%
Break even point	:	64%
Pay back period	:	2.4 years

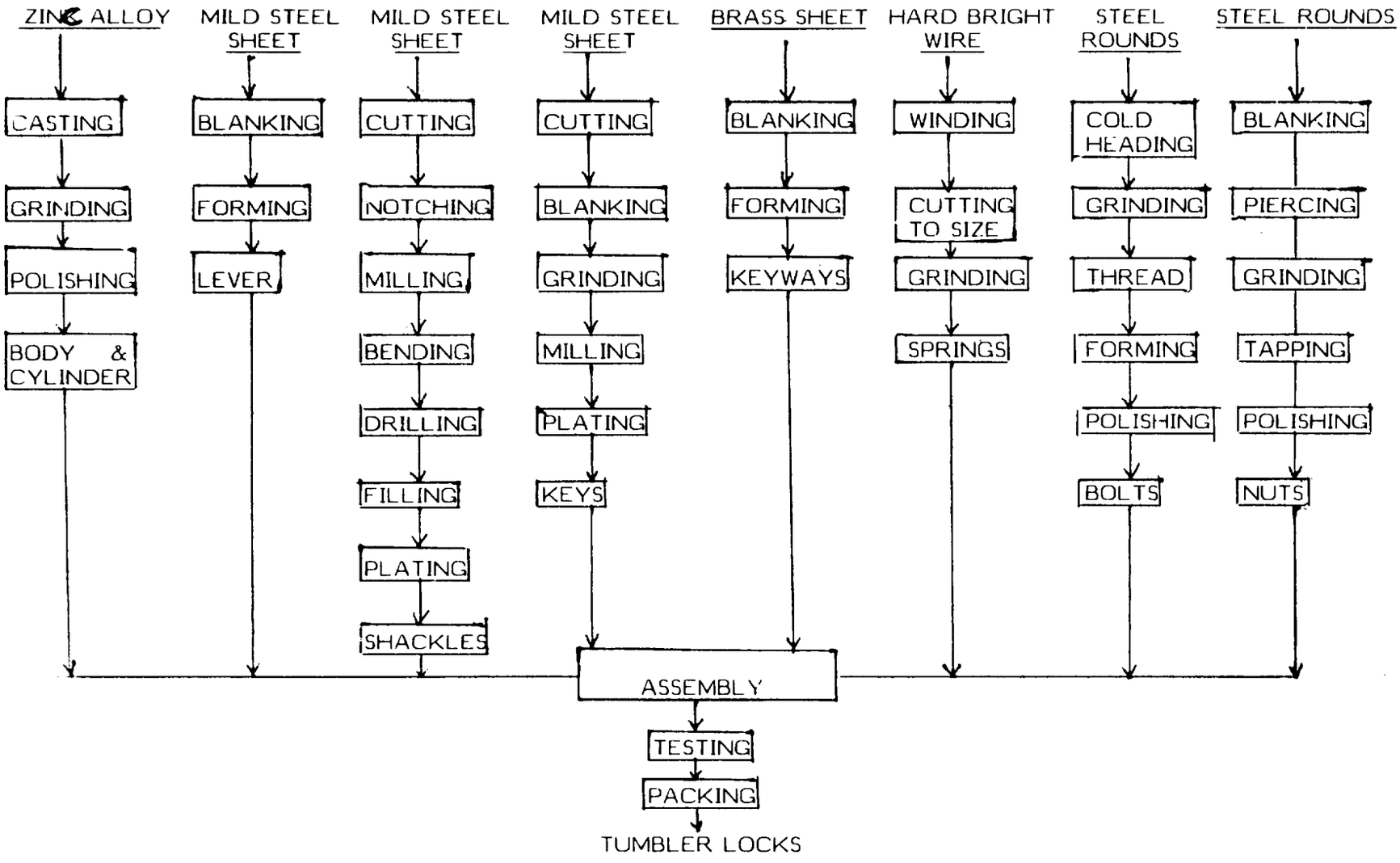
CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit/Loss*	*Depreciation*	*Net Cash Flow*
Ist	266665	231000	- 35665	6300	- 29365
2nd	320480	346500	- 26020	6300	- 2955
3rd	374300	462000	+ 87700	6300	+ 96955

OPERATION FLOW PROCESS CHART : SHEET LOCKS & G.I. LOCKS



OPERATION FLOW PROCESS CHART : TUMBLER LOCK



22. AUTOMOBILE OIL AND AIR FILTERS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

Oil and Air Filters are very important components of IC engines. The suggested capacity of this project is 10000 oil and air filters per annum. The investment on machinery and equipment is about 62,500 Birrs. The unit requires a covered area of about 250 Sq. Mts. and it could generate employment to about 20 persons. The return on investment would be 26 percent.

1.2 Description and Specifications of the Product

Any engine requires oil for running and lubrication purpose. For trouble free operation it should be free from any abrasive particles thicker than the oil film which can cause harmful wear and tear to the internal components of the engine like crank shafts and main bearings.

In case of air filters, the air from atmosphere is loaded with foreign particles. These particles are highly abrasive which can damage fuel injection system, valves and cylinder walls. Dust laden air has excess wear particles which leads to loss of power.

Specifications

Specifications of Automobile oil and Air filters follow the International Standards.

2. MARKET AND PLANT CAPACITY

2.1 Market

Automobile oil and air filters are imported mainly for the vehicle assembly units and for replacements.

The tractor assembly unit and AMCE assembly plant in Ethiopia each have a production capacity of 1400 vehicle per annum. The number of vehicles on the road are about 80,000. Life of a oil or air filter is estimated to be 5000 Hours. Assuming that 50 percent of the vehicles are between five and ten years and assuming replacement rate of 1.0 per vehicle for every two years, the demand for filters for replacement is estimated to be 20,000 Units per annum.

It is suggested that the unit manufactures 50 percent of the total requirement for replacement. The market for replacement of filters is thus 10,000 units per annum. The total present market demand for filters is estimated to be about 12800 units.

Demand Forecast

The tractor and AMCE assembly plants are the potential buyers for oil and air filters.

The output of Tractor assembly plant is expected to reach 3000 units by 1995. Similarly AMCE plant plans to increase its output to 1000 units soon. Further, it plans to expand assembly of 2500 vehicles per annum in the coming 10 years. Thus the demand for filters may grow upto 4000 and 2000 units respectively. If the assembly plants fully implement their proposal the demand for oil and air filters will be about 8000 by 1995.

2.2 Plant Capacity

The suggested plant capacity is 10,000 fuel and air filters per annum. The output may be doubled by running the unit on two shifts per day.

2.3 Production Programme

The unit is envisaged to operate one shift a day for a total of 270 days a year. It is expected to operate 50, 75 and 100 percent of the installed capacity during the first, second and third year respectively. Suggested product mix when the unit runs at full capacity is shown below :

Product Mix

Item No.	*Product*	*Qty.(Nc.)*	*Percentage*
1.	Filters for Tractors	1500	15
2.	Filters for AMCE	1500	15
3.	Filters for replacement	7000	70
	Total	10000	100

The total sales realisation at full capacity is estimated to be 0.47 million Birrs.

2.4 Distribution and Sales

Vehicle assembly plants import their components from respective suppliers directly. Spare-parts are imported and distributed by public and private companies. For assembly plants, the filter manufacturing unit shall become regular supplier. The unit shall meet 60 percent of the replacement through spare-parts dealers net work.

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw Materials

The raw materials required are specially processed filter paper, Belt lined with mesh, perforated tin coated metallic sheets, iron sheets of required gauge, springs, valves, rubber washers, gaskets, castings, and iron rods, adhesives for end sealing of elements. The raw materials are not locally available and have to be imported. The local inputs like paint and packing materials are also utilised in this project.

The total cost of raw material is estimated to be 0.21 million Birrs on CIF Addis basis.

3.2 Utilities

The utilities required in this project are water and electricity. The consumption of electricity and water per annum are 12,000 KWH and 240 M^3 respectively. The annual expenditure on electricity is 1440 Birrs and water is 120 Birrs. Hence the total cost of utilities is estimated to be 1560 Birrs.

4. TECHNOLOGY AND ENGINEERING

4.1 Technology

The technique for manufacturing the oil and air filter is difficult. Hence the personnel should be trained in the field. The know-how may be obtained through the suppliers of machinery and equipment.

The diesel engine fuel injection system is sensitive to any foreign matter. The fuel tank accumulates dirt, dust and other foreign particles during normal operation. The moisture accumulates in the fuel tank due to temperature changes. This causes rust and scale to form in the engine which affects the performance of engine. So it needs finer fuel filters.

For perfect combustion the air should be free from foreign particles. Hence the airfilters are used in the automobile engine.

4.2 Description of manufacturing process

The filter body is made out of sheet metal by pressing. Variouscomponents like filter paper, springs, valves and washers are finally assembled.

4.3 List of Machinery and Equipment

The machinery and equipment required for the suggested capacity of manufacturing 10000 oil and air filters per annum are as follows :

Helical Press (Manual) 1
Thickness 3 gauge, 85 in one stroke

Shearing press (Manual)	1
Gas welding set	1
Fleeting machine 2 H.P. Motor	1
Electric Arc welding set 10 HP, 450 Amps.	1
Centre Lathe 3 HP, Bed 2000 mm	1
Bench Grinder Wheel diameter 200 m, 1 HP	1
Radial Drilling Machine Capacity 20 mm diameter, 2 HP	1
Heavy duty soldering iron	2 sets
Plastic moulding machine Driven by A.C. 440 Volts, 3 Phase, 50 Cycles	1
Oven for heating element 5 KW Range	1
Spray Painting equipment	1
Spot Welding Machine	1

The cost of machinery and equipment in CIF addis basis is estimated to be 62,500 Birrs.

4.4 Building Layout

The project requires a covered area of 250 Sq. Mts. This area includes the space for raw material store, finished goods store and office accommodation.

4.5 Civil Works

The construction cost of the building is about Birrs 150000.

5. MANPOWER AND TRAINING

5.1 Manpower Requirement

For the operation of the plant on single shift (8 hours) basis the following are the requirement of personnel :

No.	Category	Number Required	Salary per month per person (Birrs)	Salary per annum (Birrs)
1.	Manager	1	1200	14400
2.	Supervisor	1	900	10800
3.	Skilled Workers	5	250	15000
4.	Semi-skilled Workers	6	150	10800
5.	Unskilled Workers	6	100	7200
6.	Others	1	350	4200
	Total	20		62400

The total wages and salaries is estimated to be 62400 Birrs per annum.

5.2 Training

The manufacture of oil and air filters have to be done very carefully to suit the specific requirements. It may be advisable to provide training to few of the operating personnel. This could be achieved by the following method :

- Active participation of the supervisor and skilled personnel during the installation of the plant.
- Supervisory staff should get the benefit of class room lecture by the foreign experts.
- Training of all production staff by the foreign expert during the start-up period.

5.3 Cost of Training

It may be necessary to get the services of an expert during the start-up of production for a period of six weeks. He should be able to organise production programme and also training of technical

personnel. The cost of such training is estimated to be Birrs 20000 which includes travel expenses.

6. FINANCIAL & ECONOMIC ANALYSIS

6.1 Total Capital Investment

The total investment is estimated to be Birrs 276500 of which Birr 237500 is for fixed capital and the remaining Birrs 39000 is for working capital. The details are shown in the table below :

Particulars	*F.C.*	*L.C.*	*Total Cost (Birrs)*
Fixed Capital			
Machinery & Equipment	55000	7500	62500
Building Construction		150000	150000
Office Equipment & Furniture		5000	5000
Pre-production charges		20000	20000
Working Capital	26000	13000	39000
Total	81000	195500	276500

6.2 Production Cost

The annual production cost at full capacity one shift operation is estimated to be Birr 398360. The raw material and man power costs amount to 53% and 16% respectively. This break-up is as shown below :

S.No.	*Particulars*	*Cost in Birr*
1	2	3
1.	Raw Material	210000
2.	Utilities	1560

1	2	3
3.	Labour & Supervision	62400
4.	Overheads	37000
5.	Consumables	6300
6.	Repairs & Maintenance	3200
7.	Sales/Advertising	32800
8.	Depreciation on Plant	6300
9.	Depreciation on Building	7500
10.	Interest charges	31300
	Total	398360

6.3 **Financial Evaluation**

The estimated sales realisation at full capacity is Birr 470000. The details are shown in table below :

Item No.	*Particulars*	*Qty.*	*Unit Price (Birr)*	*Annual Sales (Birr)*
1.	Filter for Tractors	1500	50	75000
2.	Filter for AMCE	1500	44	66000
3.	Filter for Replacement	7000	47	329000
	Total			470000

Total Sales Realisation	:	470000 Birrs
Net Profit	:	71640 Birr
Return on Investment	:	26%
Break-even point	:	67%
Pay-back period	:	2.9 years

CASH FLOW STATEMENT

Year	Production Cost	Sales Realisation		Profit	Depreciation	Net Cash Flow
1st	271430	235000	-	36430	6300	- 30130
2nd	334895	352500	+	17605	6300	- 6225
3rd	398360	470000	+	71640	6300	+ 71715

23. TYPEWRITER RIBBONS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of Project

The proposal envisages setting up a small scale unit for the production of Typewriter Ribbons which would yield an annual sales realisation of Birr 810000 at full capacity. The project could provide employment for about 9 persons. The break-even point is 56%. The return on investment is estimated to be 36.4%.

1.2 Product Description

As the name itself implies, this item is used in typing machine as a source for supply of ink. Typewriter ribbons are generally made of cotton, silk and synthetic fibres. There are various types of ribbons depending upon their end use, such as record ribbons and copying ribbons.

Typewriter ribbons are manufactured by inking the fabric evenly in a manner so as to yield clear and legible typed impressions required for the purpose. The ribbons should have good typing life and maintain an even density of impressions throughout. The typed impressions shall not bleed into the paper when impressions are taken on typewriter paper, and there should be no evidence of filling of types.

1.3 Product Specification

The typewriter ribbons manufactured by the technology mentioned below shall conform to the Indian specifications IS 4174-1969, which is given below :

Requirements

Typed work

The typed work shall be well defined and cleaned and in the normal process of typing, the paper shall not get soiled with the ink of the ribbons. There shall be a gradual and not abrupt loss of distinctness of typed work when repeated at the same place.

Cotton Fabric

The weave cotton fabric shall be plain, the fabric shall be capable of withstanding sufficient wear on typewriters and shall have a minimum thread count of 500 ends (warp) and 500 picks (weft) per decimetre. The edges of the ribbon shall be straight and treated to prevent fraying.

Dimensions

The ribbon shall be of the following dimensions :

a) Width of Ribbons : 12.7 ± 0.40 mm unless otherwise specified.

b) Length of Ribbons : 10 metres or 5 metres as required, (tolerance on length shall be ± 1.5%).

c) Thickness of Ribbons : 0.15 mm max.

2. MARKET AND PLANT CAPACITY

2.1 Demand

For forecasting the future demand for typewriter ribbons, import data of a past seven years (1976-1982) have been analysed. These import data are tabulated below :

Table a

Import Data

Year	*Quantity ('000 kg)*	*Value ('000 Birr)*
1976	0.5	20.9
1977	11.5	193.4
1978	12.9	248.5
1979	9.1	209.8
1980	5.8	103.0
1981	7.3	283.9
1982	10.2	426.6
Annual average	8.2	212.4

Source: Annual External Trade Statistics

The tabulated statement given above indicates, the import data collected between 1976 and 1982 reflects an annual average demand of 8.2 tons. In order to forecast the demand a time trend analysis has been conducted which indicates that the import of typewriter ribbons has been increasing both in quantity and value at the rate of 1,300 Kgs and 45,000 Birr per year respectively as shown in the following table :

Table b

Demand Trend for Typewriter Ribbons

Year	*Quantity ('000 Kg)*	*Value ('000 Birr)*
1986	16.0	527
1987	17.3	572
1988	18.6	617
1989	19.9	662
1990	21.2	707
1991	22.5	752
1992	23.8	797
1993	25.1	842
1994	26.4	887
1995	27.7	932

As can be observed from the previous table, the import of typewriter ribbons has been of the order 8.2 tons annually on an average during the last seven year (1976-1982) and it is expected that the annual demand would be about 28 tons after a decade.

2.2 Plant Capacity

It has been indicated earlier that the annual demand in the year 1995 would be about 28 tons. It is, therefore, suggested that a plant with a capacity to manufacture about 27,000 dozens of typewriter ribbons per year which is equivalent to about 8 tons/year could be considered at the first phase and a bigger capacity plant can be considered at a later stage in order to satisfy the future demand.

2.3 Production Programme

The installation of the plant has to be made in consideration of the selection of technology, the selection of the suppliers of equipment and others. It would take about one year for fabrication and supply of equipment. The plant could be installed and commissioned in about 3 months after receipt of equipments at site. During the first year 50% production could be achieved, 75% of rated capacity in second year and full production of 8 tons by third year.

3. MATERIAL INPUTS AND UTILITIES

3.1 Major Raw Materials

The major raw materials for the production of typewriter ribbons are cambric cloth, ink chemicals, spools, tin containers and card board boxes.

The raw material requirements per ton of product is given below :

Table : Raw Material Requirement with Price

S.No.	*Particulars*	*Unit Rate in Birrs*	*Annual Requirement*
1.	Cambric cloth	8.5/m^2	50000 m^2
2.	Ink chemicals	1.65/kg. of product	
3.	Spools	2.9/kg. of product	
4.	Tin containers	5.25/kg. of product	
5.	Card board boxes	125 Birr/ton of product	

The total annual expenditure on procurement of these raw materials is estimated to be 513400 Birr.

3.2 Utilities

The utility requirement per ton of product is :

Electricity	:	500 KWH
Fuel	:	31.3 Litres

It is estimated that annual expenditure on this account of these items is 10560 Birrs, which shall include the provision for consumables, repairs and maintenances.

4. TECHNOLOGY AND ENGINEERING

4.1 Process Description

Scoured and bleached cambric cotton cloth is slit to ribbons of required width and wound in the form of rolls on a machine. These slit ribbons are inked on another machine operated manually or by motor. The spools are then packed in containers which may be vacuum sealed. Ink is prepared separately with paint making machines and fed to the inking machine.

4.2 Engineering

List of Machinery & Equipments

For the proposed plant with a capacity of 27000 dozens of ribbons per year, the following are the major equipments :

Triple Roll paint grinding machine with 5 HP motor	1 No.
Paint mixing machine with 3 HP motor.	1 No.
Slitting machine with 1 HP motor.	1 No.
Spooling machine with 1 HP motor.	1 No.
Vacuum sealing machine complete with pumps motor 2 HP	1 Unit

4.3 Cost of Machinery & Equipment

The cost of machinery and equipment CIF Addis is estimated to be Birr 66100 excluding foundation and installation charges.

4.4 Building Layout

The covered area required for housing this plant would be 250 m^2.

4.5 Civil Works

The construction cost of the building is about Birr 150000.

5. MANPOWER & TRAINING

5.1 Manpower Requirement

The manpower requirement for operating the plant in one shift shall be as indicated below :

Table c

Manpower Requirement

Category	*No. Required*	*Salary/ person month/Birr*	*Annual expenditure Birr*
Managerial	1	1200	14400
Supervisory	1	900	10800
Skilled	6	250	18000
Unskilled	1	100	12000
Total	9	4600	55200

The total annual manpower expenditure that would be incurred to the operating personnel is estimated to be Birr 55200.

5.2 Training

The process for making typewriter ribbons is rather simple and as such does not require any specialized training. However, if the operating personnel are recruited during the installation period itself, they could associate themselves with the overseas implementing agency during trial run and commissioning of various equipments.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis : Production Capacity : 27000 dozens/year
10 m each ribbon

One Shift

270 days operation.

6.1 Total Capital Investment

Particulars	*F.C. (Birr)*	*L.C. (Birr)*	*Total (Birr)*
Plant & Machinery *	60600	5500	66100
Office equipment and furniture		3000	3000
Preproduction expenses		6160	6160
Building		150000	150000
Working Capital	63925	13660	77585
Total	124525	178320	302845

* Plant and machinery cost includes technology fee.

6.2 Production Cost

For producing 27,000 dozens of typewriter ribbons/annum, the production cost has been estimated to be 699750 Birrs, as given below, out of which, raw materials account for 71.5%, energy and other manufacturing costs account for 2% and expenditure that would be incurred on the operating personnel has been estimated to be 9.5%.

Sl.No.	*Particulars*	*Total Amount (Birr)*
1.	Raw Materials	513400
2.	Energy and other manufacturing costs	10560
3.	Labour & Supervision	55200
4.	General Overheads	33120
5.	Sales/advertising	33750
6.	Depreciation on plant and machinery	6910
7.	Depreciation on buildings	7500
8.	Interest on long term loan	18020
9.	Interest on short term loan	21290
	Total production cost	699750
	Production cost per dozen	Birr 26 (approx.)

6.3 Financial Evaluation

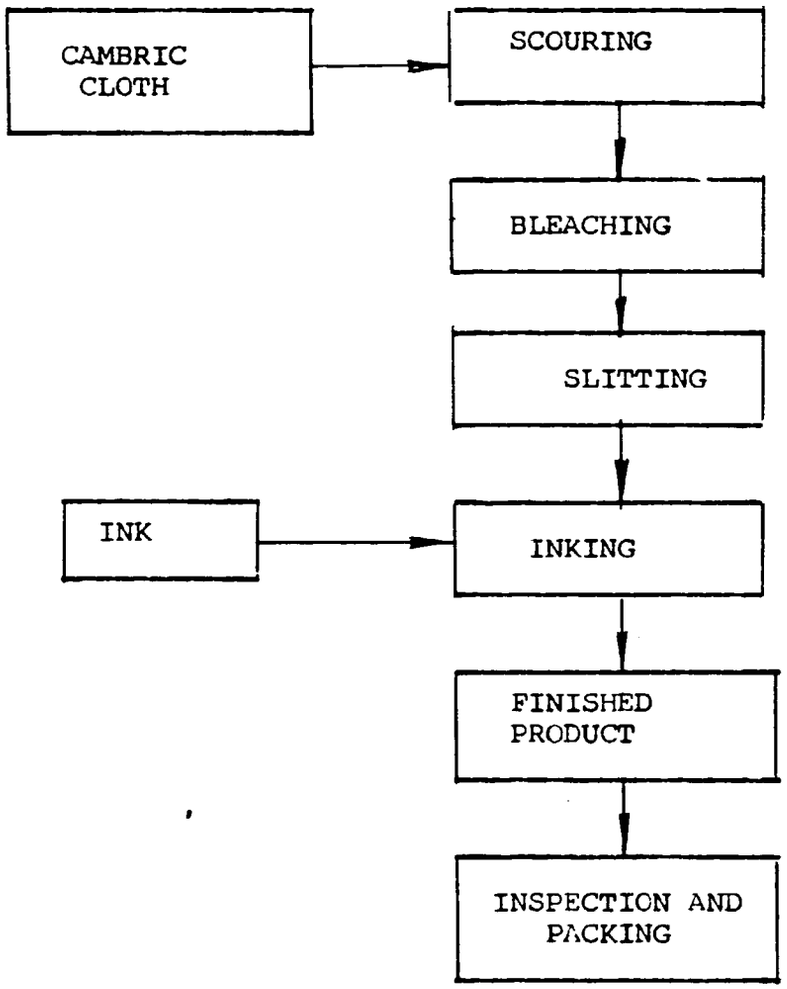
Total sales realisation at 30 Birr/dozen	Birr 810000
Profit before taxes	Birr 110250
Return on investment	36.4%
Break-even point	56.0%
Pay-back period	2 years 5 months

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales*	*Profit*	*Depreciation*	*Cash Flow*
1st year	420895	405000	- 15895	+ 6910	- 8985
2nd year	583870	607500	+ 23630	+ 6910	+ 30540
3rd year	699750	810000	+ 110250	+ 6910	+ 117160

Pay-back period : 2 years 5 months

TYPE WRITER RIBBONS



24. COOKING STOVES AND HOT PLATES

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

The project proposes to manufacture 3000 Nos. of Single Hot plates, 1500 Nos. of Double Hot plates, 50 Nos. of cooking range with single hot plates, 70 Nos. of cooking range with three hot plates & 300 Nos. of baking ovens per annum. The investment on machinery and equipment is estimated to be Birrs 71900. It requires a covered area of about 250 sq. mts. and it can generate employment to 15 persons. The return on investment would be about 26%.

1.2 Description and Specification of the Product

Domestic electrical appliances are convenient and time saving gadgets. Cooking stoves and hot plates make the cooking easy. With easy availability of power, more and more people are switching over to electrical appliance in comparison to other conventional methods. Cooking stoves and hot plates are made in different wattage ratings.

Specifications

Cooking stoves and hot plates are made in different wattage ratings. International Standards and Specifications are available for this products.

2. MARKET AND PLANT CAPACITY

2.1 Market

Cooking stoves and hot plates have been imported from various sources. Import figures in the last several years are substantial and hence it is worth considering manufacture of these utility essential items locally.

Import data from 1976 upto 1982 have been collected from External

Trade Statistics data and are given in table below. The figures are in aggregate. For individual type of stoves import datas are not available.

Import data of cooking stoves and hot plates

Year	*Qty.Nos.*	*Value in Birrs*
1976	5400	189800
1977	2600	100300
1978	2900	113600
1979	9400	566500
1980	7600	533500
1981	5100	516600
1982	1300	605200

Import data is not smooth and does not indicate any trend. This may be due to import and other trade restrictions. Nonetheless, using the moving average growth rate during 1976 to 1982, is estimated to be 10 percent per annum.

2.2 Demand Forecast

The future demand for cooking stoves and hot plates depend on the electrification programme. The ten year indicative plan assumes an average annual growth rate of about 10% for electrification. The projected demand for the next ten years are given below :

Demand Forecast

Year	*Qty. Nos.*	*50%*
1986	8650	4325
1990	11740	5870
1995	15600	7800

2.3 Plant Capacity

There are various types of cooking range and hot plates. The envisaged plant may satisfy upto 50% of the projected demand. It is suggested that a plant with a capacity of about 5020 cooking range and ther items per annum may be installed.

2.4 Production Programme

The unit is envisaged to operate one shift a day for 270 days a year. It is expected to operate at 50, 75,and 100 percent of the installed capacity during the first, second and third year respectively. The product mix is shown in the following table. The various product mix has been selected based on the experience of the market demand. The annual sales realisation at full capacity is estimated to be 0.37 million Birrs.

Product Mix

Item No.	*Product*	*Qty.Nos.*	*Percentage*
1.	Single Hot Plate	3000	59.76
2.	Double Hot Plate	1500	29.88
3.	Cooking range with Single Hot Plate	150	3.00
4.	Cooking range with Three Hot Plates	70	1.36
5.	Baking Ovens	300	6.00
	Total	5020	100

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw Materials

The raw materials required in this project are mild steel sheets, mild steel rods, cast iron plates, Nichrome Wire, Rotary Switches,

ceramic beads, aluminium and magnesium oxide. These materials are not locally available and have to be imported. Some miscellaneous items like bolts, screws, nuts, paints and packing materials which is locally available are also used.

The raw material requirement for the manufacture of 3000 Nos. of single hot plates, 1500 Nos. of double hot plates, 150 Nos. of cooking range with single hot plates, 70 Nos. of cooking range with three hot plates, 300 Nos. of baking ovens per annum are given below :

Raw Material Requirement

Item No.	*Description*	*Price per kg. Birrs*	*Quantity*
1.	Mild steel, 22 SWG Flats and Angles	2.92	10000 Kgs.
2.	Mild Steel rods 9 mm diameter	2.92	3000 Kgs.
3.	Nichrome Wire	139	100 "
4.	Cast Iron Plates	As per production programme	
5.	Aluminium & Magnesium oxide	- do -	
6.	Rotary Switches	- do -	
7.	Local Inputs Bolts, Screws, Nuts, Paints, Packing materials	- do -	

Total Cost of raw-materials including the local inputs is estimated to be 0.14 Million Birrs.

3.2 Utilities

The utilities requirements are electricity and water. The total consumption of electricity is 80600 KWH per annum and water is 150 M^3 per annum. The cost of electricity consumption is about Birrs 9675

and the cost of water consumption is about Birr 75. Hence the total annual expenditure on utilities is about Birrs 9750.

4. TECHNOLOGY AND ENGINEERING

4.1 Technology

The technology to manufacture cooking stoves and hot plates is simple. The technical knowhow may be obtained from an operating unit through training. There are many reputed manufacturing units who may offer training facility and transfer of manufacturing know-how.

There are two types of electrical hot plates, i.e., single hot plates and double hot plates with varying capacity from 1000 Watts to 4000 Watts. Cooking stoves are of different sizes with one to five hot plates with baking oven. Single hot plate and three hot plates are the most common cooking stoves.

4.2 Description of the Manufacturing Process

The essential parts for the cooking stove and hot plates are :

i) Refractory base
ii) Cast Iron Plates
iii) Heating elements
iv) Outer case
v) Switches and controls.

Mild steel plates are cut to the desired size in the guillotine shearing machine. The sized material is passed to the power press for the blanking and deep drawing operation. The drawn material is cleaned and painted.

Cooking stove refractory base is made out of aluminium oxide or magnesium oxide paste. These are baked in the baking oven. Nichrome wire is straightened in the manually operated machine, then it is wound to specified length in the coil winding machine. The wound

coils are fitted in the refractory base. Cast Iron Plates are cut to the desired size and used in the hot plates. The components are assembled and connected with proper switches and controls.

4.3 List of Machinery and Equipment

For the suggested capacity of manufacturing cooking stoves and hot plates the following are the major machinery and equipments required :

Guillotine shearing machine 1200 mm length, capacity 8 SWG	1
Bending and forging machine (Manual)	1
Circle cutting machine, diameter : 200 mm	1
Hydraulic press 50 T capacity	1
Centre lathe Bed length : 1800 mm	1
Spot welding set : 5 KVA	1
Gas welding set	1
Power Hacksaw	1
Bench drilling machine, capacity : 12 mm	1
Bench grinder, wheel diameter : 200 mm	1
Coil winding machine	1
Spray painting equipment	1
Baking oven, 3 KW capacity	1
Hand shearing machine	1

The cost of machinery and equipment on CIF addis basis, is estimated to be Birrs 71900.

4.4 Building Layout

It is estimated that a covered area of about 250 sq. mts. is necessary for housing the machinery and equipment. This area includes the space for raw material store, space for finished goods store and office accommodation.

4.5 Civil Works

The construction cost of the building is about 0.15 Million Birrs.

5. MANPOWER AND TRAINING

5.1 Manpower Requirement

For the full operation of the production unit, 15 employees would be required as given in the table below :

No.	*Category*	*Number Required*	*Salary per month per person Birrs*	*Salary per annum Birrs*
1.	Supervisor	1	900	10800
2.	Skilled workers	4	250	12000
3.	Semi-skilled workers	6	150	10800
4.	Unskilled workers	3	100	3600
5.	Others	1	350	4200
	Total	15		41400

The total expenditure on wages and salaries is estimated as Birrs 41400.

5.2 Training

It may be necessary that few of the operating personnel get acquainted with the plant operation before the unit goes on stream.

This could be achieved by active participation of the supervisor and few skilled personnel during the installation and commissioning of the plant.

5.3 **Cost of training**

It may be necessary to get the services of an expert during the start-up of production for a period of four weeks. He should be able to organise production programme and also training of technical personnel. The cost of the expert is estimated to be Birr 15000 including travel expenses.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis

Capacity	:	5020 Nos.
No. of shifts/day	:	1
No. of working days/year	:	270

6.1 **Total Capital Investment**

The total investment is estimated to be Birrs 275900 of which Birr 241900 is for fixed capital and the remaining Birr 34000 is for working capital. The details are as shown below :

Particulars	*FC*	*LC*	*Total cost Birr*
Machinery and equipment	63300	8600	71900
Building construction		150000	150000
Office equipment and furniture		5000	5000
Pre-production expenses		15000	15000
Working Capital	21000	13000	34000
Total	84300	191600	275900

6.2 Production Cost

The annual production cost at full capacity one shift operation is estimated to be Birr 292010, out of which raw material and manpower costs account for 48% and 14% respectively. The break-up is shown in the following table :

Sl.No.	*Particulars*	*Cost (Birr)*
1.	Raw Material	143060
2.	Utilities	9750
3.	Labour & Supervision	41400
4.	Overheads	24800
5.	Consumables	7200
6.	Repair & Maintenance	3600
7.	Sales/Advertising	18000
8.	Depreciation on Machinery	7200
9.	Depreciation on Building	7500
10.	Interest	29500
	Total	292010

6.3 Financial Evaluation

The estimated revenue at full capacity is Birr 365500. The details are as shown below :

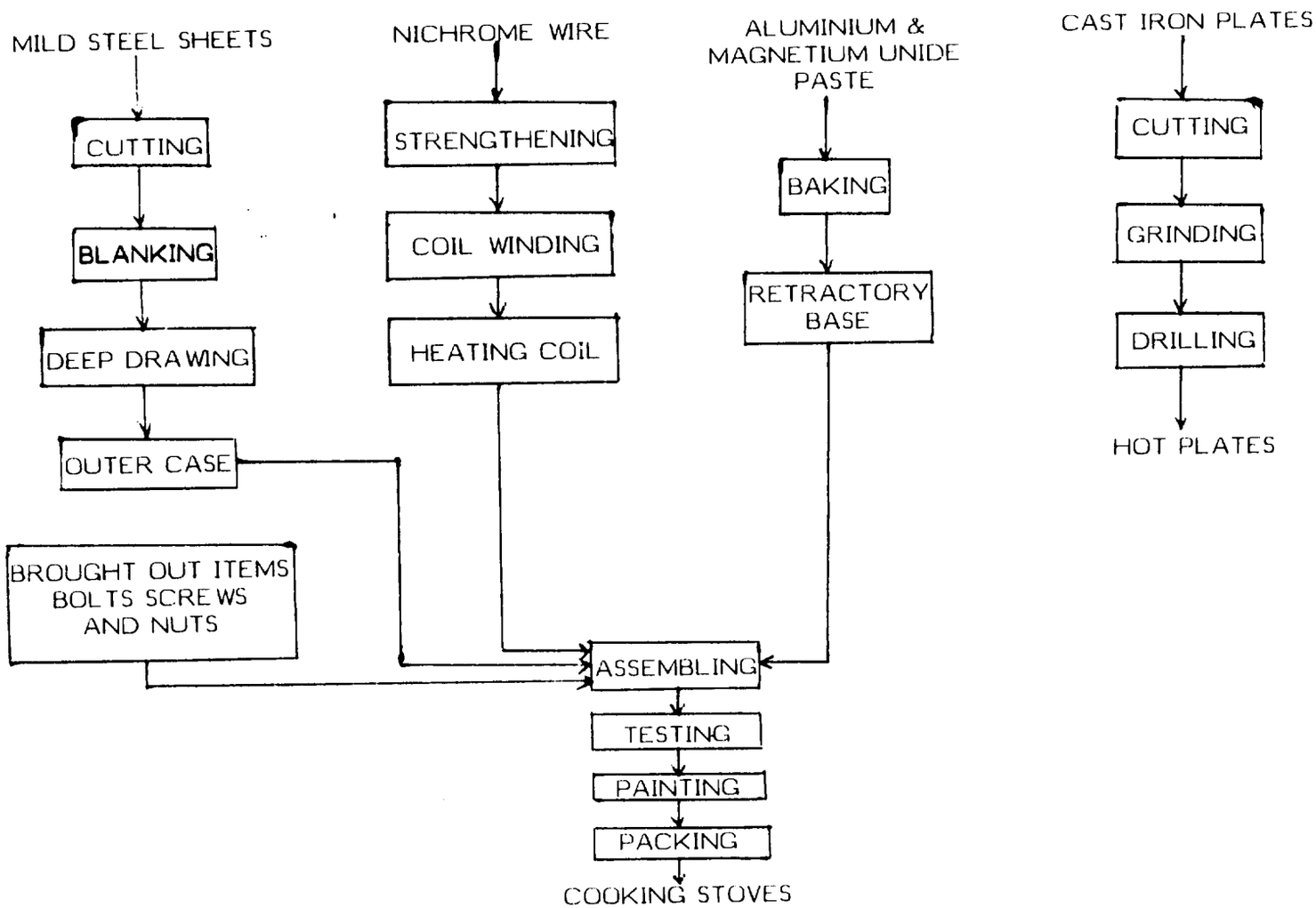
Sl. No.	*Particulars*	*Qty. Kg.*	*Unit Price Birr*	*Annual Sales Revenue Birr*
1.	Single Hot Plate	3000	40	120000
2.	Double Hot Plate	1500	75	112500
3.	Cooking range with Single Hot Plate	150	200	30000
4.	Cooking range with Three Hot Plates	70	400	28000
5.	Baking Ovens	300	250	75000
	Total			365500

Total sales Realisation	:	Birr 365500
Net Profit	:	Birr 73490
Return on Investment	:	26%
Break-even Point	:	60%
Pay-back period	:	2.6 years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*		*Profit/ Loss*	*Depreciation*	*Net Cash Flow*
Ist	01205	182750	-	18455	7200	- 11255
2nd	246600	274125	+	27525	7200	+ 23470
3rd	292010	365500	+	73490	7200	+ 104160

OPERATION FLOW PROCESS CHART



25. WHEEL BARROWS & HAND CARTS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

This proposal envisages manufacture of 4800 Wheel Barrows and 500 Hand Carts per annum. The total investment on machinery and equipment is about Birrs 72500. The project requires a covered area of 250 sq. mts. and it can generate employment to about 9 persons. The return on investment would be around 25%.

1.2 Description and Specification of the Product

Wheel Barrow is used for transporting small quantity of materials like building materials and road construction materials for short distances. This helps in reducing fatigue and human efforts. Wheel Barrows are also used for internal movement of material in some industries and large farms. In municipalities and municipal corporations these are used for the removal of garbage etc.

Specifications

There is no standard design and specification for wheel barrow and hand carts. Manufacturers may evolve their own design specifications. The drawings and specifications may be prepared accordingly.

Hand Cart

Hand Cart is a cheap mode of transporting materials from one place to another over a short distance. It is used in agricultural activities, construction sites and even in metropolitan cities for transporting goods. It is a cheap means of transport where cheap labour is not available.

2. MARKET AND PLANT CAPACITY

2.1 Market

Wheel Barrows have been imported from Europe to meet the demand.

Exact import data for the last few years are not available. As it is an imported item, it is proposed to manufacture locally.

2.2 Demand Forecast

Wheel Barrows are required for the construction activities, industries, municipalities, agricultural departments etc. The future demand depend on the development plans for these sectors. IPS has suggested an estimated demand of 9300 units per annum.

2.3 Plant Capacity and Production Programme

It is proposed to manufacture 4800 Wheel Barrows and 500 Hand Carts per annum. The proposed unit will meet about 50% of the estimated demand. The unit is envisaged to operate one shift a day for 270 days a year. It is expected to operate at 50, 75 and 100 percent of the installed capacity during the first, second and third year respectively. The details of the products are given below :

Product Details

Item No.	*Product*	*Qty. Nos.*
1.	Wheel Barrows	4800
2.	Hand Carts	500

The annual sales realisation at full capacity is anticipated to be 1.25 million Birr.

2.4 Distribution and Sales

The public and private enterprises are distributing Wheel Barrows along with other construction equipments. The major consumers are the Governmental agencies for road construction, Building construction, Industrial organisations etc. The product can easily find their sales outlet through the same chanels as the imported ones.

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw Materials

Wheel Barrows are manufactured by fabrication process. The major raw materials required are the sheet metal, mild steel flats, rods and iron angle. These materials are not locally available and will have to be imported. The hardware items like Bolts, Nuts, Rivets, Paint, Cast Iron Wheels, Welding Electrode may be procured from the local market or imported.

The raw materials required for the manufacture of Hand Carts are mild steel rods and wooden materials. Mild steel rods are not locally available and have to be imported. The wooden materials can be procured from he local market.

The raw material requirement for the manufacture of 4800 Wheel Barrows and 500 Hand Cart per annum is given below :

Raw Material Requirements

Item No.	*Description*	*Unit Cost in Birr*	*Quantity in Kgs.*
	Wheel Barrows		
1.	Mild Steel Sheet 12 to 18G	2.0	144000
2.	Angle Iron & T Iron 3 mm x 25 mm	2.68	192000
3.	Mild Steel Flats 3 mm x 25 to 31 mm width	2.68	48000
4.	Mild Steel Rod 25 mm dia	2.68	36000
	Hand Carts		
1.	Mild Steel Flats & Rods	2.68	100000
	Local Input		
6.	Wood, Bolts, Screws, Nuts, Welding rods	As per production programme	

The expenditure that would be incurred per year for the procurement of these raw materials is estimated to be 0.94 Million Birr.

3.2 Utilities

The utilities required for the plant are electricity and water. The annual consumption of electricity is 22560 KWH and water is 120 M^3. The annual expenditure on the utilities is estimated to be Birrs 2760.

4. TECHNOLOGY & ENGINEERING

4.1 Technology

The technology to manufacture Wheel Barrows and Hand Carts are simple. The technical knowhow may be obtained through machinery suppliers.

It may also be obtained from an operating unit through training. There are many manufacturing units who can offer training facilities and transfer of manufacturing knowhow.

Wheel Barrows are made of steel sheets, steel rods and cast iron wheels. The manufacture of Wheel Barrows mainly involves fabrication, and thus a manufacturing unit may be started with very little investment even in smaller towns to cater the demand of nearby market. Hand carts are made from wooden materials.

4.2 Description of manufacturing process

The Wheel Barrows are made out of steel sheets, rods and C.I. wheels. The sheets are cut to desired shape and size. They are formed to the shape of the body of the barrow. All the sheets of the body are welded together. The axles are turned from steel rods on lathe. The C.I. wheels are bored to house the axle. The angle iron for handles are cut on power press and the bolt holes are punched. The Wheel Barrow is painted.

Hand Carts

Wooden material is cut to the required size on the wood cutting Band saw. The profiles are made in the wood (wherever it is necessary) using the circular saw. The sized material is finished on the jointer planer. Mild steel flats are turned in the lathe and then it is drilled. The parts are assembled with Wheel Barrows.

4.3 List of Machinery and Equipments

The machinery & equipment requiredfor the manufacture of 4800 Wheel Barrows and 500 Hand Carts per year are as given below :

1.	Power Press 30 Ton Capacity with 2 HP Motor and Starter	1
2.	Gas Welding Set	2
3.	Guillotine Shearing Machine cutting capacity 12 to 26 gauge 1200 mm size. with 2 HP motor and starter	1
4.	Lathe 8 ft. with electric motor 2 HP and starter	1
5.	Drilling Machine 12 MM capacity with 1/2 HP motor and starter	2
6.	Bench Grinder with 1 HP Motor and Starter 250 mm Wheel capacity	1
7.	Wood cutting hand saw 450 mm with 4 HP motor	1
8.	Circular Saw 300 MM with 2 HP Motor	1
9.	Jointer Planer 150 mm blade with 3 HP Motor	1
10.	Centre Lathe with 1.5 m bed length and 2 HP motor	1

Cost of Plant & Machinery

The cost of Machinery and equipment is estimated to be Birrs 72500 on CIF Addis basis.

4.4 Layout

To house the machinery and equipment, it is estimated that a covered area of 250 sq. mts. should be required. This area includes the space for raw materials, store, finished goods store and office accommodation.

4.5 Civil Works

The construction cost of the building is about Birrs 150000

5. MANPOWER

5.1 Manpower Requirement

For operating this plant, a total manpower of 9 is required as per details given below :

No.	*Category*	*No. Required*	*Salary per month per person (Birrs)*	*Salary per Annum (Birrs)*
1.	Manager	1	1200	14400
2.	Supervisor	1	900	10800
3.	Skilled Workers	2	250	6000
4.	Semi-skilled Workers	2	150	3600
5.	Unskilled Workers	2	100	2400
6.	Others	1	350	4200
	Total	9		41400

The total expenditure on wages and salaries per annum works out to be Birrs 41400.

6. FINANCIAL & ECONOMIC ANALYSIS

6.1 Total Capital Investment

Basis

Capacity	:	4800 Wheel Barrows 500 Hand Carts
No. of working days/year	:	270
No. of shifts/day	:	One

The total capital investment is estimated to be Birr 374500 of which Birr 237500 is the fixed capital and the remaining Birr 137000 is for the working capital. The details are as shown below :

Particulars	*FC*	*LC*	*Total Cost (Birrs)*
Fixed Capital			
Plant & Machinery	63800	8700	72500
Building Construction		150000	150000
Preproduction expenses		10000	10000
Office equipment & furniture		5000	5000
Working Capital	117100	19900	137000
Total	180900	193600	374500

6.2 Production Cost

The annual production cost at full capacity on one shift operation is estimated to be Birr 1155800. Raw Materials and Manpower costs amounts to 81% and 3% respectively. The break-up is shown in the table below :

Sl.No.	*Particulars*	*Cost in Birr*
1.	Raw Materials	936840
2.	Utilities	2760
3.	Labour & Supervision	41400
4.	General Overheads	24800
5.	Consumables	7300
6.	Repairs & Maintenance	3600
7.	Sales/Advertising	55000
8.	Depreciation on plant & machinery	7300
9.	Depreciation on building	7500
10.	Interest charges	69300
	Total	1155800

6.3 Financial Evaluation

The estimated sales revenue at full capacity is Birr 1247500. The details are given below :

Item No.	*Particulars*	*Qty.*	*Unit Cost (Birr)*	*Annual Sales Revenue (Birr)*
1.	Hand Carts	500	95	47500
2.	Wheel Barrows	4800	250	1200000
	Total			1247500

Total sales realisation	:	Birr 1247500
Net Profit	:	Birr 91700
Return on Investment	:	25%
Break even point	:	62%
Pay back period	:	2.6 years

CASH FLOW STATEMENT

Year	Production Cost	Sales Revenue	Profit/Loss	Depreciation	Net Cash Flow
Ist	653050	623750	- 29300	7300	- 22000
2nd	904425	935625	+ 31200	7300	+ 16500
3rd	1155800	1247500	+ 91700	7300	+ 115500

26. WATER METER

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

The Project envisages manufacture of water meter for domestic application. It is proposed that the unit will manufacture 6000 meters per annum with an investment of about 94000 Birrs on plant and equipment. The unit requires a built in area of about 250 sq. mt. and could provide employment to about 29 persons. Return on investment would be about 30%.

1.2 Description and Specification of the Product

Water meter is an important instrument which is used for measuring flow of water which is required for computing the consumption charges. It is an essential item like electricity meter, in every house and industrial establishment.

Specifications

Specification for water meter follow the International Standards.

2. MARKET AND PLANT CAPACITY

2.1 Market

Water Meters have been imported from Europe and the Far East. Import data for the last few years are not available. It is proposed to manufacture water meter locally.

2.2 Demand Forecast

Water Meters are required for all water supply departments and Municipalities. The future demand for water meters depend on the development plans for the construction sector. IPS has suggested an estimated demand of 6000 units per annum.

2.3 Plant Capacity & Production Programme

It is proposed to have a unit capable of manufacturing 6000 water meters per annum. The unit is envisaged to operate one shift a day for 270 days a year. It is expected to operate 50 and 75 per cent of the installed capacity during the first and second year respectively. Full capacity could be achieved from third year onwards when an annual sales realisation of 0.63 Million Birrs could be anticipated.

2.4 Distribution and Sales

The public and private organisations are distributing water meters along with other water supply items. The major consumers are the Governmental agencies like Water supply Department, muncipalities etc. The product can easily find their sales outlet through the same channel as the imported ones.

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw Materials

The raw materials for the manufacture of water meters are Bronze Castings, Aluminium sheets, Brass castings, Stainless Steel rods, Acrylic Sheets, Bakelite, Plastic granules and powder. These materials are not locally available and will have to be imported. In addition the following items may also be imported or procured from local sources wherever available. These components are O-ring, rubber washer, C.I. bodies, pins, nuts, impeller shaft and jewel, Glass dial cover, springs, brass knobs and other miscellaneous items.

The main raw material requirements for manufacture of 6000 meters per annum is given below :

Raw Material Requirement & Cost

Item No.	*Material*	*Unit Price in Birr*	*Qty.(Kgs.) Per Year*
1	*2*	*3*	*4*
1.	Bronze Castings	8.3	24000

1	2	3	4
2.	Acrylic sheets, Bakelite, Plastic Granules	8.3	300
3.	Stainless Steel rods	26.8	300
4.	Brass rods	8.3	120
5.	Brass Castings	8.3	3600
6.	Aluminium Sheets	6.7	1800
	Bought Out Components		
7.	Impeller Shaft and Jewels		6,000 Nos.
8.	Glass dial Covers		6,000 Nos.
9.	C.I. Bodies		6,000 Nos.
10.	O-rings, rubber washer		
11.	Pins, Nuts, Washer, etc.		
12.	Springs, Wipers etc.		
13.	Packing Material	Lump sum.	

Cost of raw material including bought out items is estimated to be 0.29 million Birrs on CIF, Addis basis.

3.2 Utilities

The utilities required are electricity and water supply. The total consumption of these are given below :

Electricity	:	4000 KWH/month
Water	:	50 M^3/month

The annual expenditure towards electricity and water is estimated as Birrs 6100.

4. TECHNOLOGY & ENGINEERING

4.1 Technology

Water meters are used to measure quantity of water consumed by individual to bill them according to their consumption. They are specified in a range of five sizes such as 15 mm, 20 mm, 40 mm and 50 mm. Thus is an essential item, like electric meter in every household in a city and industrial township. These are generally used by municipal water supply agencies.

4.2 Description of Manufacturing Process

Stainless steel rods are fed to the precision lathe to get the shaft of required diameter and length. These shafts are then drilled and passed to the milling machine for slotting purposes. The impellers and pistons thus manufactured are finished by grinding to obtain the desired surface finish.

Brass rods are fed t the high precision lathes for turning to the desired diameter. The material is then fed to the Gear hobbing machine for gear cutting operation. The gears are finished in the gear grinding machine.

The plastic granules are fed to the injection moulding machine for making the dial and handles. The aluminium sheets are passed to the power press for the combined operations of blanking and forming.

Brass cuttings and Bronze castings are fitted with rotary block work and counter mechanism. After the testing and inspection the dial and hands are assembled. Then the meter is passed on to the spray painting section.

4.3 List of Machinery and Equipment

For the suggested capacity of 6000 water meters per annum, the following are the major equipments needed :

Precision centre lathe 340 mm Swing bed 600 mm with 3 HP motor and starter	1
Capstan Lathe 25 mm bar capacity Swing overhead 200 mm with 2 HP motor and starter	1
High speed production lathe Max. bar capacity 32 mm swing over slide 160 mm with 1.5 HP motor and starter and suitable chucks	1
Universal milling machine bed 1000x260 mm with dividing head, fixtures for components etc. with 4 H.P. motor and starter	1
Hand operated injection moulding machine 5 Kg. capacity	1
High precision, high speed bench drilling machine. 12 mm capacity with tapping attachment and 1 HP motor	1
Double ended bench grinder 200 mm wheel dia	1
Power press 20 Ton capacity heavy extra duty with fly-wheel and 2 HP motor	1
Screw Press Length : 800 mm	1
Hand fly press No. 5 Bed Length : 457 mm Weight of fly wheel : 53 kg. Stroke : 152 mm.	1
Precision Gear Hobbing machine with phase hobbing attachment and accessories hobbing dia. 63 mm max. hobbing length 40 mm max. pitch 0.075 per 100 with plunge cutting facilities and coolant pump etc.	1
Horizontal polishing machine R.P.M. : 1400 : Motor 1 H.P.	1
Tool grinding machine (double ended) wheel dia : 300 mm Motor 2 h.P.	1
Spray painting machine with aircompressor 8 cu.m.	1

The cost of machinery and equipment on CIF Addis is estimated to be Birrs 94000.

4.4 Building Layout

For housing the equipment, it is estimated that a covered area of 250 sq. mts. will be required. This area includes office space and storage space for raw materials and finished goods.

4.5 Civil Works

The construction cost of the building is about Birrs 15,0000.

5. MANPOWER & TRAINING

5.1 Manpowr Requirement

It is estimated that the unit would require about 29 employees as shown in Table. The annual wages and salaries is estimated at Birrs 94200.

Category	*Number Required*	*Salary per month per person (Birrs)*	*Salary per month*
1. Manager	1	1200	14400
2. Supervisor	1	900	10800
3. Skilled Workers	7	250	21000
4. Semi-skilled Workers	10	150	18000
5. Unskilled Workers	4	100	4800
6. Others	6	350	25200
Totai	29		94200

5.2 Training

All production staff should have training in the production technology maintenance and quality control, for which the following methods could be adopted :

- Training of Manager or Supervisor foreman for two weeks at the existing manufacturing facility.
- Active participation of the Manager, Supervisor and skilled personnel during the installation of the plant.
- Supervisory staff should get the benefit of class room lecture by the foreign experts.
- Training of all production staff by the foreign expert at the start-up period.
- Training of the Inspector on quality control and inspection standards.

It may be necessary to train one person (Manager or Supervisor or Foreman) in a running manufacturing unit for two weeks. It may also be necessary to get the services of an expert during the start-up of production for a period of three weeks.He alongwith the other trained person should be able to organise production programme and also training of technical personnel. it is expected that in plant training will be given free of charge and however the cost of transport and boarding may have to be met. The total cost for training abroad and expenditure on expert is estimated to be Birr 15000 including travel expenses.

6. FINANCIAL AND ECONOMIC ANALYSIS

6.1 Total Capital Investment

The total capital investment is estimated to be Birrs 314000 of which Birr 264000 is for the fixed capital and the remaining Birr 50000 for working capital. The details are as shown below :

Particulars	*F. C.*	*L.C.*	*Total (Birrs)*
Fixed Capital			
Machinery & Equipment	82500	11500	94000

Particulars	*F.C.*	*L.C.*	*Total (Birrs)*
Building Construction		150000	150000
Office Equipment & Furniture		5000	5000
Pre-production charges		15000	15000
Working Capital	31000	19000	50000
Total	113500	200500	314000

6.2 Production Cost

The anual production cost at full capacity on one shift operation is estimated to be Birrs 536400. Raw material and manpower costs amount to 53% and 18% respectively. The break-up is shown below :

S.No.	*Particulars*	*Cost (Birr)*
1.	Raw Material	286500
2.	Utilities	6100
3.	Labour and Supervision	94200
4.	Overheads	57000
5.	Consumables	9400
6.	Repairs & Maintenance	4700
7.	Sales/Advertisement	25000
8.	Depreciation on Plant	9400
9.	Depreciation on Building	7500
10.	Interest Charges	36600
	Total	536400

6.3 Financial Evaluation

The estimated sales revenue at full capacity is Birrs 630000. The details are shown below :

Item No.	*Particulars*	*Qty.*	*Unit Price*	*Annual Sales (Birrs)*
1.	Water Meter	6000	105	630000
	Total			630000

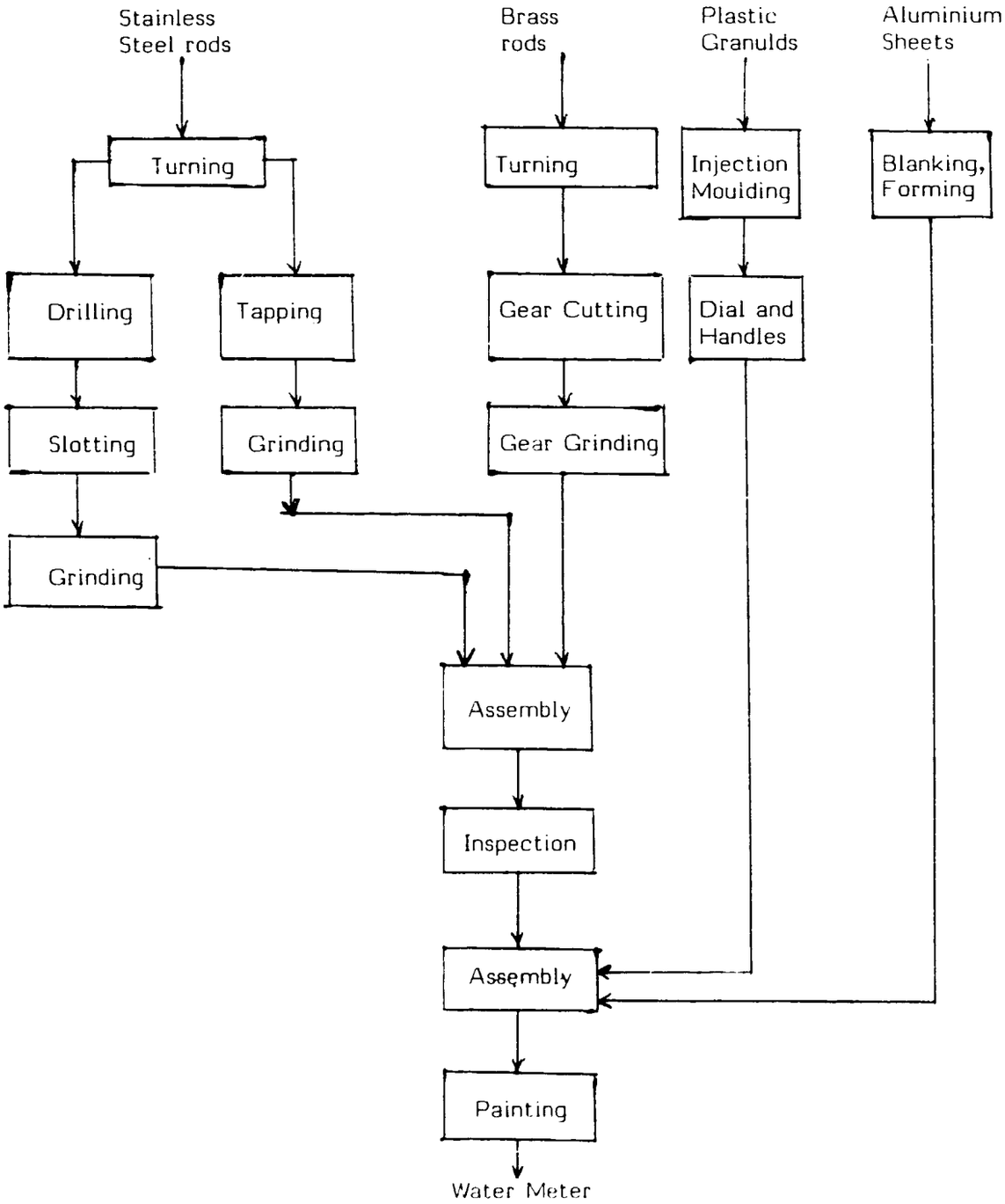
Annual Sales Realisation	:	Birr 630000
Profit before taxes	:	Birr 93600
Return on Investment	:	30%
Break-even point	:	69%
Pay-back period	:	3.1 years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit/Loss*	*Depreciation*	*Net Cash inflow*
Ist	370550	315000	- 55550	9400	- 46150
2nd	453475	472500	+ 19025	8500	- 18625
3rd	536400	630000	+ 93600	8500	+ 83475
4th	536400	630000	+ 93600	8500	+ 185575

OPERATION FLOW PROCESS CHART

WATER METER



27. EUCALYPTUS OIL

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

Essential oils may be defined as odiferous bodies of oily nature, mostly obtained from vegetable kingdom. The essential oils may occur in any part of the plant viz. root, stem, bark, leaf, flower, etc. They consists chemicals like terpenes, alcohol, aldehydes, ketones, esters, ethers, phenols, acids, nitrogenous and sulphur compounds. They are usually liquids at ordinary temperature.

Essential oils are extensively used in a wide range of consumer products like soaps, cosmetics, perfumes, medicines, confectionery, perfumed tobacco, snuff, aerated water, syrups, ice creams, disinfectants and detergents. The cost of essential oil added in the above products varies from 2% to 10%. The average cost could be taken around 5%.

The demand for essential oil is continuously increasing. These oils are used in perfumery items, in medicines and as basic raw materials for extraction of various valuable chemicals; and if essential oils are produced at a reasonable rate, they may successfully compete with their synthetic substitutes. The proposal envisages setting up a small unit capable of distilling Eucalyptus leaves to yield 8 tonnes of oil per annum. The plant shall operate in single shift to start with. The total investment on plant and machinery is estimated to be about 106400 Birrs. The annual sales realisation at full capacity is estimated to be 400,000 Birrs. The return on investment is 23% and the unit is expected to break even at about 69% capacity. Such a unit is capable of generating employment for 15 persons.

1.2 Product Specifications

The oils of Eucalyptus tree are as per Indian Standards Specification No. 328 of 1957 which is given below :

REQUIREMENTS

S.No.	*Characteristic*	*Requirements*
1.	Colour and Appearance	Colourless or pale yellow liquid
2.	Odour and Taste	Characteristic aromatic Camphoraceous odour, pungent and camphoraceous taste followed by a sensation of cold.
3.	Specific gravity at,	
	a) 25°C	0.9005 to 0.9075
	b) 30°C	0.8965 to 0.9035
4.	Optical rotation	- 5° to + 10°
5.	Refractive Index at	
	a) 25°C	1.457 to 1.4678
	b) 30°C	1.4548 to 1.4656
6.	Cineole content by weight (Min.)	60

2.0 MARKET AND PLANT CAPACITY

In order to decide the plant size for inclusion in the industrial estate, import data were collected for 7 years from 1976 to 1982 from 'The Annual Trade Statistics'. As per the Table given below, the quantity of Eucalyptus oil imported has been going up steadily and is on an average 142 tonnes/annum. However, since the collection of raw materials viz., Eucalyptus leaves and transporting this to the industrial estate plant site may be rather difficult, it is felt that on an experimental basis, a small plant with a production capacity of 8 TPA oil could be set up. Since this is a simple steam distillation process, operation on 2 shifts instead of single shift could easily double the output without any additional investment on plant and machinery, but with a marginal increase in the operating personnel. After gaining experience, similar or bigger units can be set up nearer to the source of raw material.

Table - Import Data of Essential Oil

Year	*Qty. ('000 Kg)*	*Value ('000 Birrs)*
1976	33.9	775.9
1977	22.3	2751.7
1978	127.3	2029.8
1979	375.4	3240.7
1980	133.6	2248.1
1981	126.7	1425.1
1982	176.0	1178.4
Annual Average	142.2	1959.0

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw Materials

The major raw material that is required is only Eucalyptus leaves. This is locally available and it is estimated that on annual basis, an expenditure of Birr 190,000 is likely to be incurred on these items as given below :

Material	*Unit cost (Birrs)*	*Qty.*
Eucalyptus Leaves	300	600 Tons
Packing materials	-	Lumpsum

3.2 Utilities

The major utilities annually required are :

- Electrical Energy : 20,000 KWH
- Water : 600 Kl
- Steam : 50 Tonnes

In addition to these three items, provision is made for procuring consumables items and for repairs and maintenance.

The total expenditure on this account is estimated to be 19900 Birr per year.

4. TECHNOLOGY AND ENGINEERING

4.1 Process Description

The oil from eucalyptus leaves is obtained by steam distillation process. The process consists in preparation of charge and then distillation with saturated low pressure steam. Care should be taken to see that the plant materials are not finely ground and they should not contain long stalk and bigger pieces of roots or barks etc. The powdered material is loosely filled in steam distillation still, through which steam at low pressure is passed. The distilled oil and water Vapour then passes through a condenser. The water is then removed from the oil by using a oil-water separator. The oil is collected in a receiving tank. It is then dried, filtered and stored in a cool and dry place.

4.2 Engineering

- List of Machinery & Equipments

Steam distillation still with condenser and other accessories
Chaff cutter (power operated)
Cooling tower of capacity 2000 Litres/hr
Centrifugal filtration pump
Laboratory and testing equipment
Boiler

The CIF Addis cost of this equipment is estimated to be 106430 Birrs.

4.3 Layout

The covered area required for housir timated to be 150 sq.m.

4.4 Civil Works

The cost of construction of building works out to be 90,000 Birrs.

5. MANPOWER AND TRAINING

5.1 Manpower

The personnel required for operating this unit single shift basis are :

Category	*Nos. Required*	*Sales/month* (Birrs)	*Annual expenditure (Birrs)*	
Managerial	1	1200	14400	
Technical	1	900	10800	
Skilled	3	250	9000	
Unskilled	8	100	9600	
Others	2	350	8400	
Total	15	4350	52200	Birrs

The total expenditure that would be incurred towards payment of salaries and wages to these personnel is estimated to be 52200 Birrs per annum.

5.2 Training

Since the process is a simple steam distillation one, it is felt that no specialised training is necessary for the operating personnel and they would be able to grasp the operation if they are associated with the implementing agency during the trial run and commissioning stages.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis -	Production Capacity	:	8 TPA
	No. of shifts/day	:	One
	No. of working days/year	:	270

6.1 Total Capital Investment

Particulars	*F.C. (Birrs)*	*L.C. (Birrs)*	*Total (Birrs)*
Plant and machinery (including technology fees)	93360	13070	106430
Office equipment and furniture	-	3000	3000
Pre-production expenses	-	10640	10640
Buildings	-	90000	90000
Working Capital	-	23200	23200
Total	93360	139910	233270

Say : 233300 Birrs

6.2 Production Cost

The total production cost for producing 8 TPA of Eucalyptus oil works out to Birr 346000, as given below, out of which raw materials account for 55%, Energy and other manufacturing costs 6% and expenditure on manpower accounts for 15%.

S.No.	*Particulars*	*Amount in Birrs*
1.	Raw Materials	190000
2.	Energy and other manufacturing costs	19900
3.	Labour and supervision	52200
4.	General Overheads	31300
5.	Sales/advertising	16000
6.	Depreciation on plant and machinery	10600
7.	Depreciation on building	4500
8.	Interest on long term loan	16800
9.	Interest on short term loan	4600
	Total	345900

Say : Total Production Cost : 346000 Birrs

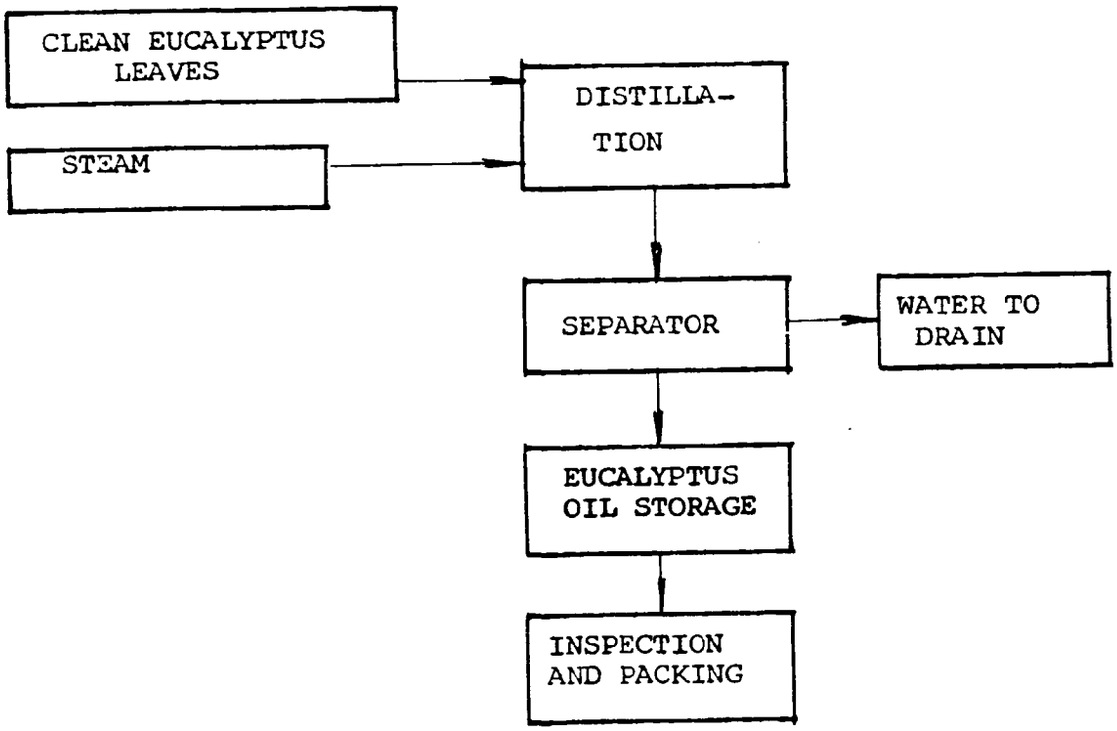
6.3 Financial Evaluation

Total sales realisation @ 50 Birrs/Kg.	:	400,000 Birrs
Profit before taxes	:	54,000 Birrs
Return on investment	:	23%
Break-even point	:	69%
Pay-back period	:	3 Years 7 months

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	232950	200000	- 32950	10600	- 22350
2nd	289425	300000	+ 10575	10600	- 1175
3rd	346000	400000	+ 54000	10600	+ 63425
4th	346000	400000	+ 54000	10600	+ 128025

EUCALYPTUS OIL



28. BOLTS SCREWS AND NUTS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

The project envisages manufacture of Bolts, Screws and Nuts. The recommended capacity of the unit is to manufacture about 290 tons per annum of bolts, screws and nuts. The total investment required on machinery and equipment is about Birr 115000. This unit requires a covered area of about 250 sq. mts. Return on investment would be about 24 per cent and would generate employment to about 31 persons.

1.2 Description and Specification of the Product

Bolts, screws and nuts are the industrial fastners. These arethe basic hardware items which are required for all engineering industries. There are many types and sizes of bolts, screws and nuts.

2. MARKET AND PLANT CAPACITY

2.1 Market Demand

Bolts and nuts have been imported from Europe and the far east to meet the demand. Import figures in the last several years are substantial and hence it is worth considering manufacture of these hardware items locally.

Import data from 1976 upto 1982 are collected and analysed (table below). The figures are in aggregates.

Import Data of Bolts & Nuts

Year	*Quantity Kgs.*	*Value Birrs*
1976	91100	245500
1977	122000	573000
1978	105100	508900
1979	703400	1876100
1980	422000	1784600
1981	312800	1427600
1982	67100	155100

Source : External Trade Statistics.

The supply trend is not smooth and does not show any trend. This may be due to trade or other import restrictions. The average import is about 260500 Kgs. valued Birrs 938700.

2.2 Demand Forecast

The future demand for these hardware items heavily depends on the industrial and development plans. The ten year indicative plan assumes an average annual growth rate of 19.4 per cent for building construction, where these hardware items are one of the important inputs, apart from industrial growth rate. This is very ambitious, and the time trend growth rate of 10 per cent per annum is considered in forecasting the demand.

Demand Forecast

Year	*Quantity/Kgs.*
1986	435300
1990	539500
1995	669600

2.3 Plant Capacity

There are various types of Bolts & Nuts. It is proposed to manufacture from 6 mm to 12 mm size as per international standard organisation (ISO) specification. The proposed capacity is about 290 tonnes per annum, which would meet a part of the local demand. The proposed plant capacity may be doubled easily by working two shifts a day.

2.4 Production Programme

The unit is envisaged to operate one shift a day for 270 days a year. It is expected to operate at 50, 75 and 100 per cent of the installed capacity during the first, second and third year respectively. The product mix is shown in the following table.

Item No.	*Product*	*Quantity Kgs.*
1.	Bolts & Screws and Nuts	290000
	Total	290000

The total annual sales realisation at full capacity is estimated to be 1.20 Million Birr.

2.5 Distribution and Sales

Public and private organisations are distributing bolts and nuts along with other hardware items. The major consumers are industries, automobile work-shops etc. The envisaged products can easily find their sales outlet through the same channels as the imported ones.

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw Materials

The raw material required for manufacturing the bolts, screws and nuts are mild steel rods and hexagonal steel bars. These materials

are not locally available and shall have to be imported. The locally available packing materials can be used for packing purposes.

The raw material requirement for the manufacture of 290 tons of Bolts, Screws and Nuts per annum is given below :

Raw Material Requirement

Item No.	*Description*	*Unit Cost Birr/Kg.*	*Quantity Kg.*
1.	Mild Steel Nos. 6 mm to 12 mm thickness	2.7	225000
2.	Hexagonal bright steel bars	2.7	75000

3.2 Cost of raw material is estimated to be 0.81 Million Birrs on CIF, Addis basis.

3.3 **Utilities**

The utilities requirement are electricity and water. The annual consumption of electricity is 24000 KWH and water is 240 M^3. The cost of electricity consumption is about Birr 2880 and the cost and water consumption is about 120. Hence the total cost of utilities per annum is estimated to be Birr 3000.

4. TECHNOLOGY AND ENGINEERING

4.1 **Technology**

The tecnology for manufacture Bolts, Screws and Nuts is simple. The 'Know-How' may also be obtained through the supplier of plant and equipment.

4.2 **Description of manufacturing process**

The hydraulic hacksaw machine is employed for cutting suitable length

of rod from long steel rods. For bolts and screws the pieces are cut to size desired plus a little extra length, for bolt head. For nuts, long bars upto 130 mm in length are cut. Oil fired furnaces are used to heat the cut pieces to forging temperature, which is about 900°C to 1000°C approximately. One furnace is used to heat the bolt & screw pieces at one end. The other furnace is used to heat the bars of 130mm in length for nuts.

Bolts

Pieces which are heated to forging temperature at one end and forged on the automatic double stroke hot forging machine. The bolt heads are formed and the pieces are passed on to the bolt trimming machine. The sheared end is prepared to take the dies in the thread rolling machine. These pieces are then passed to the thread rolling machine for threading operation. The bolts are finished in the polishing drum.

Screws

Pieces which are heated to forging temperature at one end are forged on the automatic double stroke . . hot forging machine. The screw heads are formed and the pieces are passed on to automatic screw head slotting machine. After the slotting operation is over at the screw head it is passed on to the screw printing machine. The sheared end is prepared to take the dies in the thread rolling machine.

Nuts

The heated bar of suitable diameter is fed to the automatic nut forging machine. The forged nut blanks are fed to the automatic lathe which automatically face, chamber and countersink the nut blanks to the required size. Nut blanks duly completed in operations are put in hoppers or magazines from where they come one by one to the tapping machine. The tapped nuts are then finished in the Polishing drums.

4.3 List of Machinery and Equipment

For the suggested capacity of manufacturing 290 T of Bolts, Screws

and Nuts - the following are the machinery required :

Hydraulic hacksaw Stroke 300 mm	2
Automatic double stroke hot forging machine capacity 6 mm diameter - 1 HP motor	2
Automatic double stroke hot forging, machine capacity 12 mm - 1 HP motor	2
Automatic bolt-head trimming machine capacity 6 mm dia	1
Automatic bolt-head trimming machine capacity 6 mm dia	1
Automatic thread rolling machine capacity 6 mm dia x 37 mm length	1
Automatic thread rolling machine capacity 6 mm dia meter x 37 mm length	1
Automatic screw head slotting machine/capacity 10 mm	1
Automatic Lathe Bed length 2000 mm	2
Automatic Nut tapping machine capacity 7 mm to 12.5 mm	1
Drilling machine Capacity 18 mm	1
Special purpose printing and facing machine/motor 1 HP	1
Oilfired furnace	1
Polishing drums	3
Capacity 80 - 100 kg/hour 2 HP motor x rpm 1440	
Pedestal grinding machine wheel dia 200 mm, 1 HP motor	2

The cost of the machinery mentioned above is estimated to be 0.12 Million Birrs on CIF Addis basis.

4.4 Building Layout

The house all the machinery mentioned above, it requires a covered area of 250 sq. mts. This includes the space to raw-material storage, finished goods store and office accommodation.

4.5 Civil Works

The construction cost of the building is bout 150000 Birrs.

5. MANPOWER AND TRAINING

5.1 Manpower Requirement

For the full operation of the unit on single shift basis (8 hours) the requirement of operating personnel would be as given below :

No.	*Category*	*Number required*	*Salary per month per person/Birr*	*Salary/ annum/Birr*
1.	Manager	1	1200	14400
2.	Supervisor	1	900	10800
3.	Skilled Worker	12	250	36000
4.	Semi-skilled Worker	10	150	18000
5.	Unskilled Worker	5	100	6000
6.	Others	2	350	8400
	Total	31		93600

The total expenditure on wages and salaries is estimated 93600 Birrs.

5.2 **Training Requirements**

All production staff should have training in the production, technology, maintenance and quality control. The following step-by-step approach is recommended.

Active participation of the supervisor during the installation of the plant.

Supervisory staff should get the benefit of class room lecture by the foreign experts.

Training of all productions staff by the foreign expert at the start-up period.

5.3 **Cost of Training**

It may be necessary to get the services of an expert during the start-up of production for a period of four weeks. He should be able to organise production programme and also training of technical personnel. The expenditure on training is estimated to be Birr 10000 which includes travel expenses for the expert.

6. FINANCIAL AND ECONOMIC ANALYSIS

6.1 **Total Capital Investment**

Basis

Capacity	:	290 Tons
No. of shifts/day	:	One
No.of working days/year	:	270

The total capital investment is estimated to be Birr 410000 of which Birr 280000 is for fixed capital and the remaining birr 130000 is for working capital. The details are as given below :

Particulars	*FC Birr*	*LC Birr*	*Total Cost Birr*
Fixed Capital			
Machinery & Equipment	101200	13800	115000
Building & Construction		150000	150000
Office Equipment and Furniture		5000	5000
Pre-production expenses		10000	10000
Working Capital	100000	30000	130000
Total	201200	208800	410000

6.2 **Production Cost**

The annual production cost at full capacity one shift operation is estimated to be Birr 1119200. Raw Material and man-power costs amount to 72% and 8% respectively. The break-up is shown in the following table :

Production Cost

Sl.No.	*Particulars*	*Cost in Birr*
1.	Raw Material	810000
2.	Utilities	3000
3.	Labour & Supervision	93600
4.	Overheads	56000
5.	Consumables	11500
6.	Repair & Maintenance	6000
7.	Sales/Advertising	53300
8.	Depreciation on Plant & Machinery	11500
9.	Depreciation on Building	7500
10.	Interest Charges	66800
	Total	1119200

6.3 Financial Evaluation

The estimated sale revenue at full capacity is Birr 1218000. The details are shown below :

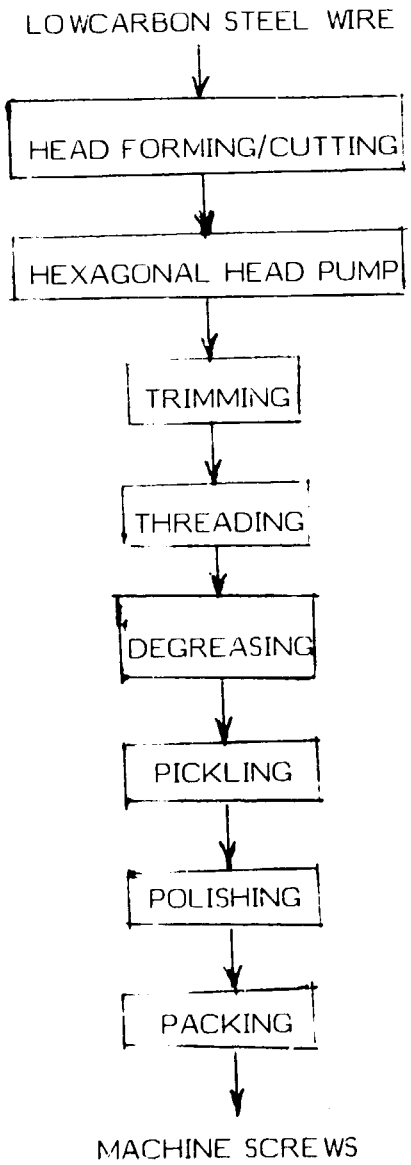
Item No.	***Particulars***	*Quantity*	*Unit Price Birrs*	*Annual Sales Revenue*
1.	Nuts, Bolts, Screws	290 T	4200/T	1218000

Total Sales Realisation	:	Birr 1218000
Net Profit	:	Birr 98800
Return on Investment	:	24%
Break even point	:	70%
Pay-back Period	:	3.3 years

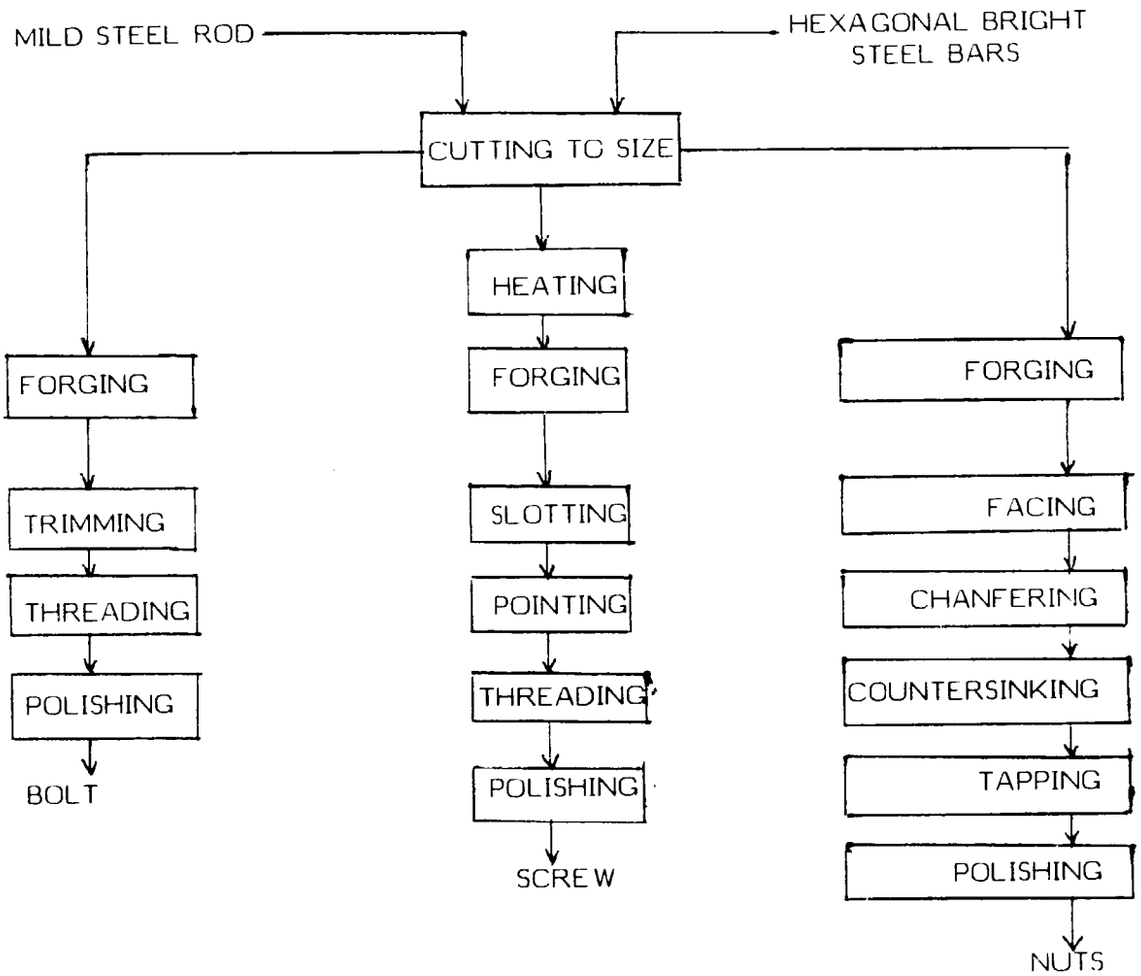
CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit/Loss*	*Depreciation*	*Net Cash Flow*
Ist	77300	609000	- 68300	11500	- 56800
2nd	898250	913500	+ 15250	11500	- 30050
3rd	1119200	1218000	98800	11500	+ 80250
4th	1119200	1218000	98800	11500	+ 190550

MACHINE SCREWS



OPERATION FLOW PROCESS CHART



29. STREET LIGHT FITTINGS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

Electrical light fittings are those articles which are used as accessories of shade fittings like street light fittings, fluorescent light fittings, chokes, starters, reflectors, etc. For this proposed unit with the production capacity of 14400 light fittings per annum, a covered area of 250 sq. mts. is required. The total investment cost on machinery and equipment comes to about 0.12 Million Birrs. This project can provide employment to 20 persons and the return on investment is about 22 percent.

1.2 Description and Specification of the Product

Street light fittings are used on public through fares and on industrial service roads. It is a housing for the light source.

Specifications

Specifications and standards are available for light fittings with the manufacturing industry. The reputed manufacturing companies have established their own standards and specifications for their products. While transferring technology 'knowhow' the required product specifications and quality standards will also be transferred.

2. MARKET AND PLANT CAPACITY

2.1 Market

Electric light fittings are being imported from Europe and the Far East to meet the demand. Import figures in the last several years are substantial and hence it is worth considering manufacture of various light fittings locally.

Import data from 1976 to 1982 are collected and analysed (table below). The figures are aggregate. To convert the weights into units

one unit of light fittings is estimated to weigh about 2.5 kilograms.

Import Data of Lamp Fittings

Year	*Qty. Kgs.*	*Qty. Nos.*	*Value Birr*
1976	7500	3000	41600
1977	11300	4520	90100
1978	43500	17400	514600
1979	42600	17040	401800
1980	25600	10240	276600
1981	84000	33600	595900
1982	82700	33080	179500

Source : External Trade Statistics

Supply trend is not very smooth, but gives an indication that there is progressive increase in supply. Using the moving average growth rate, during 1976 to 1981, it is estimated that the annual growth rate is about 10 percent.

2.2 Demand Forecast

The future demand for street light fittings depends on the development plan for electrification sector. The projected demand for the next ten years are given below :

Demand Forecast

Year	*Qty. (Kgs.)*	*Qty. (Nos.)*
1986	143600	57440
1990	203600	81440
1995	278700	11480

2.3 Plant Capacity

There are different types of lamp fittings, namely, flourescent tube fittings and mercury vapour lamp fittings.

The recommended plant capacity is about 14400, numbers of all types. This is about 25 percent of the projected demand. Additional units can be put up after the first unit is successfully launched.

2.4 Production Programme

The unit is envisaged to operate one shift a day for 270 days a year. It is expected to operate at 50, 75 and 100 percent of the installed capacity during the first, second and third year respectively. The proposed product mix is shown in the following table :

Product Mix

Item No.	*Product*	*Qty.Nos.*	*Percent*
1.	Flourescent tube		
	a) Blow formed plastic cover	6000	41.6
	b) Expanded metal cover	6000	41.6
2.	Mercury Vapour Lamp Fittings	2400	16.8
	Total	14400	100

The total sales revenue at full production is estimated to be 0.41 Million Birrs per year.

2.5 Distribution and Sales

Several public and private enterprises are distributing electrical items. The major consumers are the state electricity distributing authorities. The envisaged product can easily find their sales outlet through the same channels as the imported ones.

3. MATERIAL INPUTS & UTILITIES

3.1 Raw Material

The major raw materials required are CRCA sheets, choke. Aluminium wire, copper wire, polyester resin, paint (stoving enamel) Rotor holders, insulated wire, capacitor, acrylic sheet, starters, condensers, PVC sleeving paint etc.

The other raw material required for manufacturing light fittings (box type, patty type, decorative for domestic purpose light fittings, street light fittings and mercury vapours fittings) is given below :

Item No.	*Raw Material*	*Unit Price*	*Quantity*
1.	Cold Rolled Sheets of SWG 24-26	Birr 2.6/Kg.	30000 Kgs.
2.	Bought out items like Aluminium Wire, Copper wire, laminations, choke container, polyester resin, paint (stoving enamel) Rotor holders, main connector, Insulated wire, capacitor, Acrylic sheet, starters, hand woven condensor, PVC sleeving, paint packing cases, etc.		As per production programme

The major raw material used in this project is cold rolled sheet, the cost of which is Birr 78000. The other bought out items cost Birrs 100000 and the total cost of raw material is 0.18 Million Birrs.

3.2 Utilities

The utilities used in this project are electricity and water. The total consumption of electricity is about 40,000 KWH pr annum, and water is about 120 M^3 per annum. The total cost of utilities works out to be Birrs 4860.

4. TECHNOLOGY AND ENGINEERING

4.1 Technology

The light fittings are employed where the protection to tubes and bulbs are necessary. The light fittings will have a light reflector or light dispersive surrounding or other enclosure which may be associated with the light source in order to modify the light distribution in a desired manner. It protects the light source from weather and insects. It also gives desired appearance, brightness and other lighting characteristics of the source.

4.2 Description of manufacturing process

Cold rolled sheets of 24-26 G are cut in guillotine shearing machine to the required size. These are further processed by bending, punching, rivetting on bending machine, press brake and fly press respectively. The items are cleaned, painted and baked in stoving furnace. Plastic covers are formed on special type cover forming machine Metallic covers are prepared by bending expanded metal sheet on press brake machine. Other fittings like hinges, catches, gaskets and choke, starters are fitted and then assembled. Similar street light fittings for mercury vapour lamps are made from purchased cast iron body castings. The castings are cleaned and painted in the shop. All other accessories are fitted and assembled. The process flow chart is given separately.

4.3 List of Equipments

The machinery and equipments required for this project are :

Power Press, 3 Ton Capacity	2
Power Press, 5 Ton Capacity	1
Power Press, 10 Ton Capacity	1
Hand Press (Fly Press) No. 2 Bed length : 330 mm, weight of flywheel : 20 Kg. stroke 114 mm, height of body - 584 mm.	1

Hand Press (Fly Press) No. 4 Bed length : 413 mm, weight of fly wheel : 39 Kg. Stroke : 140 mm Height of the body : 710 mm.	1
Hand Press (Fly Press) No. 6 Bed length : 477 mm, weight of fly wheel : 70 Kg., Stroke : 165 mm. Height of the body : 876 mm.	1
Shearing machine 1200 MM stroke 18 SWG	1
Press Brake (bending machine with 5 HP motor capacity, 2 M x 3 mm)	1
Welding machines	2
Bench Grinder (double ended) dia of wheel 150 x 200 MM	1
Drill machine capacity : 12 MM	1
Gas Welding Set	1
Compressor, 5 HP	1
Spray painting equipment	1
Drying oven for paint 25 KW size 4 M x 1.25 M x 2 M	1
Cleaning tanks	2
Exhaust fans	2
Winding machine for 6 coils, 1/4 HP Motor	1
Winding machine for M.V. choke	1

Testing equipments

- Voltmeter
- Ammeter
- Wattmeter
- Voltage regulator
- High voltage tester
- Stirrer

The total cost of machinery and equipment works out to be 0.12 Million Birr.

4.4 Building Layout

For housing the machinery and equipment, it is estimated that a covered area of 250 sq. mts. will be required.

4.5 Civil Works

The construction cost of the building is about Birr 150000.

5. MANPOWER AND TRAINING

5.1 Manpower Requirement

The unit requires 20 employees out of which one is supervisor, four are skilled workers and the remaining semi-skilled and unskilled. Annual salary and wage costs are Birr 53400.

Cost of production manpower and supervisory staff are estimated for one shift (8 hours basis) production as indicated below :

Category	*Number Required*	*Salary per Month Birrs*	*Salary per Annum Birrs*
1. Supervisor	1	900	10800
2. Skilled	4	250	12000
3. Semi-skilled	6	150	10800
4. Unskilled	6	100	7200
5. Others	3	350	12600
Total	20		53400

5.2 Training Requirements

All production staff should have training in the production technology maintenance and quality control. The following step by step approach is recommended :

- Active participation of the supervisor during the installation of the plant. Others should be employed as helpers in order to become acquainted with the machinery.

- Supervisory staff should get the benefit of class room lecture by the foreign experts.

- Training of all production staff by the foreign expert at the start-up period.

5.3 **Cost of Training**

It may be necessary to get the services of an expert during the start-up of production for a period of four weeks. he should be able to organise production programme, and also training of technical personnel. The expenditure incurred for expert is estimated to be Birr 15000 including travel expenses.

6. FINANCIAL AND ECONOMIC ANALYSIS

6.1 **Total Capital Investment**

Basis

Capacity	:	14400 Nos.
No. of working days/year	:	270
No. of shifts/day	:	One

The total capital investment is estimated to be Birr 309200 of which Birr 286200 is for fixed capital and the remaining Birr 23000 is for working capital. The details are shown below :

Particulars	*F.C.*	*L.C.*	*Total cost Birrs*
Fixed Capital			
Machinery & Equipment	96000	20200	116200
Bldg. Construction		150000	150000
Pre-Production Cost		15000	15000
Office equipment and Furniture		5000	5000
Working Capital	10000	13000	23000
Total	106000	203200	309200

6.2 Production Cost

The annual prdouction cost at full capacity one shift operation is estimated to be Birr 345900. Raw material and manpower cost amounts to 51 & 15% respectively. The break-up is shown below :

Production Cost

No.	*Particulars*	*Cost*
1.	Raw Materials	178000
2.	Utilities	780
3.	Manpower	53400
4.	Overheads	32000
5.	Consumables	11600
6.	Repair & Maintenance	5800
7.	Sales/Advt.	15700
8.	Depreciation on Plant & Eqpt.	11600
9.	Depreciation on Building	7500
10.	Interest	29500
	Total	345900

6.3 Sales Revenue

The estimated sales revenue at full capacity is Birrs 414000. The details are shown below :

Financial Evaluation

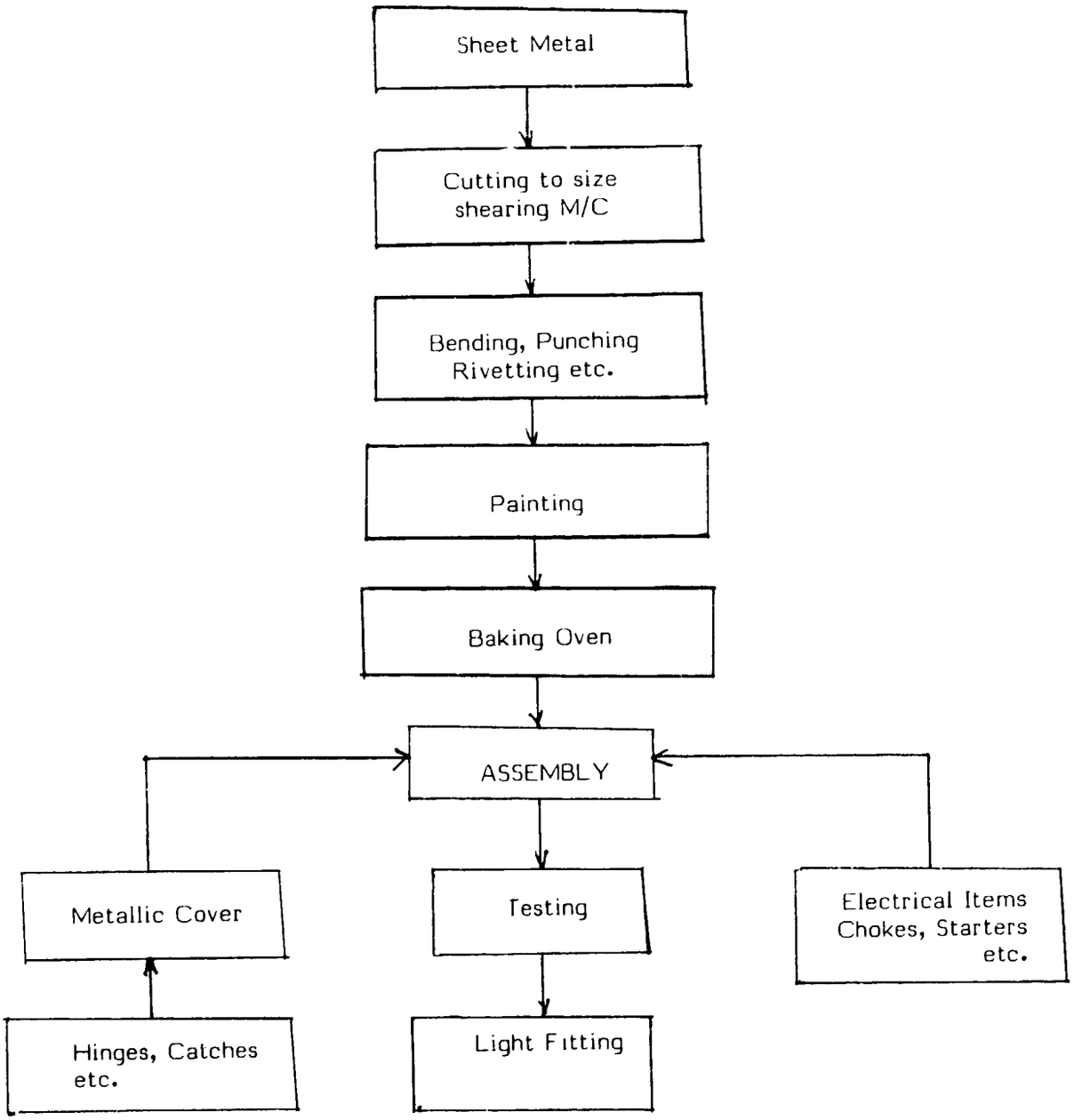
Item No.	*Particulars*	*Qty.*	*Rate Birr*	*Annual Sales Revenue Birr*
1.	Fluorescent tubes			
	a) Blow formed plastic covers	6000	30	180000
	b) Expanded Metal Cover	6000	25	150000
2.	Street Light fittings for mercury vapour Lamps	2400	35	84000
	Total			414000

Annual Sales Realisation	:	Birr 414000
Profit before Taxes	:	Birr 68100
Return on Investment	:	22%
Break-even Point	:	75%
Pay-back period	:	4.2 Years

CASH FLOW STATEMENTS

Year	*Production Cost*	*Sales Revenue*	*Profit/Loss*	*Depreciation*	*Net Cash Flow*
Ist	279280	202000	- 71280	11600	- 65680
2nd	312580	310500	- 2080	11600	- 56160
3rd	345900	414000	+ 68100	11600	23540
4th	345900	414000	+ 68100	11600	103240
5th	345900	414000	+ 68100	11600	182940

PROCESS FLOW SHEET



30. WOOD SCREWS, MACHINE SCREWS & RIVETS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

The project envisages manufacture of 80 tons of wood screws, 30 tons of rivets, 60 tons of machine screws per annum. The total investment required on machinery and equipment is about 0.14 million Birrs. This unit requires a covered area of 250 sq. mts. and it can generate employment to about 23 persons. Return on investment would be about 24%.

1.2 Description and Specification of the Product

Wood screws, machine screws and rivets are industrial fastners, which have extensive application in various engineering industries. Wood screws are mainly used in wooden furniture, packaging industry, electrical fittings and railway castings. These are also used in building construction work and repair work. There are several sizes of wood screws depending mainly on their utility and need and various constructional activities.

Machine screws and rivets are required by key and heavy engineering industries including automobiles, machine tools, ship building and heavy & light electrical equipment manufacturing industry.

2. MARKET AND PLANT CAPACITY

2.1 Market Demand

Wood screw, machine screw and rivets have been imported from Europe and other countries. Import figures for the last several years are not available. It is suggested that the local manufacture of wood screws, machine screws and rivets is worthwhile.

2.2 Plant Capacity

The future demand of these hardware items heavily depends on the industrial and developmental plans. There are various types of wood screws, machine screws and rivets. It is proposed to manufacture 80 tons of wood screws, 60 tons of machine screws and 30 tons of rivets.

2.3 Production Programme

The unit is envisaged to operate one shift a day for 270 days a year. It is expected to operate at 50, 75 and 100 percent of the installed capacity during the first, second and third year respectively. The product mix is shown in Table given below :

Item No.	*Product*	*Qty./Tons*
1.	Wood Screws	80
2.	Machine Screws	60
3.	Rivets	30

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw Materials

The raw material required for this project are Hard bright mild steel wire, low carbon steel wire and steel wire. All these materials are not locally available and have to be imported. The packing material to be used may be locally available.

The raw material required for the manufacture of 80 tonnes of wood screws, 60 tonnes of machine screw, 30 tonnes of rivets are as given below :

Item No.	Description	Price/Kg Birr	Quantity/ Annum/Kg.
1.	Hard bright mild steel wire 3-14 SWG	2.68	95000
2.	Low Carbon Steel Wire Coils 5-10 mm dia meter	2.91	70000
3.	Coil wire/rod 3.5 - 10 mm diameter	3.13	32000
4.	Local Inputs Packing materials	As per production programme	

The total cost of procuring the raw materials is estimated to be 0.57 Million Birrs.

3.2 Utilities

The utilities required for this project are electricity and water. The annual consumption of electricity is 24000 KWH and water is 240 M^3. The annual expenditure on utilities is estimated to be Birr 3000.

4. TECHNOLOGY AND ENGINEERING

4.1 Technology

The technology to manufacture wood screws, machine screws and rivets is simple. The technical knowhow may be obtained through machinery suppliers. It may also be obtained from an operating unit through training. There are many reputed manufacturing units who may offer training facility and transfer of manufacturing know how.

Wood screws are generally available with counter-sunk-head, round head and raised counter sunk head. Wood screws are made from mild steel wire.

Wood screws, machine screws and rivets are made by cold forming process:

This process is characterised by the advantage of (i) material sawing (ii) material strengthening (iii) improvement of surface finish (iv) lowering of production cost.

4.2 Description of manufacturing process

Wood Screws

The process of manufacture of wood screws is as follows :

(i) The wire is fed to an automatic heading machine where the head is formed and parting off done at the side according to desired length.

(ii) the slotting on head is made on slotting machine.

(iii) The threading is done on thread cutting machine. Threads produced by rolling methods can meet the most rigorous requirements for the maintenance of close tolerance and high quality finish. The screws are then degreased, pickled and polished in the polishing drums and then packed in the cartons.

Machine Screws

Machine Screws are manufactured from low tensile strength low carbon steel. Hard bright wire can also be used for the purpose. The material is fed in the cold heading machine and head is formed in one end and shank is pointed off from other end. The square or hexagonal faces of bolts are made on bolt head forming machine. The bolt blanks are filled in a hopper coming from the cold press and are fed automatically through the trimming dies. The head tins are trimmed and heads on shank are cut by thread rolling process. Threads produced by rolling method meets the most rigorous requirements. For maintaining close tolerance and high quality finish, the threading dies should be set accordingly. (In the machine there are two threading dies. One is

stationary and can be adjusted in all directions by suitable set screws and the other die is reciprocating. The screws are degreased, pickled and polished in the polishing drums and then packed in the cartons.

Rivets

Coil wire is fed to an automatic heading machine where the head is formed and parting off is done at the other side according to the desired length. The rivets are then degreased, pickled and polished in the polishing drums and then packed in the cartons.

4.3 List of Machinery and Equipments

The machinery and equipment required for manufacture of 80 tonnes of wood screws, 60 tonnes of machine screws and 30 tonnes of rivets are as given below :

Cold heading machine Capacity : 3-9 mm, length 6-37.5 mm Output 60 per run	1
Head trimming machine Capacity : 60 pieces/minute	2
Thread rolling machine Capacity : 100 pieces/minute	4
Screw head slotting machine Capacity : 100 pieces/minute	1
Double ended bench grinder wheel diameter : 150 mm	1
Cold heading machine Capacity 6 mm diameter and length 12-75 mm	1
Heading machine Capacity from 3-8 mm dia. metres and length from 8-35	1
Slotting machine (Heavy cuts)	1
Slotting machine (light duty)	1

High speed, single stroke automatic header. Capacity : 6 mm dia metre	1
High speed, double stroke automatic header Capacity : 10 mm diameter	1
Drilling Machine Capacity : 18 mm diameter	1
Tumbling barrel with 1 HP motor	1
Heat treating furnace (Oil fired) complete with bower and other accessories	1
Hacksaw cutting machine Stroke : 300 mm	1

The cost of machinery and equipments after including the cost of insurance, transport, freight, installation charges etc. is estimated to be 0.14 Million Birrs.

4.4 Layout

To house the machinery and equipment is estimated that a covered area of about 250 sq. mts. is required. This area includes the space for raw material, space for finished goods and space for office accommodation.

4.5 Civil Works

The construction cost of the building is about 0.15 Million Birrs.

5. MANPOWER

5.1 Manpower Requirement

For operating this plant, a total manpower of 23 is required as per the details given below :

Sl. No.	Category	Number required	Salary/month/ person Birrs	Salary/ annum Birrs
1.	Manager	1	1200	14400
2.	Supervisor	1	900	10800
3.	Skilled Worker	6	250	18000
4.	Semi-skilled Worker	4	150	7200
5.	Unskilled worker	10	100	12000
6.	Others	1	350	4200
	Total	23		66600

The total expenditure on the wages and salaries is estimated to be Birr 66600.

5.2 Training

Active participation of the supervisor during the installation of the plant. Others should be employed as helpers in order to become acquainted with the machinery.

Supervisory staff should get the benefit of class room lecture by the foreign expert.

Training of all production staff by the foreign expert at the start-up period.

The administrative staff should be trained in accordance with Ethiopian standards and requirements in order to be abie to fulfill their duties at the start up of production.

It may be necessary to get the services of an expert during the start-up of production for a period of three weeks. He should be able to organise production programme and also training of technical personnel. The expenditure for expert is estimated to be Birrs 15000 including travel expenses.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis

Capacity	:	170 Tonnes
No. of working days/year	:	270
No. of shifts/day	:	One

6.1 Total Capital Investment

The total capital investment is estimted to be Birr 401400 of which Birr 309400 is for fixed capital and the remaining Birr 92000 is for working capital. The details are as shown below

Particulars	*F.C.*	*L.C.*	*Total Cost Birrs*
Fixed Capital			
Plant & Machinery	122700	16700	139400
Building Construction		150000	150000
Pre-production Expenses		15000	15000
Office Equipment & Furniture		5000	5000
Working Capital	71000	21000	92000
Total	193700	207700	401400

6.2 Production Cost

The annual production cost at full capacity one shift operation is estimated to be Birr 818600. The raw material and manpower costs amount to 70% and 8% respectively. the break up is shown below:

Sl.No.	*Particulars*	*Cost Birr*
1	2	3
1.	Raw Material	569700

1	2	3
2.	Utilities	3000
3.	Labour & Supervision	66600
4.	Overheads	40000
5.	Consumables	13900
6.	Repair & Maintenance	7000
7.	Sales/Advtg.	39000
8.	Depreciation on Plant & Machinery	13900
9.	Depreciation on Building	7500
10.	Interest	58000
	Total	818600

6.3 **Financial Evaluation**

The estimated sales revenue at full capacity is Birr 915000. The details are as shown below :

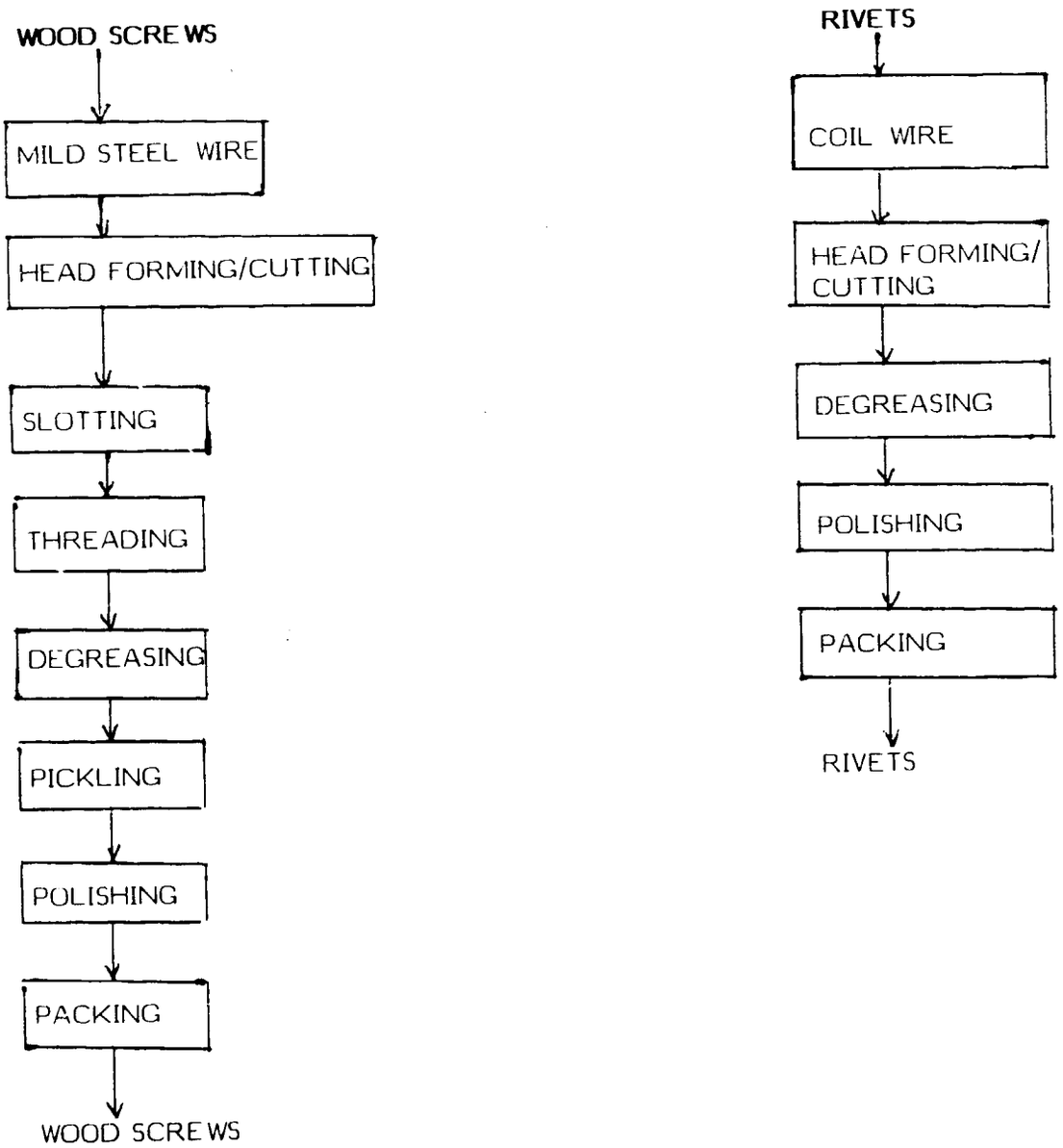
Item No.	*Particulars*	*Qty. Tonnes*	*Unit Price*	*Annual Sales Revenue Birr*
1.	Wood Screws	81	5000	405000
2.	Machine Screws	60	6000	360000
3.	Rivets	30	5000	150000
	Total			915000

Total Sales Realisation	:	Birr 915000
Net Profit	:	Birr 96400
Return on Investment	:	24%
Break-even point	:	67%
Pay back Period	:	3.3 Years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit/Loss*	*Depreciation*	*Net Cash Flow*
Ist	501700	455000	- 46700	13900	- 32800
2nd	659850	682500	+ 22650	13900	+ 3750
3rd	818600	915000	+ 96400	13900	+ 114050
4th	818600	915000	+ 96400	13900	+ 224350

OPERATION FLOW PROCESS CHART



31. CALCIUM CARBONATE (PRECIPITATED)

1. SCOPE OF THE PROJECT & PRODUCT DESCRIPTION

1.1 Summary of Project

The proposal envisages setting up a calcium carbonate unit in the industrial estate for producing 1500 tons per annum of this product. The annual sales realisation at full capacity production would be 1.5 million Birr. The return on investment is estimated to be about 21% and the project shall break even at 72%. An employment generation for about 28 persons is envisaged.

1.2 Product Description

Precipitated calcium carbonate is widely used as a filler in paint and paper industries. In food products, it is useful in pill and tablet coatings and as an anticaking medium for table salt, confectionery, sugar and baking powder etc. Its use in pharmaceuticals may be as a filler or as a neutralizing agent. It is also used in the manufacture of tooth paste and cosmetics. Precipitated calcium carbonate has become important as extender in paints and inks.

Technical grade calcium carbonate finds use as an ingredient in the manufacture of ceramics, putty polishes, insecticides and as a filler in the production of plastics, adhesives, welding rods, etc.

1.3 Product Specification

Precipitated calcium carbonate is produced in a number of different grades which range in particle size from 0.03 to 15 mm. The grades of synthetic calcium carbonate used for paper are generally controlled to an average particle size of 0.15 to 0.25. Calcium carbonate is white powder that is insoluble in water except in the presence of carbon dioxide.

Calcium Carbonate Extender (Natural Whitening)

Chemical Composition

Calcium Carbonate	$CaCO_3$	98%
Calcium Oxide	CaO	54%
Magnesium Oxide	MgO	0.26%
Aluminium Oxide	Al_2O_3	0.28%
Silicon Dioxide	SiO_2	1.25
Sulphur Trioxide	SO_3	0.04%
Potash	K_2O	0.01%
Soda	Na_2O	0.05%
Moisture		0.10% Max.
Water Solubie Salt		0.03%
PH of aqueous Extract		8.5
Conductivity		Less than 100 Micro
Copper Cu		Mho Cm-1 SPP M
Manganese Mn		210 PPm
Phosphorous Penta Oxide	P_2O_5	500 PPM
Solubility in NHCL		98.00
Solubility in H_2O (g/lts)		0.09

2. MARKET AND PLANT CAPACITY

2.1 Demand

For projecting the demand for calcium carbonate, import figures of the past six years (1977-1982) have been considered and analysed. These import figures are tabulated below:

Import Data of Calcium Carbonate

Year	*Quantity (000 KG)*	*Value (000 BIRR)*
1977	132.1	32.4
1978	368.5	80.7
1979	10.4	9.45

(Contd.)		
1980	0.40	0.65
1981	1029.6	349.9
Annual Average	312.2	94.62

Source : Annual External Trade Statistics

As shown in the above table, the import datas of lime for the period 1977-1982 is not smooth. The annual average for this period is 312.2 tons with an annual average growth rate of 29.3%. In order to forecast the future demand for calcium carbonate, the annual average import data of 312 tons has been used as a base figure for year 1986, and using the growth rate of 29.3, the forecast looks as follows :

Projected Demand of Calcium Carbonate

Year	*Quantity (Tons)*	*Value in Birr '000*
1986	326	106.80
1987	403	137.16
1988	522	177.34
1989	674	229.31
1990	872	296.50
1991	1128	383.37
1992	1458	495.70
1993	1885	640.94
1994	2437	828.74
1995	3151	1071.56

As can be seen from the previous table, the import of calcium carbonate has of the order of 312 tons annually on an average for the period 1977-1982 and it is expected that the annual demand would reach a figure of 1500 tons in the century.

2.2 Plant Capacity

It has been indicated earlier that the annual demand in year 1995 would be above 3000 tons. It is, therefore, proposed that a plant of 1500 tons per annum capacity could be considered for installation at the first phase and a bigger capacity plant can be considered at a later stage which either as an expansion to the existing unit or as an additional plant.

2.3 Production Programme

The installation of the plant depends upon the selection of technology, the selection of the supplier of equipment and other factors. However, it would take nearly one year for fabrication and supply of equipments, it may be assumed that the time of installing the plant would be another 3 months. Production in 1st year shall be at 50% its rated capacity reaching 75% of rated capacity in second year and full production of 1500 tons from third year onwards. The production programme worked out accordingly is given in the following table :

Year	*Demand*	*Production Programme (Tons)*	*% Utilization*	*% unsatisfied demand*
1986	312	-	-	-
1987	403	-	-	-
1988	522	750	50	-
1989	674	1125	75	-
1990	872	1500	100	-
1991	1128	1500	100	-
1992	1458	1500	100	-
1993	1885	1500	100	20.4
1994	2437	1500	100	38.4
1995	3151	1500	100	52.4

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw Materials

Lime and fuel oil are the major raw materials for the production of calcium carbonate.

The raw materials requirement per ton of product are given below :

Fuel oil	:	2.5 ton
Lime	:	1.4 ton

3.2 Utilities

The utility requirement per ton of product is :

Electricity	:	200 Kwh
Water	:	20 M^3

3.3 Raw Material Supply Programme

Based on the production programme, the annual raw material requirement has been worked out and given in the following table :

Input / *Year*	*Lime (TONS)*	*Fuel Oil (TONS)*
1986	-	-
1987	-	-
1988	525	303
1989	788	455
1990	1050	606
1991	1050	606
1992	1050	606
1993	1050	606
1994	1050	606
1995	1050	606

3.4 Cost of Raw Materials & Inputs

Cost of Raw Materials

It has been discussed earlier that the major raw materials are lime and fuel oil which are locally available and the following are price estimates :

Lime	:	700 Birr / Ton
Fuel Oil	:	600 Birr/ KL

The annual expenditure towards procurement of raw materials is estimated to be 1012500 Birr.

Cost of Utilities

For the quantity of electrical energy and water needed for this plant, an annual expenditure of Birr 74600 is estimated to be incurred which included provision for consumables, repairs and maintenance.

4. TECHNOLOGY & ENGINEERING

4.1 Technology

The technology involved in the manufacture of precipitated calcium carbonate is a continuous carbonation process consisting of the following steps :

- Calcination of lime stone
- Preparation of lime slurry
- Purification of the gases
- Carbonation of the lime slurry using the carbondioxide from the purified flue gases and
- Filtration, drying, pulverising and packing of the final product.

4.2 Process Description

The limestone is calcined and lime so produced is converted into milk of lime. The carbondioxide from the calcination and flue gases is used for carbonation of milk of lime, precipitated chalk is thus obtained.

The limestone is first broken into 1-1/2" - 2" size and fed to a vertical shaft kiln. The kiln may be fired by furnace oil or coal. If coal is used, it is mixed with limestone and fed. The limestone is calcined at the optimum temperature of around 1100°C and the quicklime, CaO, is collected at the bottom of the kiln.

The flue gases from the furnace is extracted through a gas extractor and cleaned by passing through a scrubber packed with limestone where water is sprayed and it is then passed through drying fillers. It is stored in a gas holder from where it is fed to the carbonation tower at static pressure. The lime is first reacted with water to form milk of lime of about 12% consistency. The temperature is maintained at 31-35°C for making precipitated chalk. The carbon dioxide gas from gas holder is passed through bottom of the carbonation tank and the precipitated calcium carbonate is removed with the aid of a filter press.

4.3 Engineering

List of Machinery & Equipment

For the suggested plant of 1500 tons capacity per annum, the following are the major equipments :

- Furnace
- Scrubber
- (Flue gas) compressor
- Filter screen
- Carbonator
- Rotary vacuum filter
- Lime Slaker
- Hydro cyclone
- Pumps for slurry and water
- Tray drier
- Micropulveriser
- Stirrer with motor
- Screens for slurry
- Tanks and Laboratory Instruments
- Pipes Valves and other auxiliaries.

Cost of Machinery & Equipment

The CIF Addis cost of the above mentioned machinery and equipment as per the price prevailing in India, at present, in Birr 149750.

4.4 ***Layout***

The covered area required to house the plant equipment shall be 400 m^2.

4.5 ***Civil Works***

The construction cost of the building is about Birr 240,000.

5. MANPOWER AND TRAINING

5.1 **Manpower Requirement**

The manpower requirement for operating the plant in three shifts shall be as indicated below :

Category	*No. required*	*Salary per month/ Birr*	*Salary/ year*
Managerial	1	1200	14400
Technical	3	900	32400
Skilled	21	250	63000
Unskilled	1	90	1080
Others	2	350	8400
Total	28	9940	119280

The total annual expenditure for the above personnel is estimated to be Birr 119280.

It may be necessary to provide training for one technical and one skilled personnel at a running factory.

These personnel could also be associated with the project implementation agency.

Cost of Training

It is expected that the training facilities shall be provided by the plant and machinery supplier free of cost but the transportation charges and local expenditure for boarding, lodging, incidental etc., for the trainees shall have to be met locally. This is estimated to be about 10,000 Birr.

6. *FINANCIAL AND ECONOMIC ANALYSIS*

BASIS : Production Capacity : 1500 TPA
: 3 shifts
: 300 days operation

6.1 *TOTAL CAPITAL INVESTMENT*

	F.C. (Birr)	*L.C. (Birr)*	*Total (Birr)*
Plant & Machinery	131360	13390	144750
Office equipment & furniture		5000	5000
Technology Fee	45000		45000
Pre-production expenses		13350	13350
Building		240000	240000
Working Capital		50000	50000
Total	176360	321740	498000

6.2 *PRODUCTION COST*

The total annual production cost for manufacturing 1500 tons of calcium carbonate is estimated to be Birr 1395470. The raw materials account for 72% of the total cost, energy and other manufacturing cost account for 5.3% and the charges for labour and supervision account for 8.5% of total cost, as given below :

Sl. No.	Particulars	Amount in Birr
1.	Raw Materials	1012500
2.	Energy and other manufacturing costs	74600
3.	Labour & Supervision	119280
4.	General overheads	71570
5.	Sales/Advertising	45000
6.	Depreciation on Building %	12000
7.	Depreciation on Plant & Machinery	14970
8.	Interest on long term loan	35850
9.	Interest on Short term loan	9700
	Total production cost	1395470

Production cost/ton 930 Birr

6.3 **Financial Evaluation**

If the product is sold at Birr 1000/ton

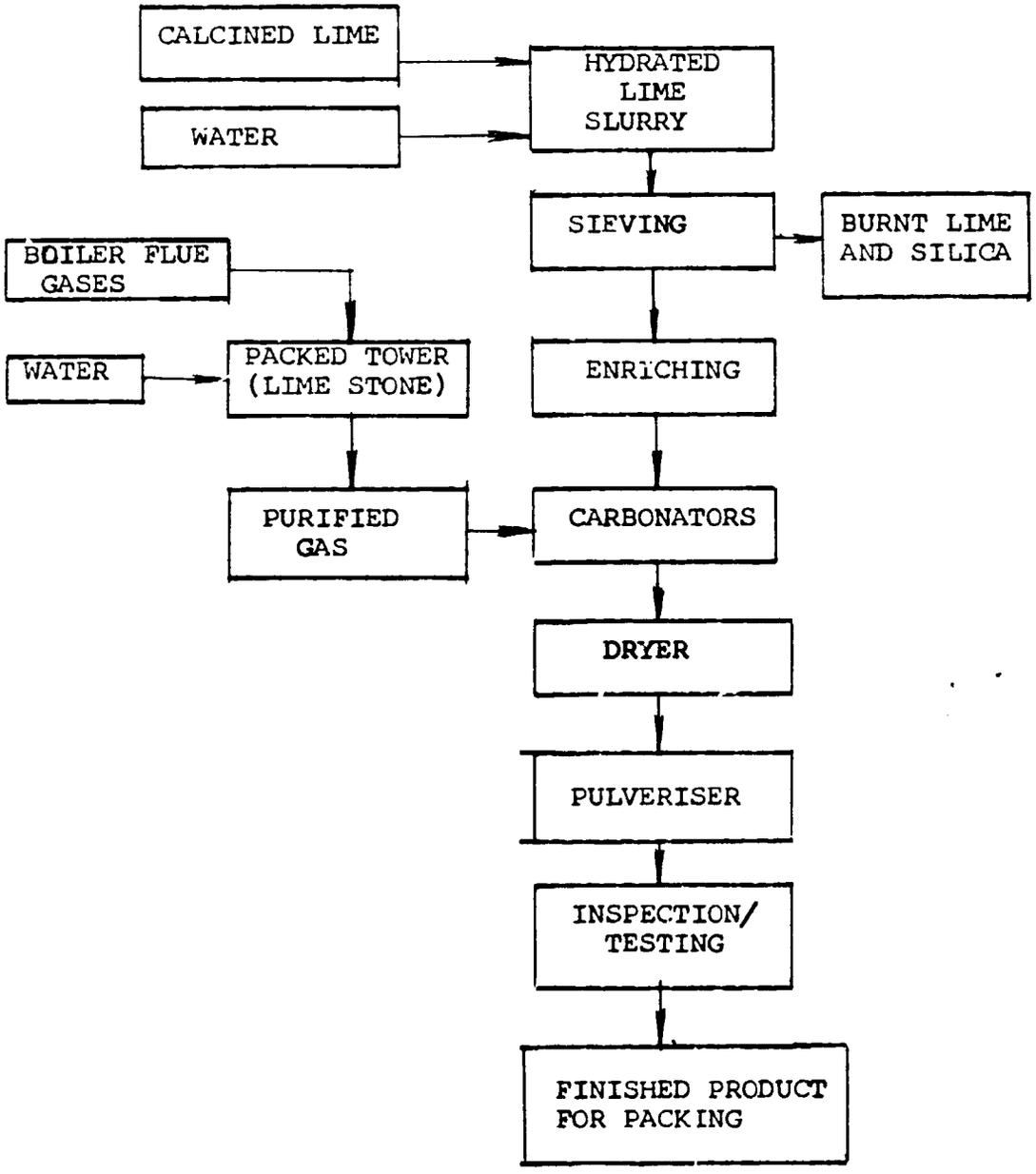
Sales realization	1500000
Profit before taxes	104530
Return on investment	21.0%
Break-even point	72.0%
Pay-back period	3.5 years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	829420	750000	- 79420	14970	- 64450
2nd	1112445	1125000	+ 12555	14970	- 36925
3rd	1395470	1500000	+ 104530	14970	+ 82575
4th	1395470	1500000	+ 104530	14970	+ 202075

Pay-back period : 3 years 5 months

CALCIUM CARBONATE



32. SPECIALITY PAPERS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 **Summary of Project**

Speciality papers are filter papers and other types of papers such as drawing paper, ashfahan (fancy paper), bond paper, album paper etc. The filter paper and filter pads find use in chemical and pharmaceutical industry. The other types of speciality papers have good demand in urban areas for a variety of end uses.

To render the process amenable to small scale sector, a small plant having a capacity of 270 kgs. per day is being proposed. Such a plant could generate employment for about 90 persons. The investment on plant and machinery shall be about 146750 Birrs. A plant of this capacity would break even around 57% of its capacity. The return on investment is about 47%.

1.2 **Product Description**

As mentioned above, the speciality papers that are to be manufactured by the process mentioned in para 4.1 shall be filter papers and filter pads, bond paper and card sheet and these papers are normally made as per customers' requirements.

2. MARKET AND PLANT CAPACITY

2.1 **Market Demand**

No import data is available for this item. But it is presumed that at present the country must be importing its requirement of bond papers, filter pads etc. which are in use in the office, pharmaceutical factories, laboratories etc. Hence a small unit is proposed for making the speciality paper.

2.2 **Plant Capacity**

The capacity of the unit proposed for installation in the industrial estate shall be 270 kgs. per day of this speciality paper which comprises 100 kgs. filter paper, 70 kgs. bond paper and 100 kgs. of card sheet.

The commencement of production depends upon various factors like selection of technology, selection of suppliers of equipment, local implementing agency and overseas agency foi turnkey services. Once the selection is over and the agencies finalised, the equipments could be delivered at plant site in about a year's time. The annual sales realisation at full production is estimated at 870000 Birrs, which could be expected in the third year of operation.

3. MATERIAL INPUTS AND UTILITIES

For a plant with a designed capacity to make 270 kgs. per day of this item on 2 shift basis, the raw material requirements are as given below :

3.1 Major Raw Materials

Material	*Unit Cost in Birr*	*Annual Requirement*
Cotton rags & cotton Linters	600/ton	72 tons per annum
Chemicals	7000/month	Lumpsum

It is estimated that an annual expenditure of Birrs 105,000 would be needed on procuring the cotton rags and cotton linters required for this production.

3.2 Utilities

The major utilities are required for operating this plant are water and power. The annual requirements of these items are given below:

Water	-	400,000 KL
Power	-	1350,000 KWH

The expenditure towards the utilities mentioned above shall be Birr 58950 which includes the annual provision made towards expenses on consumables, repairs and maintenance.

4. TECHNOLOGY AND ENGINEERING

4.1 Process Description

The process for making the three types of speciality papers, viz., filter paper, card sheet and bond paper consists in digesting the sorted, dusted and cut rags in a digester with alkali, washing it free of alkali after digestion and reducing it to half stuff in a beater. The half stuff is bleached in wooden or cement vat and then beaten to pulp; required amounts of colour, sizing chemicals and loading materials are added in the beater. The resulting pulp is diluted and passed through strainer. It is then lifted into paper sheets, which are couched, pressed, peeled, dried and surface sized. After maturing, the sheets are calendered, sorted out and packed.

4.2 Plant and Machinery

For a plant capable of manufacturing 270 kgs. per day of speciality paper, the following are the major plant and equipment required:

Rag cutter	-	1 No.
Digester	-	1 No.
Beaters	-	3 Nos.
Centricleaners	-	2 Nos.
Paper lifting vats	-	6 Nos.
Hydraulic press	-	1 No.
Calendering machine	-	1 No.
Paper cutter	-	1 No.
Weighing machine	-	1 No.
Pumps (water and pulp)	-	2 Nos.
Drying chamber	-	1 No.
Miscellaneous equipments like tools, implements, etc.		
Laboratory equipment		
Electrical motor, accessories and spares.		

The CIF Addis cost of the plant and equipments indicated above, is estimated to be about 146750 Birrs approximately.

4.3 **Layout**

The covered area required to house the plant is estimated to be 600 M^2.

4.4 **Civil Works**

The construction cost of the building is about 360,000 Birrs.

5. MANPOWER AND TRAINING

5.1 **Manpower Requirement**

In order to operate this unit, it is estimated that about 90 personnel would be required which includes personnel required for collection of rags, dusting and other related jobs. The annual expenditure towards payment of salaries and wages amounts to 188400 Birrs as given below:

S.No.	*Category*	*No. Reqd.*	*Salary/month (Birr)*	*Annual expenditure (Birr)*
1.	Managerial	1	1200	14400
2.	Technical	2	900	21600
3.	Skilled	15	250	45000
4.	Semi-skilled	25	150	45000
5.	Unskilled	45	100	54000
6.	Others	2	350	8400
	Total	90	15700	188400

5.2 **Training**

Though the operation of the plant appears rather simple, yet it would be essential that the operating personnel familiarise themselves with the Digestor operation, machines operation, etc. It is therefore suggested that one technical supervisor and two skilled personnel are sent for training in running plants for about 4 weeks. While the overseas implementing agency could be expected to provide training facilities free of cost as part of the total turnkey package, the project authorities may have to arrange for travel, local boarding/lodging and incidentals

to the trainees. It is estimated that an expenditure of about 20000 Birr may be incurred on this account.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis : Production capacity : 270 kgs/day
No. of working days : 270
No. of shifts : 2

6.1 Total Capital Investment

Particulars	*F.C. (Birr)*	*L.C. (Birr)*	*Total (Birr)*
Plant and machinery	108350	38400	146750
Office equipment and furniture		3000	3000
Pre-production expenses		13350	13350
Technology Fees	15000		15000
Buildings		360000	360000
Working Capital		58410	58410
Total	123350	473160	596510

6.2 Production Cost

The total production costs is estimated to be JO Birrs out of which raw materials account for 18%, energy and other manufacturing costs 10% and the wages and salaries for operating personnel account for 32% because it is a labour intensive technology.

Sl. No.	*Particulars*	*Amount (Birr)*
1.	Raw Material	105000
2.	Energy and other manufacturing costs	58950
3.	Labour and supervision	188400

(Contd.)			
4.	General overheads	113040	
5.	Sales and advertising	45090	
6.	Depreciation on plant and machinery	14680	
7.	Depreciation on building	18000	
8.	Interest on long term loan	41850	
9.	Interest on short term loan	3920	
	Total production cost	588930	
	Say :	589000	Birrs

6.3 **Financial Evaluation**

Total sales realisation

At 15 Birr/Kg. Filter paper		
12 Birr/Kg. Bond paper		870,000 Birrs
9 Birr/Kg. Card Sheet		

Profit before taxes : 281000 Birrs

Return on investment : 47.0%

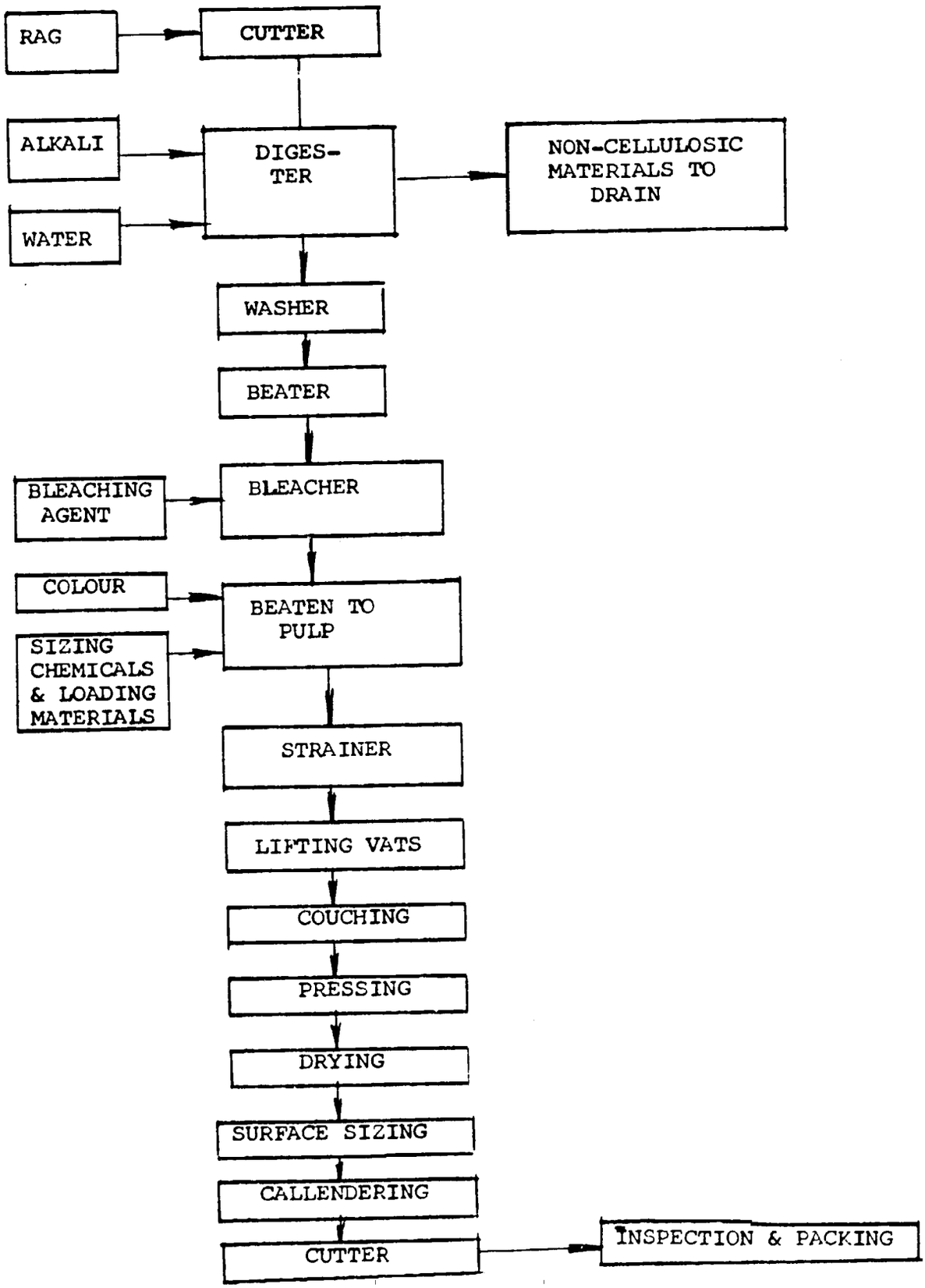
Break-even point : 57.0%

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit/ Loss*	*Depreciation*	*Net Cash Flow*
1st	484410	435000	- 49410	14680	- 34730
2nd	536670	652500	115830	14680	+ 95780
3rd	588930	870000	281070	14680	+ 391530

Pay-back period : 2.2 Years

SPECIALITY PAPER



33. MICROCELLULAR SHEETS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 **Summary of Project**

The proposal envisages setting up of a unit to manufacture 75000 sheets per annum which would yield an annual sales realisation of about 843800 Birr. Such a unit would provide employment for 17 persons and is capable of breaking even at 56% of its total capacity. The return on total investment is estimated to be about 21%.

1.2 **Product Description**

The use of microcellular sheet is becoming very popular because of its wear and tear resistance properties. In large scale units engaged in the manufacture of foot wear, this particular product has good ancillary possibilities. The investment on plant and machinery is rather low so that this could be taken up as a small scale industry.

1.3 There are no definite standard specification for microcellular sheets but these could be made as per requirements of the purchaser.

2. MARKET AND PLANT CAPACITY

2.1 **Demand**

In order to project the future demand for microcellular sheets, import figures for the period of 1976-1982 have been taken into consideration. These import data are tabulated below :

Import Data of Microcellular Sheets

Year	*Quantity ('000 Kg)*	*Value ('000 Birr)*
1976	262.0	1193.6
1977	478.9	2444.7
1978	471.9	2115.6
1979	50.9	354.4
1980	105.6	628.9
1981	40.8	343.3
1982	52.4	335.8

SOURCE : Annual External Trade Statistics

The annual average import of micro cellular sheets for the years 1976-1982 has been 209 thousand Kg. However the trend of imports has been fast declining perhaps due to the restriction on imports. However, since this item finds extensive use as an inner sole for shoes whose demand is always on the increase. For the present purpose of assuming a minimum capacity an average of 200 tons/year has been taken as would be the projected demand for the next few years with an annual growth of about 5%.

2.2 **Plant Capacity**

It is suggested that a plant capable of manufacturing 75,000 sheets per annum (equivalent to 225 tons) to be set up and if the demand is higher, the capacity could be increased by operating the plant on two shift basis.

2.3 **Production**

After the selection of technology and supplier of equipment, it would take about one year for fabrication and supply of equipments. The plant could be installed and commissioned in about three months time. During the first year the plant would manufacture 50% capacity, reach 75% in second year and full scale production of 75000 sheets per annum could be achieved from the third year onwards resulting in an anticipated sales realisation of 843800 Birrs per year.

3. MATERIALS AND INPUTS

3.1 **Major Raw Materials**

The major raw materials that are required for the manufacture of microcellular sheets are natural and synthetic rubber.

The raw material requirements per ton of product is given below :

Raw Material Requirement

Material	*Unit Price CIF Addis*	*Requirement Tons per ton of product*
Natural Rubber	3.13	0.167
Synthetic rubber	4.20	0.022
Zinc Oxide	4.20	0.167
Stearic Acid	3.70	0.019
Paraffin Wax	1.62	0.018
Wood Resin	2.40	0.017
China Clay	0.73	0.279
Aluminium silicate	1.37	0.084
Miscellaneous Chemicals like camphor, TiO_2 Redoxide and packing materials		Lumpsum

The total cost of raw materials mentioned above is estimated to be 377900 Birr per annum.

3.2 **Utilities**

The utility requirement per ton of product is :

- Electricity : 667 KWH
- Water : 4.4 KL
- Steam : 2.2 tons

For the requirement of Electricity and water for this plant, an annual expenditure of Birr 90,000 is estimated to be incurred which includes provision for annual procurement of consumables and for repairs and maintenance.

4. TECHNOLOGY & ENGINEERING

4.1 **Technology**

The technology for making microcellular sheets consists of compounding the rubber chemicals with rubber (natural) and (synthetic) and moulding in suitable moulds in hydraulic press.

4.2 **Process Description**

All the rubber chemicals are compounded along with rubber chemicals (both natural and synthetic masticated previously) and measured quantities of the compound is moulded in suitable moulds in hydraulic press which is generally of multi-daylight type. After first curing, the sheets may be cured again a second time (if required) in vulcaniser under steam pressure. The sheets are taken out and kept under load to avoid deforming while cooling.

4.3 **Engineering**

List of Machinery & Equipment

For the proposed plant of capacity 225 tons per annum, the following are the major equipment :

Mixing mill
Mixing mill for sheeting
Hydraulic press
Boiler
Vulcaniser
Weighing machine

Cost of Machinery & Equipment

The cost of machinery and equipment as per CIF Addis is estimated to be Birr 159240 excluding foundation and installation charges.

4.4 ***Layout***

The covered area required in housing this plant would be 800 m^2.

4.5 ***Civil Works***

The construction cost of the building is about Birr 480000.

5. MANPOWER AND TRAINING

5.1 **Manpower Requirement**

The manpower requirement for operating the plant in one shift shall be as indicated below :

Category	*No. Required*	*Salary/month (Birr)*	*Salary/annum (Birr)*
Managerial	1	1,200	14,400
Technical	1	850	10,200
Skilled	6	250	18,000
Unskilled	8	100	9,600
Others	1	350	4,200
Total	17	4,700	56,400

The total annual manpower expenditure that would be incurred to the operating personnel is estimated to be Birr 56,400.

5.2 **Training**

The process for making microcellular sheet is rather simple and as such does not require any specialized training. However, if the operating personnel are recruited during the installation period itself, they could associate themselves with the overseas implementing agency during trial run and commissioning period so that, they could get trained in the operation of various equipments.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis

Production Capacity : 75000 Sheets (3 Kg each) per year

: 270 days operation

: One shift

6.1 Total Capital Investment

	F.C. (Birr)	*L.C. (Birr)*	*Total (Birr)*
Plant and machinery	141440	17800	159240
Office equipment & furniture		2000	2000
Preproduction Expenses		14375	14375

(Contd.)			
Technology fees	12500	-	12500
Working Capital		61005	61005
Buildings		480000	480000
Total	153940	575180	729120

6.2 **Production Costs**

The annual production cost works out to Birr 691800 out of which raw materials account for 55%, energy and other manufacturing costs 13% and expenditure towards payment of salaries to operating personnel accounts for 8%.

Production Costs

S. No.	*Particulars*	*Amount in Birr*
1.	Raw Materials	377900
2.	Energy & other manufacturing costs	90000
3.	Labour & Supervision	56400
4.	General Overheads	33800
5.	Sales/Advertising	30000
6.	Depreciation on Plant & machinery	16000
7.	Depreciation on building	24000
8.	Interest on long term loan	47700
9.	Interest on Short term loan	16000
10.	Total Production cost	691800
11.	Production cost per/ton	3075

6.3 **Financial Evaluation**

If the product is sold at Birr 3.75 Kg

Sales realisation	Birr	843800
Profit before taxes	Birr	152000

Return on investment 21.0%

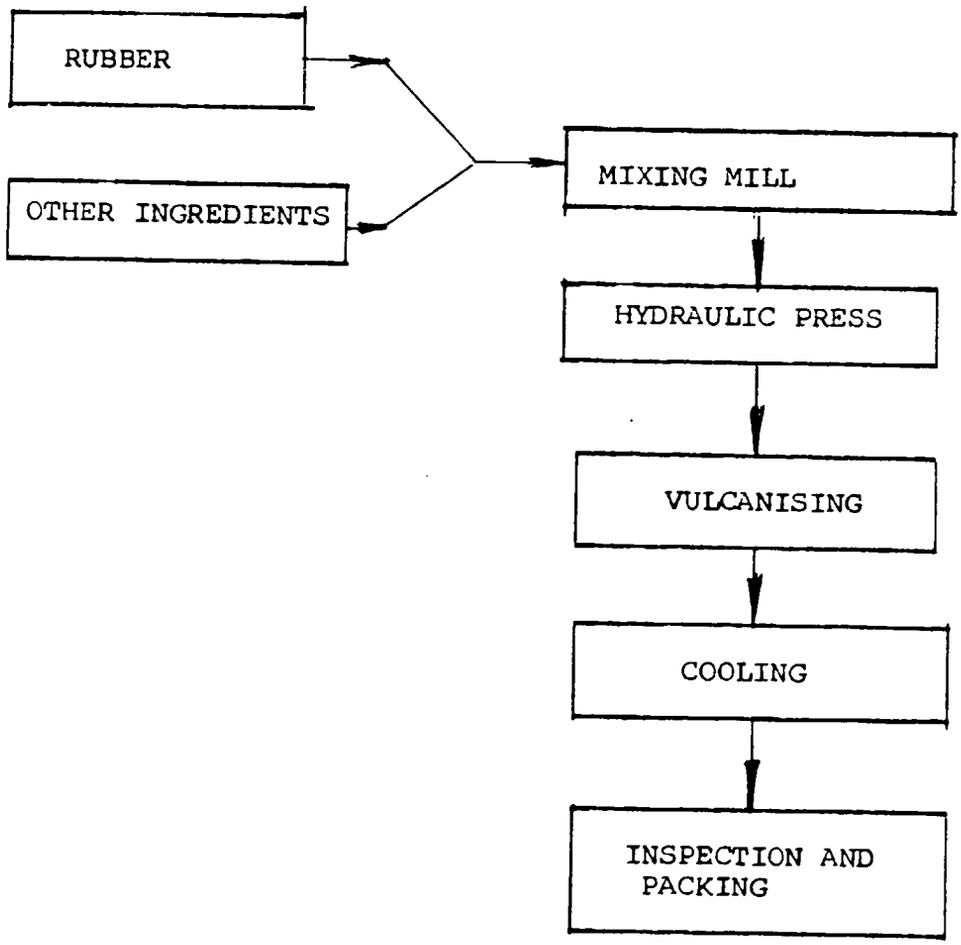
Break-even point 56%

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Return*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	457900	421900	- 36000	16000	- 20000
2nd	574800	632900	+ 58000	16000	+ 54000
3rd	691800	843800	+ 152000	16000	222000

Pay-back period : 2.6 years

MICROCELLULAR SHEETS



34. HARD RUBBER BATTERY CONTAINERS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

The demand for automobile batteries is increasing day by day with the fast development of the automobile industry in the developing countries of the world. Hence it is needless to emphasise that the manufacture of the battery containers also should be developed with reference to the production of batteries and automobiles. While functioning as an ancillary unit to the large battery manufacturers, this industry also offers good scope for creation of a number of small scale battery assembly units. Since there is no scarcity of the major raw material namely rubber in Ethiopia and the equipments for making the containers are rather simple, it would be in the interest of the country that a small unit is set up for making the battery containers.

The proposal envisages setting up of a small scale unit for the production of 60,000 Nos. of hard rubber battery containers per annum that would yield an annual sales realisation of Birrs 0.72 million. The project would provide employment for about 20 persons. The net return on investment is estimated to be 34.6% and the break-even-point is 47.6% of total capacity.

1.2 Product Specifications

Requirements

The container shall be designed and manufactured so as to withstand the normal conditions of service. The surface of the container shall have a finish, substantially free from blisters, rough spots, scales, blowholes and other imperfections or deformations.

Containers shall be tested for cracks and other imperfections by applying an alternative voltage to electrodes covering the inner and outer surfaces of the walls and the base and intercell partitions when these are present.

A voltage of tx 3000 V where 't' is the minimum thickness in mm of the walls, partition or base of the containers shall be applied. The time of application of voltage shall be one minute ± 5 seconds. There shall be no breakdown or flashover.

Impact Resistance

The minimum requirements for impact limit for different thickness of containers shall be as follows :

Wall thickness at the point of impact (mm)	*Minimum Height of fall*	
	Avg. value (mm)	*Single value (mm)*
Below 7.2	Under consideration	Under consideration
7.2 to 7.5	150	100
7.6 to 8.8	200	150
Greater than 8.8	250	200

Plastic Yield

The average plastic yield shall be greater than 5 mm.

Acid Resistance

There shall be no significant blistering, warping or distortation of the containers. During acid test the extractable impurities shall not exceed the following limits.

Iron	:	0.16 mg/cm^2 of unpainted surface
Chlorine	:	0.08 mg/cm^2 of unpainted surface
Manganese	:	0.0016 mg/cm^2 of unpainted surface

The change in mass or volume shall not be more than 4.0 mg/cm^2 and 1.2. cm^3 respectively.

2. MARKET AND PLANT CAPACITY

2.1 Market Demand

Import data of Hard Rubber Battery Container

Year	*Quantity '000 pcs)*	*Value ('000 Birr)*
1977	15.9	937.2
1978	35.5	1426.7
1979	16.2	565.4
1980	12.2	550.0
1981	391.9	1379.7
1982	23.1	369.9
Annual average	82.5	871.5

Source : Annual external trade statistics

Based on data of imports from 1977-1982 the annual average growth rate is estimated to be 7.7%. The demand forecast for this item based on the supply data is simply an imposition of this rate on the last year's import volume (1982 = 23.15 thousand pcs.). Accordingly the forecast for the years 1986-1996 has been worked out and tabulated below :

Projected Demand of Hard Rubber Battery Containers

Year	*Quantity ('000 pcs)*	*Value ('000 Bir)*
1986	31.15	497.68
1987	33.55	536.00
1988	36.13	577.27
1989	38.91	621.72
1990	41.91	669.59
1991	45.14	721.15
1992	48.62	776.68

Year	*Quantity ('000 pcs)*	*Value ('000 Birr)*
1993	52.36	836.48
1994	56.39	900.89
1995	60.73	970.26

2.2 Plant Capacity

In view of the demand projected above, it is suggested that a unit with a manufacturing capacity of 60,000 battery containers be set up with an investment of 0.18 million Birrs.

2.3 Production Programme

The unit is expected to produce 50% of its design capacity during the first year of commissioning which should go upto 75% in second year and full production could be expected from third year onwards. The production in excess of the local demand could always be exported to neighbouring countries.

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw materials

The major raw materials that are required for making 60,000 containers per annum are as given below :

Material	*Unit Cost in Birr*	*Annual Requirement*
Reclaimed Rubber	1.37/Kg.	107000 Kg.
Structural rubber	3.13/Kg.	12200 Kg.
Synthetic rubber	2.92/Kg.	5600 Kg.
Sulphur	1.57/Kg.	28500 Kg.
Ebonite	1.37/Kg.	53650 Kg.
Carbon Black	2.66/Kg.	1400 Kg.
Fillers	0.73/Kg.	76500 Kg.

Hydrated Lime	0.73/Kg.	8500 Kg.
Accelerator	10.4/Kg.	140 Kg.
Retarder	8.3/Kg.	700 Kg.
Process oil	2.6/Litre	900 Litres
Miscellaneous Chemicals	1330	Lumpsum
Packing material	25000	Lumpsum

The estimated annual expenditure for procurement of these raw materials works out to Birr 206040.

3.2 Utilities

The major utilities that are required for a plant of this size per annum :

- Electricity 72000 Kwh
- Water 600 KL
- Steam 180 T

In addition provision is made for consumable items and expenses for repairs and maintenance. The annual expenses for these items is estimated to be Birrs 46260.

4. TECHNOLOGY AND ENGINEERING

4.1 Process Description

The process for manufacture of hard rubber battery container consists in mixing natural rubber synthetic rubber and reclaimed rubber with other chemicals and ingredients in a two roll mixing mill to make the rubber compound. This is then filled into suitable moulds and cured in a steam heated hydraulic press for about 18 to 20 minutes at a temperature of 158^{o} C. After curing the pressure is released, the containers removed from the moulds, the edges and corner trimmed and packed.

4.2 Plant and Machinery

The major equipments required for making these items are as follows :

Rubber mixing mill with chilled rolls reduction gear, 60 HP motor ... 1 no.

Hydraulic press 50 tons power driven by day light 24"x24" electronic heated ... 1 no.

Boiler, 100 kg steam/Hr.

Weighing balance & pan type testing equipments.

The CIF Addis cost of these equipment as per Indian conditions are Birrs 180300 excluding foundation and installation charges.

4.3 Layout

The covered area required for housing the equipment is 600 M^2.

4.4 Civil Works

The building construction cost is estimated to be 0.36 Million Birrs.

5. MANPOWER & TRAINING

5.1 Manpower Requirement

The personnel required for operating this unit on single shift basis are :

Category	*No. required*	*Sclary/month / person Birr*	*Annual Cost Birr*
Manager	1	1200	14400
Supervisor	1	900	10800
Skilled	7	250	21000
Unskilled	10	100	12000
Others	1	350	4200
Total	20	5200	62400

The annual expenditure towards payment of wages and salaries is estimated to be Birr 62400.

5.2 Training

The operation of this plant is rather simple and hence no specialised training is needed for the operating personnel. It would suffice if they are associated during trial run and commissioning with the implementing agency.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis : Production Capacity	:	60,000 nos Containers/annum.
No. of Shifts/day	:	One
No. of working days/year	:	270

6.1 Total Capital Investment

Particulars	*FC (BIRR)*	*LC(BIRR)*	*Total (Birr)*
Plant and machinery	161600	18700	180300
Office equipment and furniture		4000	4000
Technology Fee	20000		20000
Preproduction expenses		16400	16400
Buildings		360000	360000
Working Capital		67900	67900
Total	181600	467000	648600

6.2 Production Costs

For producing 60,000 numbers hard rubber battery containers per annum the production cost has been estimated to be 495700 Birrs., as given below, out of which raw materials account for 42%, energy and other manufacturing costs account for 9% and the expenditure that would be incurred to the operating personnel has been estimated to be 13%.

S.No.	Particulars	Total amount in Birr
1.	Raw Materials	206040
2.	Energy and other manufacturing costs	46260
3.	Labour and supervision	62400
4.	General overheads	37400
5.	Advertisement/sales	39000
6.	Depreciation on plant & machinery	18400
7.	Depreciation on buildings	18000
8.	Interest on long term loan	50300
9.	Interest on short term loan	17900
10.	Total production cost	495700
	Unit Cost =	8.26 Birr/piece

6.3 Financial Evaluation

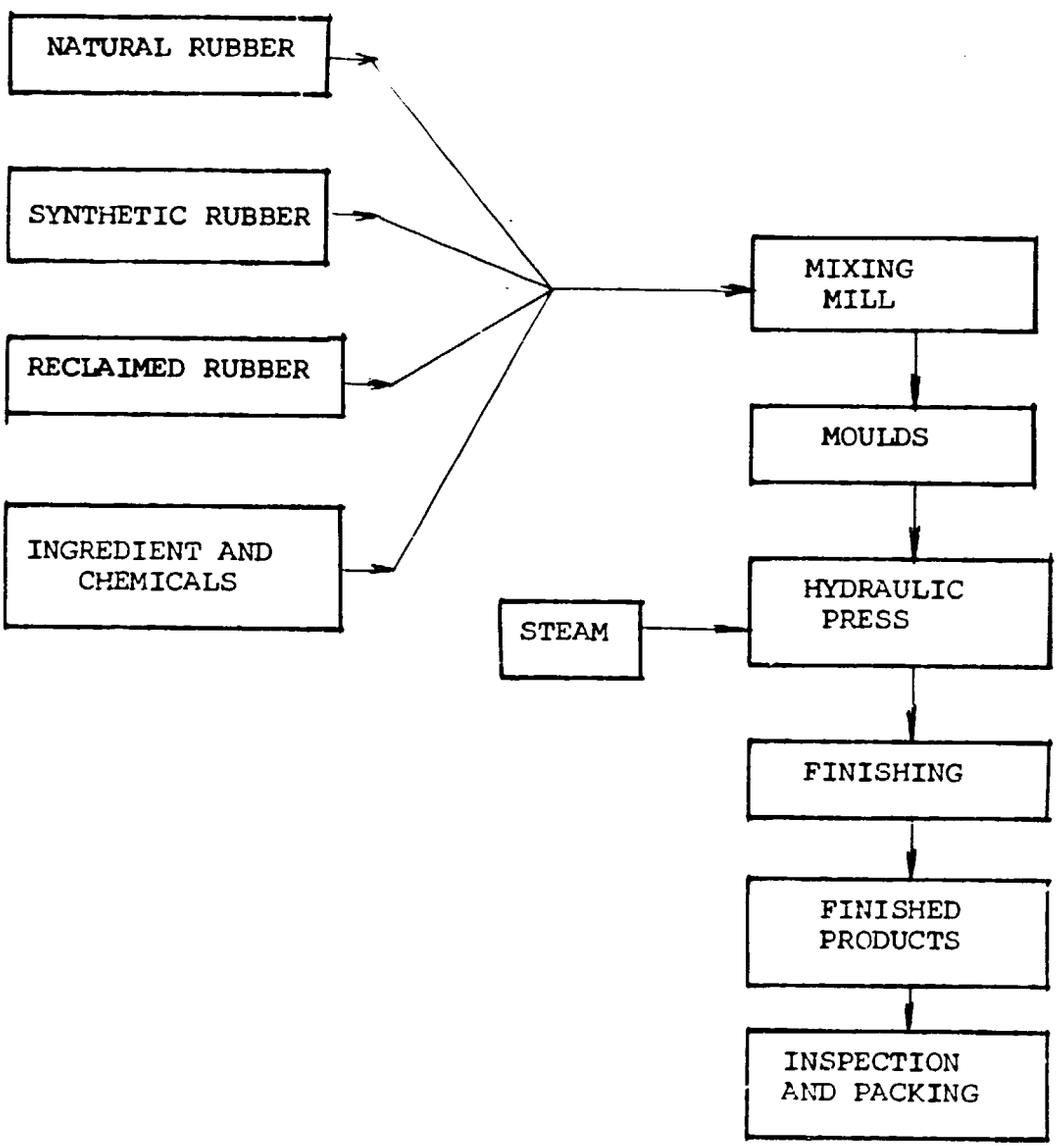
Total sales realisation at 12 Birr/container	:	Birr 720,000
Profit before taxes	:	Birr 224,300
Return on Investment	:	34.6%
Break-even point	:	47.6%
Pay back period	:	2 years

CASH FLOW STATEMENT

Year	Production Cost	Sales Revenue		Profit	Depreciation	Cash Flow
Ist	*350050*	*360000*	+	*9950*	*18400*	*28350*
2nd	*422875*	*540000*	+	*117125*	*18400*	*163875*
3rd	*495700*	*720000*	+	*224300*	*18400*	*406575*

Pay-back period : 2 years

HARD RUBBER BATTERY CONTAINER



35. PAPER CONES AND PAPER TUBES

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

The proposal envisages the setting up of the unit to manufacture 2 million pieces of paper cones and 5 million pieces of paper tubes with an investment on Birr 184750 on plant and machinery. Such a unit is capable of generating employment for 24 persons. The annual sales realisation shall be 0.74 million Birr. The unit is expected to break-even at 49% of its capacity and the return on investment works out to 25%.

1.2 Description and Specification of Product

The paper tubes are usually manufactured as per customer's requirement and follow international standards, to suit the purpose, for which it is being used. These have very good demand from textiles, handloom and other yarn manufacturing units. the paper cones, however, have certain specifications which have been described in Annexure-1.

2. MARKET AND PLANT CAPACITY

2.1 Market Demand

As per the data made available by the External Trade Statistics Authority, the import of paper cones and tubes amounted to 705,000 kgs. on an average during the years 1977 to 1982 as indicated below :

Year	*Qty. '000 Kgs.*	*Value in '000 Birrs*
1977	243.88	218.41
1978	279.72	309.32
1979	753.56	948.22
1980	1322.71	1824.76
1981	981.16	1257.86
1982	1357.22	1643.47

The demand projection made for the next 10 years is as given below:

Year	*Qty. '000 Kgs.*	*Value in '000 Birr*
1986	100.40	534.13
1990	136.60	736.71
1995	200.71	1067.68

2.2 **Plant Capacity**

A plant of capacity of 2 million pieces of paper cones and 5 million pieces of paper tubes is being proposed to start with. After studying the consumer acceptability and depending upon the demand the production could be doubled by operating plant on 2 shifts.

2.3 **Production Programme**

After the formalities like selection of technology, selection of vendors of equipments and the implementing agency are completed, the equipments could be delivered at plant site in about a year. Assuming that the installation and commissioning would take 2 months, the plant could be expected to produce 50% of its designed output during the first year of commissioning, which could be stepped up to 75% during the second year and full production could be anticipated from the third year onwards, yielding a sales revenue of Birr 0.74 million.

3. MATERIAL INPUTS AND UTILITIES

3.1 **Raw Materials**

The annual requirements of raw materials are given below in table A.

Table A

Annual Requirement of Raw Materials

S.No.	*Particulars*	*Unit cost/Birr*	*Annual requirement*
Paper Cones			
1.	Paper Box	1.246 per kg.	55000 kg.

(Contd.)			
2.	Starch	2.0 per kg.	2000 kg.
3.	Packing material	Lumpsum p.a.	2500 kg.
Paper Tubes			
1.	Paper	1316.64/Ton	140 Ton
2.	Casein Adhesive	2.66/Ton	5500 kg.
3.	Resin mixture	2.90/Ton	12000 kg.
4.	Packing material	Lumpsum p.a.	10000

The annual expenditure towards procurement of these raw materials is estimated to be Birr 317240.

3.2 **Utilities**

The requirement of utilities for this unit is as indicated below :

Power : 36,000 KWH

Provision for consumables, repairs and maintenance : 26,730 Birr

The annual expenditure on this account shall be Birr 34650.

4. TECHNOLOGY AND ENGINEERING

4.1 **Process Description**

The manufacturing process for paper tubes and cones is almost the same, only difference being their shape. The paper of required specification is punched in a punching machine when the craft paper is converted into fan shape according to the proposed size of the cone. After punching the paper is transferred to the bevelling operation. The bevelled paper is then subjected to embossing on the outside surface. The aim of embossing is to prevent the yarn from slipping down. After embossing the paper is glued.

The glued papers are then wound in proper shape in winding machine. The cone and tube is dried and the top of the product is curled. At the same step, the bottom is cut and notched. The painting of cone is then carried out. The cones and tubes are packed for despatch in wooden cases.

4.2 List of Equipments

Paper cones :

1. Automatic cone making machines with complete tackles for making 9" x 15" cones with vacuum type making spindle separate vacuum & compressed air unit with motors starters etc. 7.5 HP motor cap 22-25 cones/minute
2. 3-spindle housing machine - 2 HP
3. Paste preparing unit 1/2 HP
4. Dust Extracting Chamber with 2 HP fan
5. Special model circle knife grinding machine 1/4 HP
6. Automatic printing machine attached to cone machine

Paper Tubes :

1. Paper slitting machine 36"
2. Edge grinding machine
3. Dust extracting machine
4. Taper and straight tube winding machine (large)
5. Taper and straight tube winding machine (small)
6. Paste preparing unit
7. Drier
8. Tube compressor
9. Corrugator
10. Ferrules fixing machine - semi automatic
11. Resin impregnating vessel with compressor

12. Paint dipping arrangement

13. Electrical heater or oil fired curing oven

14. Automatic hopper feed tube cutting machine

The estimated cost of plant and machinery is Birr 184750.

4.3 **Building Layout**

It is estimated that a covered area of 800 sq. mts. shall be required to house the plant and machinery.

4.4 **Civil Works**

The cost of building construction is estimated to be 480000 Birrs.

5. MANPOWER & TRAINING

5.1 **Manpower Requirements & Expenditure**

The requirement of manpower for operating the plant on single shift basis for 270 working days shall be as given below :

S.No.	*Category*	*No. Reqd.*	*Salary in Birr per month/person*	*Total salary per annum in Birr*
1.	Managerial	1	1200	14400
2.	Skilled	11	250	33000
3.	Unskilled	10	100	12000
4.	Others	2	350	8400
	Total	24	5650	67800

The annual expenditure towards payment of wages and salaries works out to Birr 67800.

5.2 **Training**

The operations of the plant are so simple that no specialised training

is considered necessary. However, it would be in the interest of the project authorities that the recruitment of operating personnel is done before taking up the installation and commissioning project so that they could gain sufficient experience in the operation of the plant at the time of the commissioning by the implementing agency.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis :

Capacity	:	2 Million paper cones per annum. 5 Million paper tubes per annum.
No. of shifts per day	:	1
No. of working days/year	:	270

6.1 Total Capital Investment

	F.C. (Birr)	*L.C. (Birr)*	*Total (Birrs)*
Plant and machinery	165570	19180	184750
Office equipment and furniture	-	4000	4000
Pre-production expenses	-	17450	17450
Building	-	480000	480000
Working Capital	-	35860	35860
Total	165570	556490	722060

6.2 Production Cost

The annual production cost at full capacity works out to Birr 558830, out of which the raw materials account for 57%, energy and other manufacturing cost 6% and expenditure on payment of wages and salaries to the operating personnel account for 8% as per the table given below :

Production Cost

	Birr
Raw Material	317240
Energy and other manufacturing cost	34650
Labour and supervision	67800
General Overheads	40680
Advertising and sales	35000
Depreciation on plant and machinery	17450
Depreciation on building	24000
Interest on long term loan	13970
Interest on short term loan	8040
Total production cost	558830

6.3 **Financial Evaluation**

Total sales realisation at 100 Birr/1000 pieces of paper tube and 120 Birr/1000 pieces of paper cone	Birr	740000
Profit before taxes	Birr	181170
Return on investment		25%
Break-even point		49%
Pay-back period		2.4 years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Return*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	382900	370000	- 12900	17500	4600
2nd	470800	555000	+ 84200	17500	+ 106300
3rd	558800	740000	181200	17500	+ 305000

Pay back period = 2.4 years

Annexure - I

SPECIFICATION FOR PAPER CONES FOR WINDING YARN IS : 4888 - 1975

Scope

This standard prescribes the requirement for paper cones for winding yarn (cross-wound) having the following angles :

3°30, 4°30, 5°57 and 9°15

Terminology

For the purpose of this standard, the angle of cone shall mean the angle contained between the side and the axis, that is, half the total angle.

Manufacture

Types - The cones shall be of open-top type or rolled-in-top type.

Finish - The paper cones shall have plain, grooved, embossed, velvetted or flock finish. The top edge of rolled-in-top cones shall be rounded and polished for a minimum length of 10 mm from nose. The paint or enamel used for colour tipping of cone top shall be of fast colour so that it does not stain the yarn during usage.

Requirements

Dimensions - The cones shall conform to the requirements of Table 1 and Table 2.

The tolerances on internal diameter and overall length shall be as follows :

	Tolerance, mm
Internal diameter at base (D)	± 0.5
Overall length (L), mm:	± 1.5
Up to 200	± 1.5
Above 200 and up to 250	± 2.0
Above 250	± 2.5

Fitting Test - The fit of the cone shall be determined by sliding it on the plug gauge having taper equal to angle of cone without undue pressure and twisting. If the base of the cone lies within two lines marked on the gauge, the cone shall be considered to be satisfactory in respect of fit. The two lines shall be marked at a distance of ± b/2 from the nominal position of the cone base on the gauge. The value of b shall be 3.2 mm.

Concentricity - The cones shall be concentric. Eccentricity when determined by a suitable method as agreed to between the buyer and the seller shall not exceed 0.5 mm.

Mass - The average mass of a cone in a lot shall be as agreed to between the buyer and the seller. A tolerance of ± 8 percent on agreed mass shall, however, be permissible.

** Table 1 and Table 2.

Designation

The cones shall be designated by their overall length, internal base diameter, type (open-top or rolled-in-top), finish and angle of cone.

Example - A 3°30 plain finished, open-top type cone having overall length of 140.5 mm and internal base diameter of 46 mm shall be designated as under :

140.5 x 46, Open-Top, Plain, 3°30

PACKING

The cones shall be packed in either wooden boxes or wooden crates

strong enough to withstand normal hazards of storage and transport.

Note : Ordinarily, a case should contain 3000 cones.

Each case of cones shall bear the following information :

a) Manufacturer's name, initials or trade-mark, if any;

b) Number of cones packed in a case;

c) Gross and net mass;

d) Designation of cones and

e) Colour code of the cones packed.

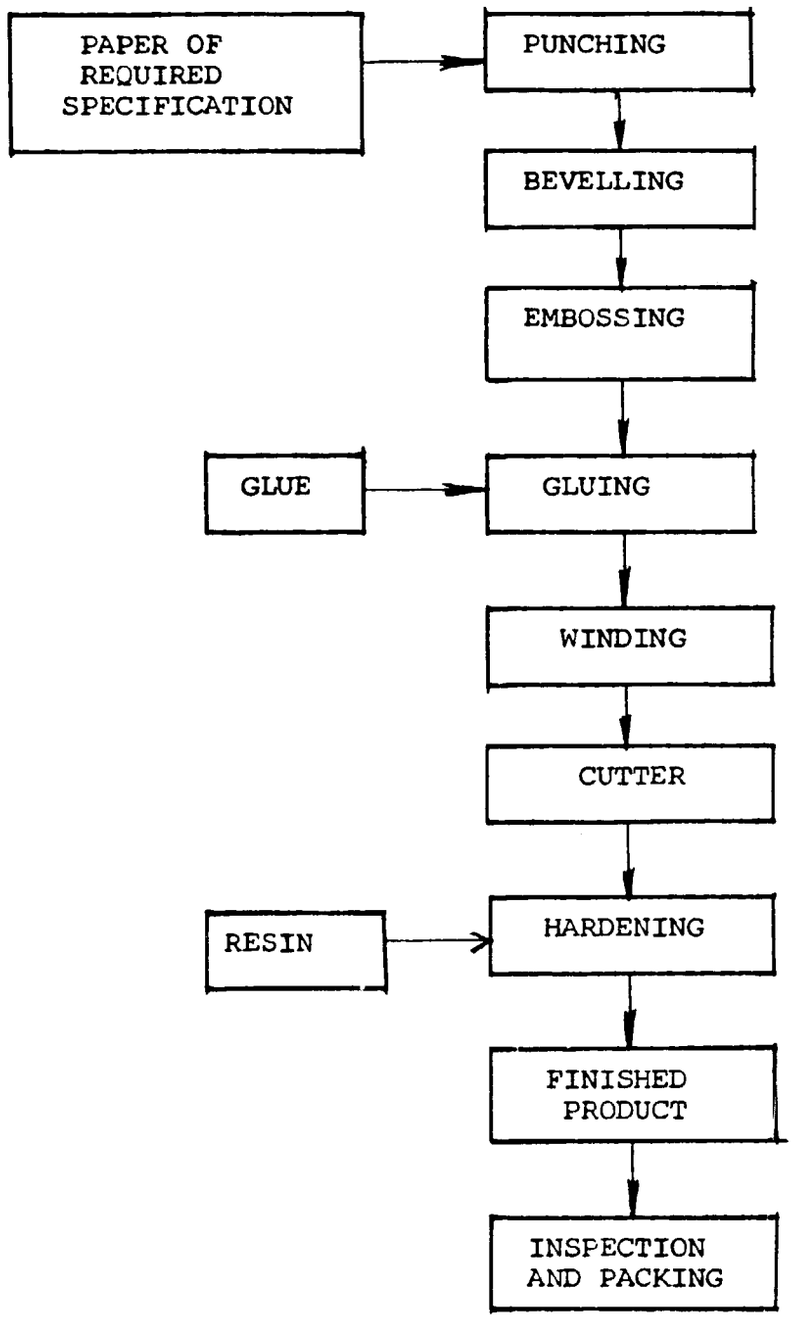
TABLE 1 : DIMENSIONS OF OPEN-TOP PAPER CONES

Dimensions	Angle of Cone	3°30									4°20	5°57	9°15
D		46	46	58	62	62	62	71.5	71.5	71.5	55	58	56	66.4
L		140.5	165.5	165.5	165.5	220.5	280.5	165.5	220.5	280.5	145	165	177.8	175

TABLE 2 : DIMENSIONS OF ROLLED-IN-TOP PAPER CONES

Dimensions	Angle of Cone	3°30							4°20	5°57	9°15
D		46	58	62	62	71.5	71.5	71.5	52.5	56	66.4
L		175	175	175	290	175	230	290	145	177.8	175

PAPER CONES AND PAPER TUBES



36. PAPER BOARD BOXES

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

The proposal envisages setting up a small scale unit for the production of 7,000 paper board boxes per day which would yield an annual sales realisation of Birrs 1.54 million at full capacity. The project would provide employment for about 25 persons. The return on investment is estimated to be 21% and the break even point is 47% of the capacity.

1.2 Product Description

Paper board has become quite familiar as a new packing material. For safety of the finished goods and their safe movement for marketing, the use of this type of board is ever increasing. It has replaced the wooden packings and tin containers because of the following advantages.

* Effective cushioning material
* Light weight (freight advantage)
* Easy to fabricate
* Easy for storing
* Easy for disposal
* More pilferproof
* No strapping necessary
* Article kept dust free after sealing
* Specially made water resistant
* Printing and advertising advantage
* Desired in export market
* Eliminates dependency on natural wood
* recyclable
* Expedites production due to one line conveyor packing

A list of major industries in which it is extensively used is given below :

* Breweries
* Glass wares
* Cigarettes
* Pharmaceuticals
* Soaps and cosmetics
* Biscuits
* Milk and milk products
* Tea and coffee
* Hoisery and footwears
* Toys
* Photographic equipments
* Textile and readymade garments
* Frozen fish
* Electric goods
* Refrigerator, air coolers and fans
* Electric bulbs and tubes
* Hardware
* Bicycle and auto-parts
* Rubber and rubber products
* Stationery
* Matches
* Defence
* Food preservations industry
* Cashewnut Industry
* Synthetic (Man-made) fibres

2. MARKET AND PLANT CAPACITY

2.1 Demand

As per the the annual import data collected for years 1977-1982, the quantity of papers boards (required for packing purposes) imported has increased nearly 6 times during the 6 year period for which data was available. On an average import of this item accounted to 700 tonnes annually and the value of imports has been 0.90 million Birrs as given below.

Year	*Qty. imported ('000 Kgs)*	*Value of Import ('000 Birr)*
1977	243.88	218.41
1978	279.72	309.32
1979	753.56	948.22
1980	1322.71	1824.76
1981	981.16	1257.86
1982	1357.22	1643.47

Annual Average : 705.46^{000}Kgs. Value : 886^{000}Birr

Source : Annual External Trade Statistics

The future demand projection for next ten years was arrived at using a constant average volume to be true for future also and the following are the estimated demand.

Year	*Qty. ('000 Kgs.)*	*Value ('000 Birrs)*
1986	738.43	1595.00
1990	1182.83	2554.91
1995	2131.49	4604.03

2.2 Plant Capacity and Production Programme

As mentioned in the scope of the project, a unit with a manufacturing capacity of 1.75 tonnes per day or 472.5 tonnes per annum on two shift operation for 270 days has been proposed for implementation in industrial estate. As it would take considerable time, for selection of source of technology before which orders could be placed for supply of plant and machinery on a total turnkey basis, it could be assumed that after a decision on setting up the plant is taken, the equipment could be supplied in about a year after installation and commissioning could commence within 3 months thereafter. The plant would go into 50% production during first year, 75% in

second year and full production 1.75 TPD could be achieved from third year onwards when a sales realisation of Birr 1.54 million could be anticipated.

3. MATERIALS INPUTS AND UTILITIES

3.1 Major Raw Materials

The major raw materials for the production of paper board boxes are kraft paper, glue and stitching wires.

The raw materials required per annum for the manufacture of paper board are as given below :

Material	*Unit Cost (CIF Addis in Birrs /Kg.*	*Annual Requirement (Kgs.)*
Kraft paper	2	475000
Glue	4.75	32000
Stitching wire	1.67	3200

The total annual expenditure on procurement of these raw materials is estimated to be 1107330 Birrs.

3.2 Utility

Power - 161005 KWH/annum

It is estimated that annual expenditure on this account is 49320 Birrs, which however includes provision for annual expenditure on consumables, repairs and maintenance.

4. TECHNOLOGY AND ENGINEERING

4.1 Process Description

Paper board is made with a corrugated sheet of paper attached to the facings of flat paper, usually kraft, by adhesives. It is mostly produced over a single facer machine.

a) ***Paper Board Manufacture***

Here to paper reels are run together. One layer of paper becomes corrugated after passing through the heated corrugated rolls and the other been glued at the tips. Thus both get pasted together and are wound in rolls. The resulting roll is now known as Single Face or 2-ply Corrugated Board. By cutting the roll with Board Cutter and glueing the corrugated side by a pasting machine, double face or 3-ply corrugated board is produced. This board is kept under a Sheet Pressing machine for some time for proper setting of the wet glued sheets. Similarly board to board can be pasted for form thick boards, i.e. 5-ply and 9-ply etc.

b) ***Printing***

For printing on corrugated board, Stereo Type Rotary Printing Machine is utilised. The sheets are placed one by one over the machine and get printed without the flutes being damaged.

c) ***Paper Board Boxes***

The process of manufacturing boxes or containers consist of five operations.

1. Slitting or Longitudinal Cutting
2. Creasing
3. Slotting
4. Flap or Corner Cutting
5. Stitching

After passing the sheet through these operations, a box or a container is ready.

4.2 **Engineering**

List of the Plant and Machinery

S.No.	Equipment/Specifications	Capacity/ Size	No. of
I.	**Corrugation Sheet Making Unit**		
1.	Single face paper corrugating machine with slitting attachment, reel loading trolley, preheater roll, heat control panel.	70 rolls/ 8 hrs. of 250 ft. length	1
2.	Board Cutter heavy duty, fitted with foot operated dab, front and back guides, hand operated with reel stands	42" x 62" size	2
3.	Sheet pasting machine with complete adjustments, motorised	72" size	1
4.	Sheet Pressing Machine motorised with reversing switch	65" x 75" size	1
II.	**Box Making Unit**		
1.	4-bar rotary cutting & Creasing machine complete with dies for cutting & creasing, motorised unit with starters	65"	1
2.	Eccentric slotter, with 3 slotting dies and 1 corner cutting die, motorised unit with starter	65"	1
3.	Stitching machine flat wire, motorised unit with starter	32" arm	2
4.	Partition slotter with 5 partition slots, slot depth 5" motorised unit with starter	Free size	1
5.	Board cutter, light model with foot operated dab, front and back guides, hand operated	42" size	1
6.	Bending Machine Foot operated	42" size	1

(Contd.)

7.	Corner cutting Machine foot operated	8" x 8" size	1
8.	Single slotting machine foot operated	10" size	1
9.	Stitching machine foot operated	20" arm	1
III.	**Corrugated Sheet Printing Machine**		
	Rubber Stereo type printing machine	42" x 80"	

Cost of Plant & Machinery

The cost of plant and machinery as per CIF Addis is estimated to be 0.2 million Birrs including foundation and installation charges.

4.3 **Layout**

The covered area required for housing this plant would be 400 sq.mt.

4.4 **Civil Works**

The construction of the building is estimated to be Birr 240000.

5. MANPOWER & TRAINING

5.1 **Manpower Requirement**

The manpower requirement for operating the plant in two shifts shall be as indicated below.

Category	*No. Reqd.*	*Salaries/ Person month (Birr)*	*Annual Cost (Birr)*
Managerial	1	1200	14,400
Technical	1	900	10,800
Skilled	2	250	6,000
Semi-skilled	5	150	9,000
Unskilled	15	100	18,000
Others	1	350	4,200
Total	25	5200	62,400

The total annual expenditure that would be incurred on payment of wages and salaries operating personnel is estimated to be Birrs 62,400.

5.2 **Training**

The process for making paper board boxes is rather simple and as such does not require any specialised training. However, if the operating personnel are recruited during the installation period itself, they could associate themselves with the overseas implementing agencies during trial run and commissioning of various equipments.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis	:	Production Capacity	-	1.75 tons/day (7,000 boxes/day)
		No. of shifts	-	2
		No. of working days	-	270

6.1 **Total Capital Investment**

Item	*F.C. (Birrs)*	*L.C. (Birrs)*	*Total (Birrs)*
Plant and machinery	175400	24600	200000
Office equipment and furniture		4000	4000
Technology Fees	20000		20000
Pre-production expenses		20000	20000
Building	-	240000	240000
Working Capital	-	52600	52600
	195400	341200	536600

6.2 **Production Cost**

For producing 7,000 boxes/day the production cost has been estimated

to be 1.42 million Birrs, as given below, out of which raw materials account for 78%, energy and other manufacturing costs account for 3%, and expenditure that would be incurred to the operating personnel has been estimated to be 4%.

S.No.	*Particulars*	*Amount in Birrs*
1.	Raw Materials	1107330
2.	Energy & other manufacturing costs	49320
3.	Labour and supervision	62400
4.	General Overheads	37440
5.	Advertising and sales	20000
6.	Depreciation on plant and machinery	20000
7.	Depreciation on building	12000
8.	Interest on long term loan	40800
9.	Interest on short term loan	13300
10.	Total production cost	1422600
11.	Production cost	3000 Birrs/ton or 3 Birrs/Kg.

6.3 Financial Evaluation

Selling price unit	:	Birrs 3.25/Kg.
Total sales realisation	:	Birrs 1535600
Profit before taxes	:	Birrs 113000
Return on investment	:	21%
Break-even point	:	47%
Pay-back period	:	3.8 years

to be 1.42 million Birrs, as given below, out of which raw materials account for 78%, energy and other manufacturing costs account for 3%, and expenditure that would be incurred to the operating personnel has been estimated to be 4%.

S.No.	*Particulars*	*Amount in Birrs*
1.	Raw Materials	1107330
2.	Energy & other manufacturing costs	49320
3.	Labour and supervision	62400
4.	General Overheads	37440
5.	Advertising and sales	50000
6.	Depreciation on plant and machinery	20000
7.	Depreciation on building	12000
8.	Interest on long term loan	40800
9.	Interest on short term loan	13300
10.	Total production cost	1422600
11.	Production cost	3000 Birrs/ton or 3 Birrs/Kg.

6.3 Financial Evaluation

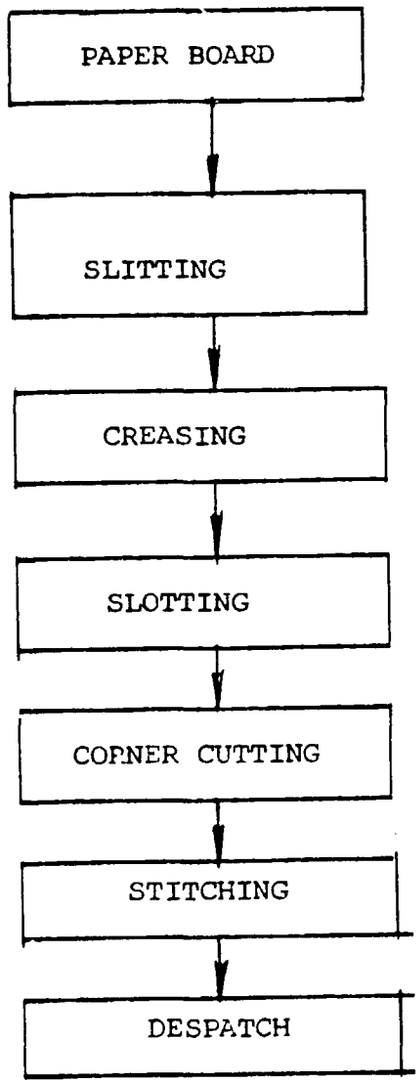
Selling price unit	:	Birrs 3.25/Kg.
Total sales realisation	:	Birrs 1535600
Profit before taxes	:	Birrs 113000
Return on investment	:	21%
Break-even point	:	47%
Pay-back period	:	3.8 years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	804265	767800	- 36465	20000	- 16465
2nd	1113427	1151700	- 38273	20000	- 34738
3rd	1422600	1535600	113000	20000	+ 98262
4th	1422600	1535600	113000	20000	+ 231262

Pay back period : 3.8 Years

PAPER BOARD BOXES



37. LIGHT ROOFING SHEETS FROM CELLULOSIC WASTE

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 **Summary of Project**

The proposal envisages setting up of a unit capable of manufacturing 4.50 TPD of light roofing sheets from Cellulosic waste. The annual sales realisation is estimated to be 2.6 million Birr. The unit is capable of generating employment of about 31 persons. The return on investment is worked out to be 21% and the plant is expected to break even at 65.0% at its full capacity.

1.2 **Product Description**

The use of paper was essentially meant for writing and printing purposes only, but the ingenuity of man has gradually extended its use for a variety of other purposes such as for packing, wrapping, liquid containers, cartons and a large no. of other products. Paper with various desirable properties, such as high wet strength, high tensile and impact strength, high folding endurance, resistance to flame or temperature, water or gas, oil grease, acid or alkali and unattackable by insects etc. have been developed. Speciality papers having diversified properties are produced by the addition of resins to cellulosic fibres or by means of chemical modification of its functional groups and other treatments such as impregnation, lamination, coating, corrugations etc. Paper is replacing glass and other metals in the packing industry. Today the other uses of paper far exceed its classical uses for writing and printing purposes, especially in advanced countries.

Utilization of paper boards plain and corrugated for the construction of paper houses is a recent development in the field of building industries. A very low cost but durable roofing materials for shelters for rehabilitation of poor people, army etc., is the need of the time, which could be well within the reach of the common man. Process is now available for manufacture of light and fire resistant paper roofing sheets which are comparatively better than the commercially available one. The conventional building material requires skilled

labour and is at the same time labour intensive. The modern materials like G.I. sheets or asbestos cement sheets are available only to a limited extent and are also expensive. The transportation of asbestos cement sheets over long distance result in heavy loss due to breakage. On the other hand, paper roofing sheets are light, water resistant cheap and could be produced in variety of colours, designs and patterns.

These roofing sheets are ideally suited for poultry sheds, cattle sheds, piggery, workshop, automative garages, barns for storing grains in agricultural farms, tobacco barns, forward defence establishments, geological survey camps, rehabilitation projects, semi-permanent theatres and exhibition halls, educational institutions and low cost houses.

1.3 Product Specifications

The characteristics of the corrugated roofing sheets are as given below :

Size	:	1 m x 0.6 m
Thickness	:	5 mm
Weight	:	3 Kg
Depth of corrugation	:	3.7 cm
Pitch of corrugation	:	10 cm
Water absorption	:	10 to 15% in 24 hrs wetting
Percolation of water	:	nil

Breaking Strength

30 cm. span	:	130 to 145 Kg
60 cm span	:	65 to 75 Kg
Fire resistance	:	satisfactory.

2. MARKET AND PLANT CAPACITY

2.1 Market Demand

The manufacture of roofing sheets from cellulosic wastes by the process mentioned is a new process which is being proposed for

implementation. As could be seen from the end uses of the product mentioned above, the aim of the proposal is to make a low cost roofing sheet within the reach of common man. Since the country has just now come out of the clutches of draught which had been affecting the economy during the last three years it is very essential that draught stricken people are provided proper shelter at reasonably low cost, it is felt that this project could be of considerable utility in the country.

2.2 **Plant Capacity**

A plant with a capacity of 4.5 tons per day is being proposed for implementation.

2.3 **Production Programme**

Regarding the production programme, this depends upon the time taken for selection of technology, selection of vendors for equipments and the implementing agency. It is expected that these activities would take about one year after which the equipments are received at the ject site and commissioned in a year's time. A production of 50% rated capacity could be anticipated in the first year, 75% in second year and full production from third year onwards, yielding an annual sale revenue of Birr 2632500 from third yeard onwards.

3. MATERIAL INPUTS AND UTILITIES

3.1 **Major Raw Materials**

The main raw materials required for making this product are waste paper, straw chemicals and asphalt and the requirement of the main raw material are as given below :

Material	*Unit Cost (Birr)*	*Requirement*
Waste paper	600/Ton	2 TPD
Straw	100/Ton	3 TPD
Asphalt |		
Chemical|	Lumpsum	

The cost of raw material and chemicals required for making 4.5 TPD of the sheet, has been estimated to be Birr 1680000 per annum.

3.2 **Utilities**

Power	:	240000 KWHr
Water	:	5335 Kl
Coal	:	900 Tons

The utilities are electricity, water and coal and the annual expenses on account of these items amounts to about Birr 350230 which includes provision for procuring consumables on yearly basis as also for repairs and maintenance.

4. TECHNOLOGY AND ENGINEERING

4.1 **Brief Description of Process**

The process for making the paper roofing sheets consists of :

1. Chopping
2. Cooking and wasting
3. Pulping of waste paper or any other cellulosic material
4. Board making
5. Corrugation and drying
6. Impregnation
7. Fire retardant treatment and finishing

Rice straw, Bagasse etc., after Chopping is put into digestor for cooking chemical solution is added and heated at a particular temperature and pressure. After digestion, the cooked material is discharged into RCC tank. The liquid is drained out and washed with water. Cooked & washed straw is passed on to the beater where it is beaten to the desired degree of freeness. Chemical are added in the beater for internal sizing.

Waste paper is first soaked in water for sometime and then beaten to the degree of freeness. Chemicals are added in the beater for internal sizing. The beaten straw pulp and waste paper are mixed in the stock chest.

Multilayered sheets are formed from the above stock in the cylinder mould machine. The sheets are pressed in a screw press to remove as much water as possible. The sheets after removal from the press are corrugated manually with steel rollers on wooden moulds and then dried in the sun. Electrical or steam heated airdriers can be used when production is increased.

The corrugated and dried boards are then impregnated with asphalt at a particular temperature. A fire resistant composition is applied with a brush. The sheet can then be painted of any colour on one or both sides. The malt finish in different colours can also be painted.

4.2 List of Major Equipments

For a plant with a rated production of 4.5 TPD of paper roofing sheets, the following are the major equipments required :

Straw Cutter	:	1
Vessel for emulsion preparation	:	1
Digestor	:	1
Beater with washing drum	:	2
Stock chest with agitator	:	1
Flow box	:	1 set
Riffler	:	1
Strainer	:	1
Stuff pump	:	2
Machine chest with agitator	:	1 set
Cylinder mould machine	:	1
Hydraulic press	:	1
Corrugation mould	:	1 set
Board cutter	:	1
External Treatment Plant	:	1 set
Boiler	:	2
Process water pump	:	2

The total cost of plant and machinery as mentioned above is estimated to be approximately 281160 Birr CIF Addis excluding foundation and installation charges.

4.3 **Layout**

For a plant of this size, it has been estimated that a covered area of about 600 m^2 would be required.

4.4 **Civil Works**

Construction of such a building would involve an expenditure of Birr 360000.

5. MANPOWER AND TRAINING

5.1 **Manpower**

For the operation of the plant for making roofing sheets from cellulosic waste, the following personnel are required :

Category	*No. Reqd*	*Salary/Person/ Month/Birr*	*Total salary/ Year/Birr*
Managerial	1	1200	14400
Supervisory/Technical	4	900	43200
Skilled	12	250	36000
Unskilled	12	100	14400
Others	2	350	8400
Total	31	9700	116400

The total annual expenditure that would be incurred towards wages and salaries to these personnel shall be Birr 116400.

5.2 **Training**

Though the process for making roofing sheet by this method is simple, few personnel should be trained in the factory of overseas suppliers where the process has been developed and the others could be associated with the implementing agency at the time of installation and

commissioning. It would be necessary that the local implementing agency shall pay for air-fare, boarding, lodging and incidentals to the personnel deputed for training. It is estimated that an amount of 10,000 Birr would be necessary for this purpose.

6. FINANCIAL AND ECONOMIC ANALYSIS

Product	:	Light Roofing sheet 1 m x 0.6 m thickness 5 mm weighing 3 kg/sheet
Capacity	:	4.5 TPD
No. of shifts/day	:	3
No. of working days per year	:	300

6.1 Total Capital Investment

Particulars	*F.C. (Birr)*	*L.C. (Birr)*	*Total (Birr)*
Investment on plant & machinery	251020	30140	281160
Office equipment and furniture		5000	5000
Pre-production Expenses		26270	26270
Technology Fee	60000		60000
Building		360000	360000
Working Capital		78000	78000
Total	311020	499410	810430

6.2 Production Cost

The total production cost for manufacture of 1350 tons of roofing sheet per year works out to 2465770 Birr out of which raw materials account for 72%, energy and other manufacturing costs 14% and expenditure towards payment of wages and salaries accounts for 4.7%.

S.No.	Particulars	Amount in Birr
1.	Raw Materials	680000
2.	Energy and other manufacturing costs	350230
3.	Labour and supervision	116400
4.	General overheads	69840
5.	Sales/advertising	135000
6.	Depreciation on plant & machinery	28500
7.	Depreciation on building	18000
8.	Interest on long term loan	49000
9.	Interest on short term loan	18800
10.	Total production costs	2465770
11.	Production cost/ton	1827

6.3 Financial Evaluation

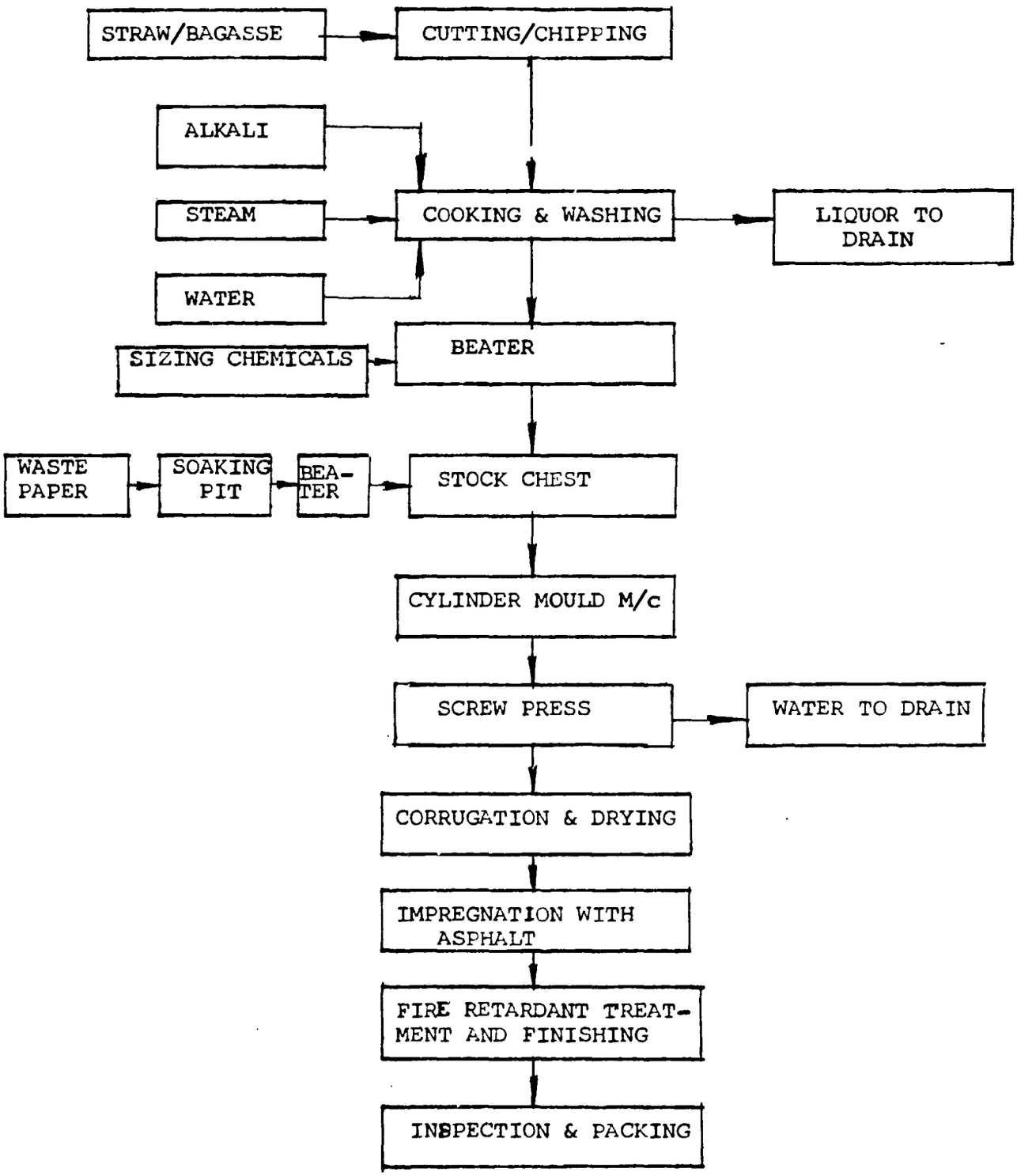
Total sales realisation at	1950 /Birr/ton		
	Birr	..	2632500
Profit Before taxes	Birr	..	166730
Return on investment	Birr	..	21.0%
Break-even point		..	65%
Pay-back period		..	3.8 Years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Return*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	1452500	1316300	- 136200	28500	- 107700
2nd	1960000	1974400	+ 14400	28500	- 64800
3rd	2467600	2632500	+ 164900	28500	+ 128600
4th	2467600	2632500	+ 164900	28500	+ 322000

Pay-back period : 3.8 year

LIGHT ROOFING SHEETS FROM CELLULOSIC WASTES



38. CONCRETE MIXERS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

Concrete mixer is the most suitable mixer available in the market for small construction job. It is proposed that the unit will manufacture 120 nos. of concrete mixers per annum. The investment on machinery and equipment is 0.31 million Birrs and the unit requires a covered area of 250 sq. mts. This project can offer an employment to about 26 persons and the return on investment would be 24 percent.

1.2 Description and Specification of the Product

Concrete mixer is an essential machine for mixing sand, gravel and cement in specific proportion for any civil construction work. Such machines are used by construction men for buildings,dams, bridges, reinforcing and similar construction work. Concrete mixers may be fabricated in different sizes to meet the need of different type of construction work. The mixers has the tilting arrangement, hopper feed and driven by 5 HP water cooled diesel engine.

1.3 Specification

Overall length	300 cms
Overall width	125 cms
Overall height	165 cms
Weight	700 kg
Discharge Height	60 metres

2. MARKET AND PLANT CAPACITY

2.1 Market Demand

Concrete mixers have been imported from Europe and other countries. Import figures for the last several years are not available. It is suggested that local manufacture of concrete mixers is worthwhile.

The demand for concrete mixers depend on the development plans

for the construction sector. The ten year indicative plan assumes an average annual growth rate of 19.4 percent for building construction. However, this is very ambitious and the time trend growth rate (10% per annum) is considered in forecasting demand. Accordingly, IPS have suggested a demand consideration of about 60 numbers per annum for the proposed plant.

2.2 Plant Capacity and Production Programme

It is proposed that the economical plant capacity is about 120 units, per annum which is about 200 percent of the projected demand. It is expected that the demand shall increase with the increase in various construction activities.

The unit is envisaged to operate one shift a day for 270 days a year. It is expected to operate at 50 and 75 percent of the installed capacity, during the first and second year respectively. Full production could be achieved from the third year onwards yielding an annual sales revenue of 1.44 million birr.

2.3 Distribution and Sales

Several public and private enterprises are distributing concrete mixers long with other construction materials. The major consumers are the high way department and building construction agencies. The envisaged products can easily find their sales outlet through the same channels as the improted ones.

3. MATERIAL INPUTS AND UTILITIES

3.1 Raw Materials

The raw materials required for the manufacture of concrete mixers are pig iron, mild steel, channels of 100 mm x 50 mm, 75 mm x 40 mm, 125 mm x 65 mm, 150 mm x 75 mm; mild steel angles of 40 mm x 5 mm, 50 mm x 50 m 6 mm, 75 mm x 75 mm x 10 mm, 65mm x 65mm x 8 mm, 25 mm x 25 mm x 3mm; mild steel square of 25, 32, 40, 50 & 63 mm; mild steel flats of 25 x 3 mm, 32 x 5 mm, 40x 6 mm, 50 x 6 mm, 50 x 10 mm, 62 x 10 mm; mild steel rounds of 12-90

mm, mild steel plates of 3-25 mm with the gauge of 8-18 etc. All these materials are not locally available and have to be imported.

The raw materials for manufacturing 120 numbers of concrete mixtures per annum with their cost are given below :

Raw Materials Requirement

Item No.	*Description*	*Unit Price Birr/Kg*	*Quantity in Kg.*
1.	Mild steel sections (Channels, angles, swuare, flats, plates)	2.7	95000
2.	Gun metal	6.0	5000
3.	Pig Iron	5.2	90000
4.	Diesel engine	1335	120 numbers

The total cost of raw material is estimated to be 0.92 Million Birrs on CIF, Addis basis.

3.2 The utilities required in this project are electricity and water. The annual consumption of electricity and water are 36000 KWH and 240 M^3 respectively. The annual consumption cost and electricity is about Birrs 4320 and the water is about Birrs 120. Hence the total cost and utilities per year works out to be Birrs 4440.

4. TECHNOLOGY AND ENGINEERING

4.1 **Technology**

The technique for manufacturing the concrete mixer is difficult. The know how may be obtained through the supplier of machinery and equipment.

The main parts of concrete mixer are chasis, drum, yoke, hand wheel and lever. The chasis of the mixer is fabricated from heavy steel sections and is robust to withstand continuous hard use. The drum is made of heavy steel plates and has a reinforced mouth. Specially shaped mixing blades are fitted in the drum to ensure a thorough unsegregated mix in the latest possible time. The box type yoke is fabricated from mild steel in greater strength and quality. A large diameter steel-spoked hand wheel and lever is provided for easy tilting and locking of the drum in the correct position. The unit is mounted on a robust chasis fabricated from mild steel and is fitted with 4 wheels; a swivelling axle and drawbar.

4.2 Description of manufacturing process

Pig iron is heated to the melting temperature in cupola. Rotary drum, heavy gears, brackets and wheels are casted from cupola. The casted parts are then finished using the hand grinder. The fixing stands are manufactured using the plate bending machine. Mild steel rounds re fed to the gear hobbing machine for the gear cutting operation. The gears are finished (removing burns) using the tool grinder. The yokes are made from M.S. Plates and M.S. Angles. This involves the cutting operation and machining operation in the gas cutting machine and lathe respectively. The casted and machined parts are assembled. Then the hopper is made from M.S. Channel and M.S. Plates. This is assembled with earlier assembly. A four wheel trolley is fabricated and the mixer is mounted on that. The mixer is to be tested after mounting by driving the rotary drum and observing its general performance.

4.3 List of machinery and equipment

For the suggested capacity of manufacturing 120 numbers of concrete mixers per annum the following are the machinery required:

- Cupola with fan, engine motor and moulds & pattern with the sand 1

-	Lathe Bed length 1800 mm	1
-	Lathe Bed length 3000 mm	1
-	Drilling machine Capacity : 6 mm diameters	1
-	Hacksaw cutting machine length 350 mm	1
-	Hand drilling machine	2
-	Welding set / 3 phase A/C	3
-	Gas cutting set (with oxygen/cooking gas)	1
-	Shaping machine Length 3000 mm	1
-	Plate bending machine Length 1800 mm	1
-	Tool grinder (bench type) wheel dia : 20 mm	1
-	Hand grinder (motorised) width dia; 180 mm	1

The total cost of machinery estimated to be 0.31 Million Birrs on CIF Addis basis.

4.4 **Layout**

For housing the machinery and equipments it is estimated that a covered area of 250 sq. mts. may be required, which however, includes the raw materials store, finished goods store and office accommodation.

4.5 **Civil Works**

The construction cost of the building works out to be Birrs 150000.

5. MANPOWER

5.1 **Manpower Requirement**

For the recommended capacity on single shift operation (8 hours).

The unit requires a total manpower of 26 persons.

No.	Category	Number required	Salary per month per person Birrs	Salary/ annum Birrs
1.	Manager	1	1200	14400
2.	Supervisor	1	900	10800
3.	Skilled Worker	6	250	18000
4.	Semi-skilled Worker	8	150	12000
5.	Unskilled Worker	6	100	7200
6.	Others	4	350	16800
	Total	26		79200

The total expenditure on wages and salaries is estimated to be Birrs 79200.

5.2 Training

All production staff should have training in the production technology maintenance and quality control, which could be organised by the project authorities by recruiting the supervisory and skilled personnel at the time of installation and commissioning so that they could familiarise themselves with the operation of various equipments.

It may be necessary to get the services of an expert during the start-up of production for a period of six weeks. He should be able to organise production programme and also training of technical personnel. The expenses on the expert is estimated to be Birrs 20000 including travel expenses.

6. FINANCIAL AND ECONOMIC ANALYSIS

6.1 Total Capital Investment

The total capital investment is estimated to be Birr 628500 of which

Birr 487500 is for the fixed capital and the remaining 141000 is for working capital. The details are shown below :

Particulars	*FC/Birr*	*L/C Birr*	*Total Cost Birr*
Fixed Capital			
Plant & Machinery	275000	37500	312500
Building Construction		150000	150000
Pre-production expenses		20000	20000
Office equipment and furniture		5000	5000
Working Capital	116000	25000	141000
Total	391000	237500	628500

6.2 **Production Cost**

The annual production cost at full capacity one shift operation is estimated to be Birr 1290600 Birrs. Raw material and manpower costs amount to 72% and 6% respectively. The break-up is shown in table below :

Sl.No.	*Particulars*	*Cost Birrs*
1.	Raw material	924500
2.	Utilities	4440
3.	Labour & Supervision	79200
4.	Overheads	47500
5.	Consumables	31300
6.	Repair & Maintenance	15600
7.	Sales/Advertising	60000
8.	Depreciation on plant	31300
9.	Depreciation on building	7500
10.	Interest charges	89300
	Total	1290600

6.3 Financial Evaluation

Annual sales realisation at 12000 Birr per Mixer	:	Birr 1440000
Profit before Taxes	:	Birr 149400
Return on Investment	:	24%
Break-even point	:	63%
Pay-back period	:	3.4 years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit/Loss*	*Depreciation*	*Net Cash Flow*
Ist	772720	720000	- 52720	31300	- 21420
2nd	1031680	1080000	+ 48320	31300	+ 58200
3rd	1290640	1440000	+ 149360	31300	+ 238860
4th	1290640	1440000	+ 149360	31300	+ 419520

39. DUPLICATING STENCIL PAPER

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of Project

The proposal envisages setting up of a small scale unit for the production of Duplicating Stencil Paper of 300 TPA capacity which would yield an annual sales realisation of 2.43 million Birrs at full capacity. The project could provide employment for about 21 persons. The return on investment is estimated to be 27.3%. The break-even point is 55%.

1.2 Description & Specification of Product

There are mainly two types of stencils which are in use now-a-days. They are typing stencils and pen stencils. The stencil papers which are coated with a compound of nitrocellulose are mainly used for duplicating and these stencil papers can produce more than thousand copies per stencil paper.

The main consumers of the stencil papers are the different government institutions, offices as well as various government establishment and commercial establishments.

1.3 Product Specification

Description

The stencil paper when cut on the typewriter or by a stylus by hand, shall be capable of rendering impressions when worked on a duplicating machine with duplicating ink. The impressions shall be of good definition and shall be free from patches, pin holes, marks etc.

Elongation

The average elongation of both directions shall be not more than 6 per cent.

Tensile Strength

The average tensile strength of both directions shall be not less than 0.35 kg/cm-width.

Burst Factor

The burst factor shall be not less than 7.5.

Mass Coating

The mass of the coated stencil paper shall be not less than 48 g/m^2 and the mass of the soluble coating shall be not less than 35 g/m^2.

Performance

The stencil paper shall be capable of producing not less than 750 clear copies and then, after three days, another 500 copies without distortion.

Keeping Quality

The stencil paper shall be capable of retaining its serviceability under normal storage conditions for not less than 2 years from the date of manufacture.

Backing Sheet

Each sheet of stencil paper shall be properly backed with a backing sheet of suitable quality. The backing sheet head shall be suitably punched to enable it to be properly fitted to the respective duplicating machine for which the punching has been intended.

Sizes

The size of the stencil paper shall be as agreed to between purchaser and supplier.

Scale

The limits up to which the cutting can be done for different sizes of stencil paper including A3 or A4 size, as the case may be, shall be indicated on the stencil.

2. MARKET AND PLANT CAPACITY

2.1 Demand

In order to project the demand for duplicating stencil paper, past import figures of the last seven years (1976-1982) have been taken into consideration and analysed. The import figures are tabulated below in Table A.

Table 'A'

Import Data of Duplicating Stencil Paper

Year	*Quantity ('000 Kg)*	*Value ('000 Birr)*
1976	66.2	343.4
1977	140.3	550.6
1978	285.0	606.5
1979	98.1	847.3
1980	106.8	852.6
1981	61.1	484.4
1982	103.3	716.1

Source : Annual External Trade Statistics

The import of duplicating stencil paper seems to have been growing at the rate of 43.7 thousand Birr in value and declining at the rate of 8 thousand kgs/yr. As this trend of declining import quantity is not tenable with the apparently growing institutions and offices which obviously place an additional demand, the alternative method are adopted to arrive at an annual rate of growth and apply this rate on the forecast accordingly.

Annual average growth rate is 7.69.

Table 'B'

Year	*Quantity ('000 Kg)*	*Value ('000 Birr)*
1986	138.93	963.11
1987	149.62	1037.17
1988	161.12	1116.93
1989	173.51	1202.82
1990	186.85	1295.32
1991	201.22	1394.93
1992	216.70	1502.20
1993	233.36	1617.72
1994	251.31	1742.12
1995	270.63	1876.09

As can be observed from the previous table, the import data of duplicating stencil paper has been to the order of 123 tons on an average during the last seven years (1976-1982) and it is expected that the annual demand would be about 270 tons during the next 10 years.

2.2 Plant Capacity

As indicated earlier that the annual demand in year 1995 would be about 270 tons. It is, therefore, suggested to consider installation of a plant with an annual capacity of 405000 quires (equivalent to about 300 tons) which would be adequate to meet the demand for the next decade.

2.3 Production Programmes

The installation of the plant depends on several factors, however it would take nearly one year for fabrication and supply of machinery and equipment, it may be assumed that the plant would start production at 50% of its installed capacity during the 1st year of commissioning reaching 75% of rated capacity in second year and full production of 300 tons from third year onwards.

3. MATERIALS AND INPUTS

3.1 Major Raw Materials

The major raw materials for the production of duplicating stencil paper are tissue paper, nitrocellulose, oleyl alcohol, ether, spirit, pure castor oil, TiO_2, Carbon paper, backing sheet, interlining paper, glue, ethyl acetate, ink, etc.

The raw materials requirements per ton of product are given below:

Raw Material Requirement Per Ton of Product

Material	*Unit*	*Requirement*	*Unit Cost CIF Addis in Birr*
Tissue Paper	Kgs.	33.3	46.86
Nitrocellulose	Kgs.	23.3	10.4
Oleyl Alcohol	Kgs.	40.0	14.74
Ether	Kgs.	83.3	3.13
Spirit	Litres	200.0	1.84
Pure Castor Oil	Litres	23.3	4.46
TiO_2	Kgs.	23.3	26.30
Carbon Paper	Kgs.	20.0	5.75
Packing sheet	Kgs.	333.3	3.13
Interlining paper	Kgs.	23.3	5.75
Glue	Kgs.	10.0	6.00
Ethyl Acetate	Kgs.	16.7	3.7
Ink	Kgs.	1.0	16.02
Chemicals	Kgs.	50.0	6.00
Packing materials		As required	70.00

The annual total expenditure on procurement of these raw materials is estimated to be 1661300 Birr.

3.2 **Utilities**

The utility requirement per ton of product :

-	Electricity	:	333 KWH
-	Water	:	6.7 M^3
-	Steam	:	1.7 Tons

It is estimated that annual expenditure on this account would be 110300 Birr.

4. TECHNOLOGY AND ENGINEERING

4.1 **Process Description**

First the pigments and oil are mixed, then ground thoroughly on the triple roll mill to make it in the paste form. This paste is mixed in a high speed mixer, with nitro cellulose, Ether and Spirit , Titanium dioxide etc., for nearly an hour. Then this paste is coated on the tissue paper by the stencil tissue coating machine and after the coating it is wound on a receiving roller. The coated paper roll is then taken to stencil collecting machine, where the coated paper, interlining paper and the backing paper, fed simultaneously, are pasted to the tissue paper duly printed and cut to size. All the operations are automatic. The sized stencil papers are then packed in boxes.

4.2 **Engineering**

For the proposed plant of 300 tons capacity per annum, the following are the major equipments.

Triple mill
High Speed Mixer
Stencil tissue coating machine with drying arrangement
Vertical power press with motor
Stencil collecting machine
Boiler
Testing equipment

Cost of Machinery and Equipment

The CIF Addis cost of the above mentioned machinery and equipment is Birr 340500 excluding foundation and installation charges.

4.3 **Layout**

The covered area that would be required to house the plant equipment shall be 400 M^2.

4.4 **Civil Works**

The construction cost of the building is about Birr 240000.

5. MANPOWER & TRAINING

5.1 **Manpower Requirement**

The manpower requirement for operating the plant in one shift shall be as indicated below :

Category	*No. required*	*Salary/Person/ Month Birr*	*Salary/year Birr*
Manager	1	1200	14400
Technial	2	900	21600
Skilled	7	250	21000
Semi-skilled	10	250	30000
Others	1	350	4200
Total	21	7600	91200

The total manpower expenditure shall be Birr 91200 per year approximately.

5.2 **Training**

Training would be organized at the running factory abroad for the technical manager and one supervisory personnel. These personnel could also be associated with the Project Implementing Agency. It is expected that the training facilities shall be provided by the plant & machinery suppliers free of cost but the travel expenses and local expenditure for boarding, lodging, incidental, etc., for the trainees shall have to be met locally. This is estimated to be about 10,000 Birr.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis : Production capacity : 300 TPA 3 shifts
300 days operation

6.1 **Total Capital Investment**

Particulars	*F.C. (Birr)*	*L.C. (Birr)*	*Total (Birr)*
Plant and Machinery	303070	37430	340500
Office equipment and furniture		5000	5000
Pre-production Expenses		30800	30800
Technology Fees	25000		25000
Buildings		240000	240000
Working Capital	207700	50100	257800
Total	535770	363330	899100

6.2 **Production Cost**

The total production cost works out to 2.18 million Birr out of which raw materials account for 77%, energy and other manufacturing costs 5%, expenditure on payment of wages and salaries to operating personnel at 3.7% as given below :

S.No.	Particulars	Amount in Birr
1.	Raw Materials	1661300
2.	Energy and other manufacturing cost	110300
3.	Labour and supervision	91200
4.	Sales/advertising	111400
5.	General overheads	54720
6.	Depreciation on plant & machinery	34500
7.	Depreciation on buildings	12000
8.	Interest on long term loan	34900
9.	Interest on short term loan	74100
10.	Total production cost	2184420
11.	Production cost per quire	5.40

6.3 Financial Evaluation

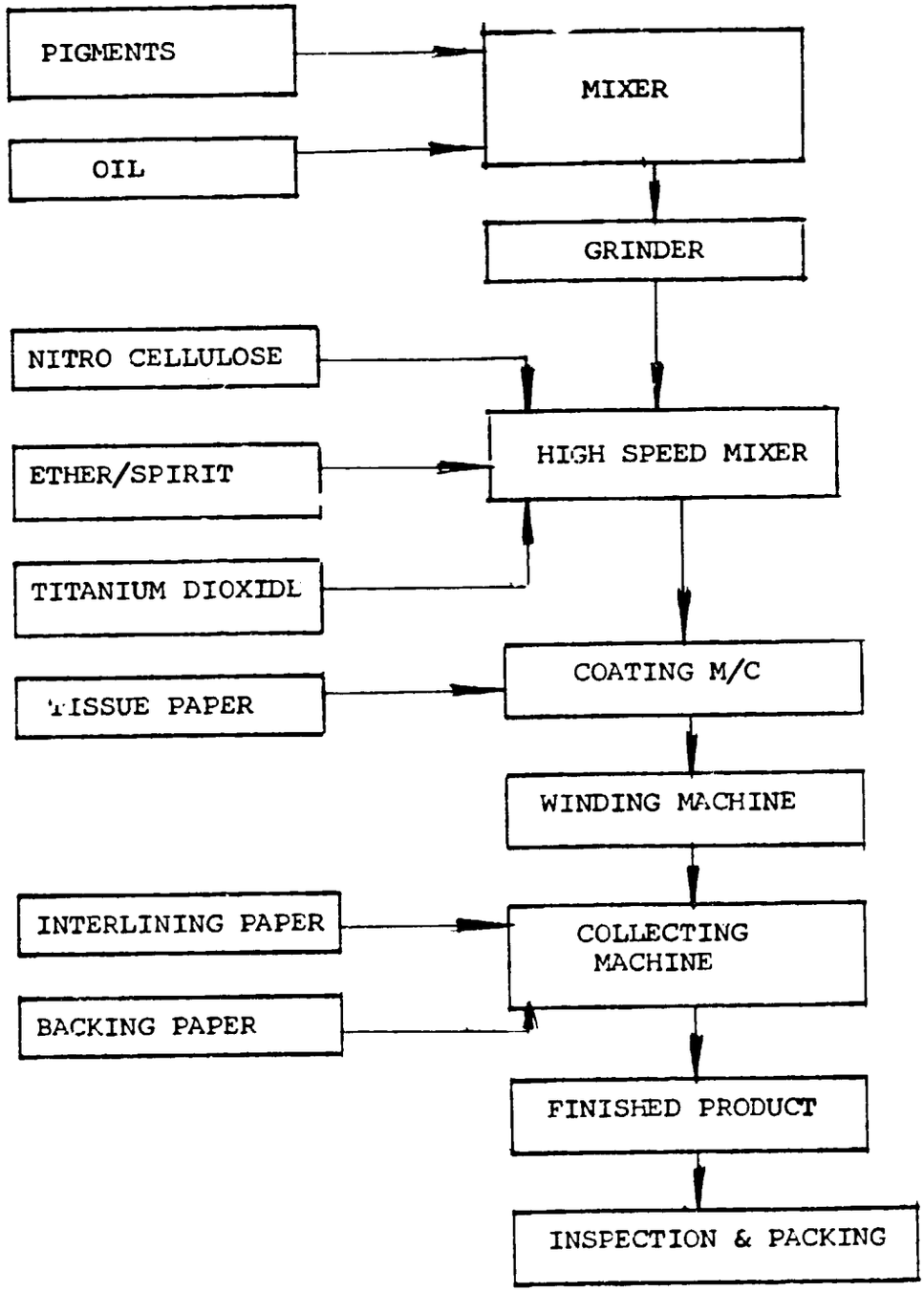
Total sales realisation at Birr 6.00 per quire	:	Birr 2430000
Profit before taxes	:	Birr 245580
Return on investment	:	27.3%
Break-even point	:	55%
Pay-back period	:	2.6 years

CASH FLOW STATEMENT

Year	Production Cost	Sales Revenue	Profit	Depreciation	Net Cash Flow
1st	1242920	1215000	- 27920	- 33500	+ 5600
2nd	1713670	1822500	+ 108830	33500	+ 147930
3rd	2184420	2430000	+ 245580	33500	+ 427010

Pay-back period : 2.6 years

DUPLICATING STENCIL PAPER



40. NYLON ZIP FASTNERS

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

The proposal envisages setting up a unit capable of manufacturing 600000 meters per annum of nylon zip fastners with an investment of 412000 Birr. Such a unit could provide employment for about 35 persons. The total turnover is expected to be about 1.08 million Birr and the return on investment is estimated to be 20%. The plant could break even at 65% of its total capacity.

1.2 Product Description

The nylon zip fastners are used in readymade garments, travel requisites, novelties, bags etc. and hence these fasteners are made as per the requirement of the end users. It is used for interlocking two parts of any product made from cotton, leather, rexin cloth etc.

1.3 Product Specification

Requirement

Material

Different components of the slide fastner shall be manufactured from the following materials :

Components	*Material*
Spiral	Nylon having the following physical properties. a) Relative viscosity 25 to 40 b) Melting point 208° to 220° c) Sp. gravity 1.072 to 1.09
Tape	The tape shall be woven fabric with a selvedge in the inner edge where

the spirals are securely sewn for specified length fasteners. The tape shall be continuous and without splices along the full length of the fasteners, including the tape extension.

Designations and Sizes

The slide fastener shall be designated by type, that is, closed-end or open-end and by the terms given in Table-1 according to width across the chain. The length of the fastener shall be as required by the purchaser. The first 300 mm or thereof and each subsequent 300 mm and part thereof shall be subject to a tolerance of ± 3 mm. The length of the fastener shall be taken as total length between the outsides of top and bottom stops.

Table 1

Designations and Sizes of Nylon Slide Fasteners

Designations	*Width Across Chain*	
	Over mm	*not more than mm*
Ultralight	-	3.5
Light	3.5	9.5
Medium	4.5	5.5
Heavy	5.5	7.5
Extra-Heavy	7.5	10.0

Finish

The same, chain and other component parts shall be made to the same colour as agreed to between the purchaser and the manufacturer.

2. MARKET AND PLANT CAPACITY

The demand data for this product is not available. But considering its wide range of uses, it is proposed that a plant to produce 600000 meters per annum, capacity could be considered for installation at the first phase hoping that, this will meet the present demand. A bigger capacity plant could be considered at a latter stage, depending upon the future demand, by either as an expansion to the existing unit or as an additional plant.

The plant is expected to go into production in about 2 years after the selection of technology and selection of vendors of equipments, since the delivery of equipments to plant site, installation and commissioning would take this time. After trial run and commissioning it is expected that 50% production could be achieved in first year and full production of 600,000 meters could be achieved in third year itself yielding a sales revenue of Birr 1080000 from this year onwards.

3. MATERIAL INPUTS AND UTILITIES

3.1 **Major Raw Materials**

The important raw materials required for the manufacture of Nylon Zip Fasteners are as given below :

Materials	*Unit Cost*	*Annual Requirement*
Nylon Mono filament yarn	3.2/kg.	400 kgs
Cotton tape	14 Birr/100 meters	1250000 Meters
Components like top, bottom slider, bead etc.	60 Birr/1000 sets	3400000 sets

The cost of these raw materials at the above rates works out to be about Birr 507000 annually. Perhaps the Nylon monofilament yarn may have to be imported while the other materials are assumed to be available in Ethiopia and hence the local cost would be Birr 370000.

3.2 **Utilities**

Electricity and water are the utilities which are required for manufacturing this product. The requirement per year works out to be, as given below :

Electricity	:	20,000 KWH
Water	:	1,500 KL

In addition, provision is made for consumables, repairs and maintenance under this head. These would involve an annual expenditure of Birr 65400.

4. TECHNOLOGY AND ENGINEERING

4.1 **Process Description**

Polyester wires are made into a continuous row of fastener links in a coiling machine. The zip fastener links joined to a double coil are simultaneously sewed on the right hand and left hand tape of the fastener halves in a sewing machine.

For manufacturing nylon zip fasteners the following sequence of operation are followed :

1. Stitching bead into tape.
2. Fixing teeth on the tape (stringer)
3. Joining two halves of the stringer
4. Attaching of bottom stop.
5. Rolling and brushing of stringer.
6. Mangling and waxing of stringer.
7. Attaching of slider
8. Attaching of top stop
9. Final cutting.
10. Testing and inspection.

The process flow diagram for manufacturing Nylon Zip Fasteners is given below.

4.2 **Plant and Machinery**

The list of Plant and machinery required for the manufacture of 600000 meters/day of Nylon Zip Fasteners are :

- Plastic Zip Fastener Coiling Machine : with double head, 2 unwinding devices, 2 coiling heads, 2 heating wheels, joining devices, winding up devices, 2 spools of plastic wires, 6 coil spools, tools and spare coiling brakets including the following accessories.

- High Speed sewing machine with table, holder for coil spool, coil-pitch-locating device, 2 tape brakes, pawl feed, 2 tape spool carriers with tape spools, spare needles tools etc.

- Automatic gapping machine with length control punching tool and counter.

- Automatic gap cleaning machine.

- Automatic bottom stop machine.

- Semi-automatic slider mounting machine.

Cost of Plant and Machinery

The estimated cost of plant and machinery (CIF Addis) amount to Birr 412000 inclusive of foundation and installation charges.

4.3 **Layout**

The covered area that would be required to house the plant equipment shall be 400 m^2.

4.4 **Civil Works :** The construction of buildings is about Birr 240000.

5. MANPOWER & TRAINING

5.1 **Manpower Requirement**

The requirement of operating personnel for operating the plant on one shift basis shall be as indicated below :

Category	*No. required*	*Salary/month/ (Birr)*	*Salary/year (Birr)*
Managerial	1	1200	14400
Technical	1	900	10800
Skilled	6	250	18000
Semi-skilled	25	150	45000
Unskilled	2	100	2400
Others	1	350	4200
Total	36	7900	94800

The total expenditure towards payment of wages and salaries is estimated to be Birr 94800.

5.2 **Training**

No specialised training is required for plant personnel and it would suffice if they are associated with the implementing agency during installation, trial run and commissioning.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis :	Production Capacity	:	6,00,000 meters per annum
	No. of shifts/day	:	1
	No. of working days / year	:	270

6.1 **Total Capital Investment**

Items	*F.C. (Birr)*	*L.C. (Birr)*	*Total (Birr)*
Plant and machinery	361400	50600	412000
Office equipment & Furniture		3000	3000
Technology Fee	25000		25000
Pre-production Expenses		41500	41500

(Contd.)			
Building		240000	240000
Working Capital	63400	22000	85400
Total	449800	357100	806900

6.2 **Production Costs**

The total annual production cost for manufacturing 600000 meters of nylon zip fasteners/annum is estimated to be Birr 916550. The raw materials amount for 55% of the total cost, energy and other manufacturing cost account for 7% and the charges for labour and supervision account for 10% of total cost, as given below :

Sl.No.	*Particulars*	*Amount (Birr)*
1.	Raw materials	507000
2.	Energy and other manufacturing cost	65400
3.	Labour and Supervision	94800
4.	General overhead	56880
5.	Sales/Advertisement	45000
6.	Depreciation on plant and machinery	41500
7.	Depreciation on building	12000
8.	Interest on long term loan	72150
9.	Interst on short term loan	21820
10.	Production Cost	916550
11.	Unit Cost (Per meter)	1.53

6.3 **Financial Evaluation**

Total Sales Realisation at 1.80 Birr/Meter	Birr 1080000
Profit Before taxes	Birr 163450

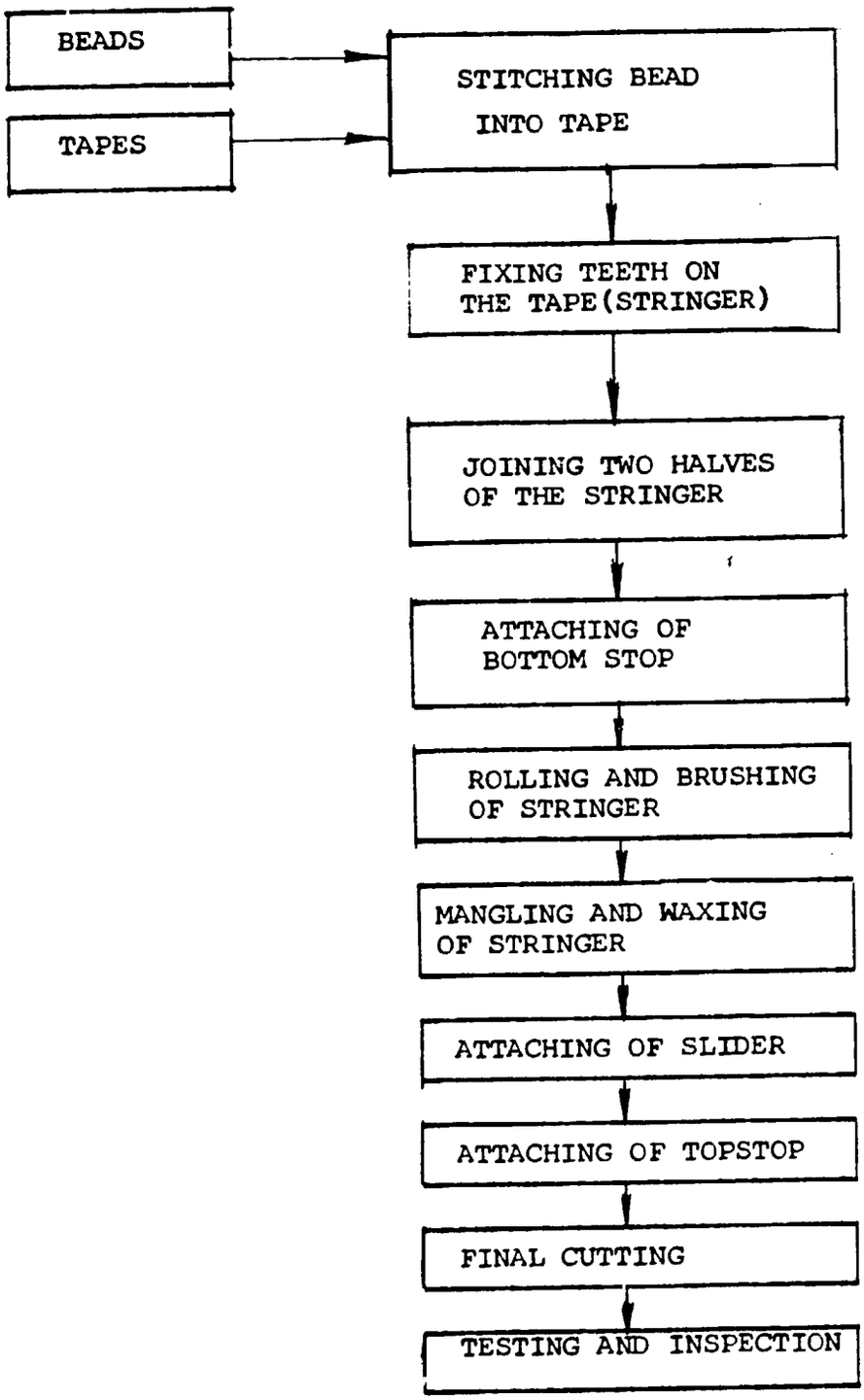
Return on investment	20.2%
Break-even point	64.5%
Pay-back period	4.2 years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	607850	540000	- 67850	41500	- 26350
2nd	762200	810000	- 47800	41500	- 32650
3rd	916550	1080000	+ 163450	41500	+ 172300
4th	916550	1080000	+ 163450	41500	+ 377250
5th	916550	1080000	+ 163450	41500	+ 582200

Pay-back period : 4.2 years

NYLON ZIP FASTENERS



41. FLASH LIGHT CASES

1. SCOPE OF PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of Project

Flash light (Torch) is a very popular and useful item due to its utility and portability. It is an item of necessity for every body be it home, factory or office. Metallic flash light torches are costly and heavy. Hence plastic flash light torches are gaining popularity due to their low price, lightness and elegance. These torch cases are made of ethyl cellulose. These can be manufactured in small scale with good profitability.

In Ethiopia flash light torch cases are not manufactured as present. Since the item is a consumer oriented one, it would be beneficial if a unit is set up for the manufacture of this item.

The proposal envisages setting up a unit capable of manufacturing 0.5 million numbers of flash light cases per annum. The annual sales realisation is estimated to be 1.5 million Birr. The unit is capable of generating employment for about 37 persons. The return on investment is worked out to be 31% and the plant is expected to break even at 48% of its full capacity.

1.2 Product Specifications

The finish of the flashlight shall be pleasing and durable. The reflecting surface of the reflector, when seen with naked eyes shall be free from defects such as scratches and deformations. The contact parts of the switch shall be so constructed as to offer easy operation and shall be capable of maintaining good electrical contact while in the "ON" position. The design of the switch shall be such as to prevent accidental short circuits. Springs, if used in the construction of flash light shall be of necessary strength and durability and shall be corrosion-resistant.

Insulation Resistance

The insulation resistance value should not be less than 2 mega ohms, when measured with an insulation resistance tester of rated volluage of 500 volts at a temperature of 27 ± 2°C and relative humidity of 65 ± 4 percent; with dry cell removed and the switch is in open circuit position.

Light Distribution

Light from the loaded flash light shall be projected on to a plane at a distance of 2 mm from the source and held prependicular to the central line of the optical axis. In case of focussing type of flash lights, this shall be done after focussing. The bright spot produced on the plane shall not exceed 30 cm in diameter.

Contact Resistance of Switch

The contact resistance of the switch shall be measured with a current of 300 mA flowing through the switch contacts, the source voltage being not greater than 3 V. The resistance shall not exceed 20 milli ohms when the flashlight is new, and 30 milli ohms after 10,000 operations of the switch.

Switch Life

The switch should continue to withstand atleast 25000 cycles. Each cycle shall comprise a full operation of the switch including locking if provided.

There shall be no severe deformation, split or crack in any part of the body or cover of the flashlight, complete with batteries, after a single drop, in horizontal position, from a height of 1 m on a wooden board of the following dimensions, placed on a concrete floor.

Thickness	Width	Length
30 mm	250 mm (min)	At least twice the length of the flashlight under test.

Dimensions

The internal dimensions of the body of the flashlight shall be such as to properly accommodate the required number of batteries.

The three different sizes prefocussed type are as per following specifications :

Type	*Battery*	*Bulb prefocussed*
Medium Size	2-D size	2.3 V
Standard	2-D size	2.4 V
Large	3-D size	3.6 V

2. MARKET AND PLANT CAPACITY

2.1 Market Demand

The market demand study on this item is based on the import data in the annual External Trade Statistics of the customs office, Government of Ethiopia.

As per the import data collected during the year 1976-1982, the following has been the import of the flash light cases :

Year	*Quantity ('000s)* Kgs.	*Value (Birr '000s)*
1976	126.12	209.6
1977	1117.40	666.8
1978	311.0	905.0
1979	311.0	324.7
1980	240.0	256.6
1981	274.4	864.7
1982	382.8	498.1
Annual Average	641.7	523.3

While there has been a decline in the import of this item during the year 1980, the trend that is shown after this year indicates an increasing

demand. In the same way, the demand forecast for the next 10 years indicates that an annual demand of 505 ton is projected for 1986. 667.6 for 1990 and 905.1 T during 1995 showing an increase of 20% during the next five years and 50% from 1990 onwards as given in Table below :

Demand Forecast for Next Decade

Year	*Demand in '000 kgs.*	*Production Programme '000 Kgs.*	% *Utilisation*	% *Unsatisfied Demand*
1986	505	-	-	-
1987	545	507	50%	90
1988	580	75	75	87
1989	620	100	100	84
1990	667.6	100	100	85
1991	705.0	100	100	86
1992	750.0	100	100	86.5
1993	800.0	100	100	87.5
1994	850.0	100	100	88
1995	905	100	100	88.0

The above table indicates that at the capacity proposed for this item, even 10% of the projected demand would not be met and the unsatisfied demand would be of the order of 85 to 90%, during the next decade. However, it is to be noted here that before scaling up the production by adding additional units, it would be better if the actual consumption pattern for this item (produced locally in Ethiopia) is studied for at least 2-3 years and once consumer acceptance of this product is established in preference to the imported materials, the capacity could be increased in stages, increasing the number of shifts in the present unit or putting up additional ones.

2.2 Plant Capacity

In view of the demand projections made, it is considered appropriate

that a unit with a manufacturing capacity of 0.5 million Nos. (equivalent to 100,000 Kgs.) of flash lights be set up in the first phase. Additional units could be set up once the demand for this product picks up.

2.3 **Production Programme**

The process for making the cases is simple and the equipment are also easy to operate. Once the Vendor for equipment supply is decided, and orders placed, the equipments could be delivered in about 9 months' time. Assuming that the installation works are completed in about 2 months after delivery at 50% production capacity, a sales realisation of 750,000 Birr could be expected during the first year, Birr 1125000 (at 75%) during 2nd year and full production could commence from third year onwards, yielding a sales realisation of1.50 million Birrs.

3. MATERIAL INPUTS AND UTILITIES

3.1 **Major Raw Materials**

The major raw materials that are required for making the torch light cases are as follows :

Materials	*Unit cost in Birr/Ton*	*Amount requirement (Ton)*
Plastic material	8316	35
Tin Sheet	3368	10
Brass Sheet	15624	5
Bulbs, Spring, eyelets glass etc.	62.2	500,000 Nos. (2500 Kgs.)

The total expenditure towards procurement of these items is estimated to be Birr 658560.

3.2 **Utilities**

The proposed unit would need a total power input of 120,000 KWH/annum

and at the current tariff of power the expenditure shall be 79400 Birr annually which however includes provision for consumables, repairs and maintenance.

4. TECHNOLOGY AND ENGINEERING

4.1 Process Description

Manufacture of torch light cases is carried out by injection moulding method which is a multistep process, carried out usually in a single machine, in which the thermoplastic material is melted or plasticized and injected into a mould of the shape and size of the desired article. The mould is kept at a temperature below the solidifying point of the plastic, causing the injected plastic mass to take the form of the mould cavity, and after sufficiently long cooling time, the mould is opened and the article ejected. The injection moulding process comprises of four stages, each of which must be closely controlled and regulated to obtain good quality mouldings. These stages are :

(i) plasticizing (ii) injection (iii) after-filling and (iv) cooling and mould release.

4.2 Plant and Machinery

Injection moulding machine - Hand operated plunger type plasticizing capacity 100 gms per shot fitted with all accessories - 2 numbers.

Moulds, tools
Jigs and fixtures
Power Press
Vacuum coating unit 24" chamber size.

The CIF Addis Ababa cost of plant and machinery is estimated to be Birr 431800 excluding installation and foundation charges.

4.3 Layout

Covered area required for this unit is 800 sq.m.

4.4 **Civil Work**

The construction cost is estimated at 480,000 Birr. The area provides for future expansion.

5. MANPOWER & TRAINING

5.1 **Manpower Requirement**

The personnel required for operating this unit on single shift basis are :

Category	*Nos. required*	*Salary/month Birr*	*Total cost annum Birr*
Managerial	1	1200	14400
Technical	1	900	10800
Skilled	20	250	60000
Unskilled	10	100	12000
Others	5	350	21000
Total	37	9850	118200

The annual expenditure towards payment of wages and salaries is estimated at Birr 118200.

5.2 **Training**

No specialised training is required though it may be useful if couple of operators are sent to factories where this injection moulding is in operation.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis : 500000 Numbers of flash light cases/annum

Shifts/day : 1

No. of working days/year : 270

6.1 Total Capital Investment

Items	*F.C. (Birr)*	*L.C. (Birr)*	*Total (Birr)*
Plant and machinery	378800	53000	431800
Office equipment and furniture		4000	4000
Technology Fee	30000	-	30000
Pre-production Expenses		39000	39000
Buildings		480000	480000
Working Capital	82300	31400	113700
Total	491100	607400	1098500

6.2 Production Cost

For producing 500000 Nos. of flash light cases/annum the production cost has been estimated to be 1160640 Birr, as given below, out of which raw materials account for 57% energy and other manufacturing costs account for 7% and expenditure that would be incurred to the operating personnel has been estimated to be 10%.

Sl.No.	*Particulars*	*Amount in Birr*
1.	Raw Materials	658560
2.	Energy & other manufacturing costs	79400
3.	Labour & Supervision	118200
4.	General overheads	70900
5.	Advertising/Sales	60000
6.	Depreciation on plant & machinery	43180
7.	Depreciation on Building	24000
8.	Interest on long term loan	76400
9.	Interest on short term loan	30000
10.	Total production costs	1160640
11.	Cost per one unit	2.32 Birr/Unit

6.3 **Financial Evaluation**

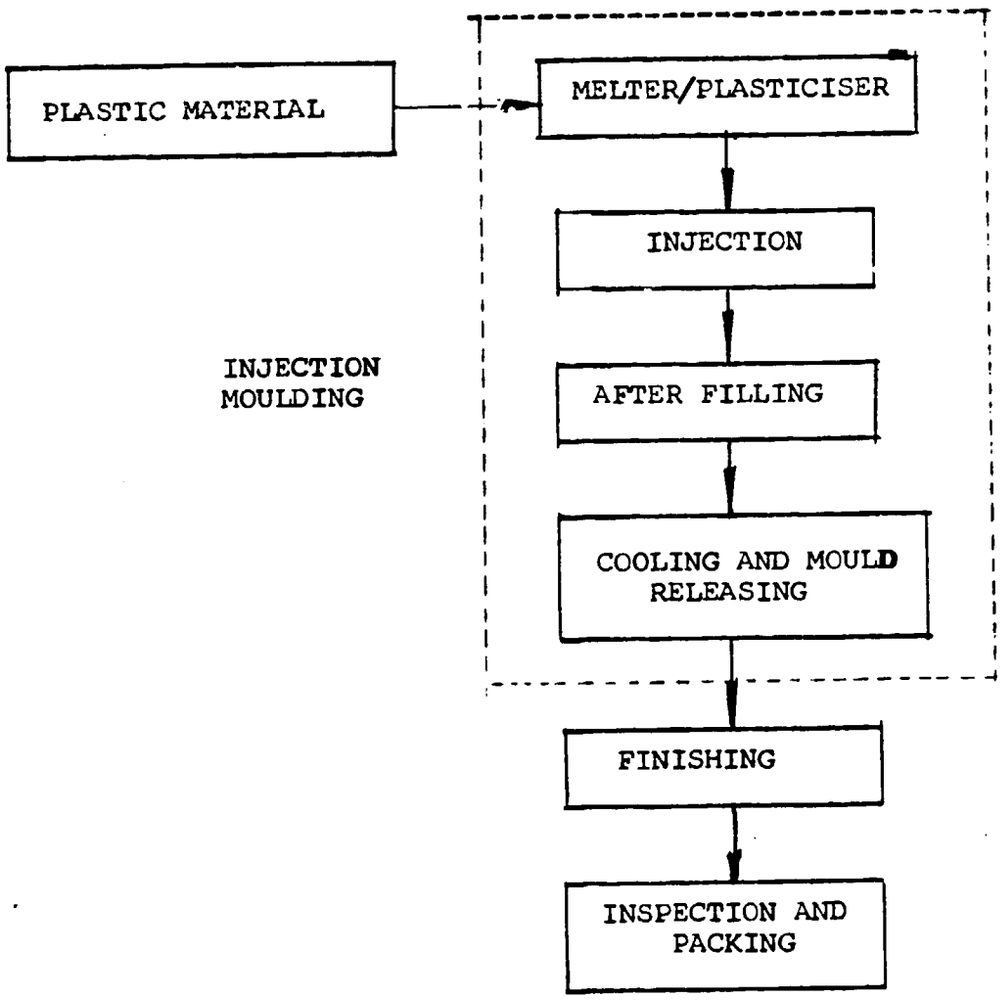
Total Sales Realisation @ 3 Birr per unit	Birr	1500000
Profit Before Taxes	Birr	337360
Return on Investment		30.90%
Break even point		48%
Pay-back period		3.1 years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Project*	*Depreciation*	*Net Cash Flow*
1st	851500	750000	- 101500	43200	- 58300
2nd	1036000	1125000	+ 89000	43200	+ 73900
3rd	1220500	1500000	+ 279500	43200	+ 396600
4th	1220500	1500000	+ 279500	43200	+ 719300

Pay-back period : 3.1 years

FLASH LIGHT CASES



INJECTION MOULDING

42. ANIMAL GLUE

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of Project

This proposal envisages etting up a small scale unit to manufacture 300 tonnes per annum of Glue which would yield an annual sales realisation of 1.425 million Birr at full capacity. The project could provide employment for about 45 persons. Under Ethiopian conditions, the plant breaks even at 63.0% of its full capacity. The return on total investment is estimated to be 28.0%.

1.2 Product Description

Glue is a form of Gelatine used to bond together two pieces of wood or other materials. Glue and adhesive are now used synomymously to describe many different substances employed in making one part of a joint adhere, stick or bond to another part of the joint.

Adhesives in general, are classified under three groups :

a) Animal Origin
b) Vegetable Origin
c) Synthetic resins based and rubber based.

While there are many types of glues and adhesives of animal origin, glues extracted from connective tissues of goats, rabits and other animal glues made from cattle origin are strong and are used in large tonnages all over the world.

Animal glues have been known and used from the earlier of civilisation. The distinction between 'gelatine and glue' however is not very sharp as both are materials derived from collagen,the principal portion of animal connective tissues.

'Collagen' is a simple protein of the albuminaid class present in the bones and connective tissue of vertebrate animals. It comprises of

large part of organic materials of bones, tendons and skin and when obtained from the different tissues, it varies in composition.

Gelatine is generally a colourless, transparent, amorphous substance containing about 11 to 14% of water. The chemical distinction between gelatine & glue in the degree of purity only, glue being an impure gelatine.

1.3 Types of Animal Glue

There are two principal types of animal glues :

i) Hide origin
ii) Bone origin

These may be :

a) Extracted bone glue
b) Green bone glues

Hide glues are derived from the collagenous materials present in the hide pieces and connective tissues.

Extracted bone glue, and green bone glue are derived from the collagen present in the structure of bones (of cattle origin).

1.4 Uses of Animal Glue

Animal glue finds wide use as a general adhesive where a strong, durable, tacky, fast setting adhesive is desired. The major uses of animal glue can be :

i) As adhesive
ii) Composition and colloidal application and
iii) As sizing agent.

- ***Adhesive Usage***

  a) Abrasive Industry : animal glue is used for making coated abrasives in sheets, rolls, belts and discs.

b) Paper box manufacture : animal glue are usually applied hot for quick setting and fast tack in paper box manufacture.

c) Wood working : manufacture of furniture, desks, chairs, tables, cases, goods, panels, casket, cabinets, patterns, toys, fishing rods etc. are areas where animal glues are used extensively.

d) Paper conversion : gummed paper and gum cloth manufacture require large tonnage of animal glues.

e) Book binding and magazine binding : edition binding of telephone directories, mail order catalogue, blank books, magazines etc. require use of animal glue.

f) Leather goods - leather belting : as leather and animal glue are closely related in chemical composition, animal glues find wide use in the fabrication of leather novelties, small and fancy leather belts, pocket books, hand bags and miscellaneous leather goods.

- ***Composition and Colloidal Application***

a) Match industry : animal glue is present in the match head of the stick and the sides of the box. In the head or bulk composition of match stick, an animal glue is used as a binder of the chemicals, fillers etc. The unique colloidal and physical properties of animal glues ensured match head of uniform composition, correct density form and solidity essential in safety match industry.

b) Cork composition : in the manufacture of gaskets, bottle cap inserts, sheets, insulations etc., animal glue is used. Extreme toughness, resillence and permanency are factors of critical importance for this end use.

c) Printer roller composition : since the early development of the printing press, animal glue composition rollers are used for the transfer ofprinting inks from the ink fountain to the impression plate. Such rollers are a tough, flexible, resilient composition of animal glue, glycerine, soribitol and water.

d) As a dye - levelling agent in the textile industry.

e) As a flocculating agent in the paper industry, water treatment, treatment of industrial wastes and electrolytic metal refining.

f) In the manufacture of dry distempers.

- ***Sizing Agent***

a) Glue is used for sizing of viscose and acetate rayon to increase the strength and elasticity of the warp ends and proper lubrication by the deposited glue film. The glue size serves as protective sheath to guard the yarn against breakage and chaffing during weaving in the loan.

b) Surface sizing of the paper : after the formation of the sheet of paper machine, fine writing paper, currency paper, cha[illegible]d blue print papers are subjected to a surface size [illegible]nimal glue. This surface sizing improves the strength of the paper, resistance to 'tear' and the folding qualities of the paper. Also prevent feathering of undue spreading of inks and imparts a desired firmness and rattle to the sheet.

1.5 Specification of Product

ANIMAL GLUE

Material : The glue shall be prepared from skin or bone material.

It shall be supplied in the form of sheets, cakes, granules, flakes or in a powder in a Kibbled form as specified by the purchaser.

Odour : The odour of a freshly prepared hot solution of the glue shall not be objectionable.

Keeping Quality : The glue shall keep not less than six days without evidence of liquifaction, putrafaction or mould growth.

Moisture Content : The average moisture content of the glue shall not be greater than 14% and no individual value shall be greater than 18%.

Storage Properties : The glue shall retain all the properties for atleast 12 months from the date of manufacture, when stored in a cool and dry place.

Chloride Content : The chloride content shall not exceed 2% calculated as Sodium Chloride.

PH Value : Shall not be lower than 4.0 and higher than 8.2.

Overlap Joint Strength in Longitudinal Shear : Shall be not less than 275 kg.

REQUIREMENTS

Description : The material shall be in the form of sheets, flakes, shreads or coarse to fine powder. It shall be colourless, faintly yellow or amber in colour. It shall not contain any preservatives which will inhibit the growth of micro-organisms.

Solubility : The material shall be insoluble in cold water but shall swell and soften when immersed in it. It shall be soluble in hot water forming a jelly on cooling. It shall dissolve in acetic acid and in hot mixture of Glycerol and water. It shall be insoluble in 95% alcohol, in chloroform and ether solvent.

The material shall form a suitable gel with Agar. The surface of the gel shall not allow any physical distortion (scum like surface). A gel obtained from 15% gelatine shall be firm and media containing this proportion of gelatine should withstand autoclaving at 115°C for 15 minutes without loss of gel strength.

2. MARKET AND PLANT CAPACITY

2.1 Market Demand

In order to project the demand for animal glue and gelatine, import figures collected during the past 7 years (1976-1982) have been analysed. These import figures are tabulated below :

Importation of Glue and Gelatine

Year	*Quantity ('000 kg)*	*Value ('000 Birr)*
1976	630	1,124
1977	185	462
1978	428	1,037
1979	541	1,315
1980	709	2,883
1981	355	798
1982	467	1,045

Source : Annual External Trade Statistics

As can be seen from the above table, the import figures are erratic. An annual average growth rate for the period of 1978-1982 has to be used for demand forecasting. Considering 1978 as a base year, the annual average growth rate of import accounts to 2.18%. Taking this growth rate and applying it to the import data of year 1982 projecting. A base figure of 509.1 tons has been reached for year 1986. The demand projection for years 1986-1995 is given in the following table.

Projected Demand of Glue and Gelatine

Year	*Quantity ('000 Kg)*
1986	509.1
1987	520.2
1988	532.5
1989	543.1
1990	554.9
1991	567.1
1992	579.4
1993	592.1
1994	605.2
1995	618.5

As shown in the above Table, the import of glue and gelatine has been in the order of 474 tons annually on an average during the past seven years and it is expected that the annual demand would be of the order of 600 tons during the next 10 years.

2.2 **Plant Capacity**

As indicated earlier that the annual demand in year 1995 would be in the order of 600 tons. It is, therefore, felt that a plant of 300 tons/ annum capacity could be considered for installation at the first phase and a bigger capacity plant can be considered at a later stage in order to satisfy the demand gap.

2.3 **Production Programme**

The implementation of this project depends on several factors. However taking 1 year for fabrication and supply of machinery & equipment, it may be assumed that the plant would be installed is about 3 months and start production at 50% of its installed capacity during 1st year, reaching 75% of rated capacity in second year and full production of 300 tons from third year onwards yielding an annual sales realisation of 1.425 million Birr.

3. MATERIALS AND INPUTS

3.1 Raw Materials

The major raw materials for the production of glue and gelatine are Hide Fleshings and bone sinews. These materials are locally available. Other materials have to be imported.

The raw material requirement per ton of product is given below :

Raw Material Requriement in Kgs. Per Ton of Product

Material	*Requirement Kgs.*	*Unit cost CIF Addis in Birrs/Ton*
Hide fleshings/bone sinews	5000	200
Slaked Lime	1000	600
Calcium chloride	6.70	11527
Hydrochloride acid	507	753
Bleaching powder	3.3	9857
Soda Ash	0.33	9316
Other Chemicals	L/S	
Packing materials	As required	

The total annual expenditure for procurement of these items is estimated to be Birr 432145.

3.2 Utilities

The utility requirement per ton of product is :

- Electricity : 3360 KWH
- Water : 350 m^3
- Steam : 3 tons

The expenditure incurred on account of the utilities like power, water and steam required for this unit is estimated to be 324525 Birrs annually which includes the provision for annual procurement of consumables and expenses for repairs and maintenance.

4. TECHNOLOGY & ENGINEERING

4.1 Technology

The commercial production of glue and gelatine by hydrolysis of collagen is carried out by two main processes viz.,

1. The acid process which involves essentially adjustment of the PH value of the gelatine and subsequent extraction of gelatine at fairly low temperature between 50°C and 60°C.

2. The alkaline process which involves treatment of the collagenous material with alkali under rigidly controlled conditions of lime, PH value, and temperature. In general, a suspension of lime is used as the alkaline medium, the treatment being prolonged as long as 70 - 100 days, when processing ossein at temperature maintained between 10 and 18°C. However when NaoH is used as alkaline medium while processing wet hides pieces and splits, the treatment time is drastically reduced to between 5 and 8 days.

   Animal glue is generally processed under the alkaline process whenever bone sinews and hide fleshings are processed.

4.2 Process Description

The hide fleshings are dumped in the air washer for a period of 2 hours in running water with air agitation to remove the lime and transferred to soaking vats. The soaking is carried out for a period of 6 days.

The object of soaking is to remove the fat and non collagenous material. The fleshings are washed in running water with good agitation. Hydrochloric acid of the desired composition and concentration is added in small quantities to remove the alkalinity and make it slightly acidic.

The glue is extracted usually in fractions in - batch process in open tanks. The hide fleshings are transferred to the extraction tanks. The liquor extracts are treated with preservatives and fillers to ensure keeping qualities of glue. Evaporation of glue and gelatine is normally done under vacuum in triple effect units. The strong liquor is collected in the receiving tanks.

The animal glue is dried in steam heated drying cylinder with steam coils inside. Theconcentrated liquor is fed into an emulsifier. The sheet of dried glue film is scrapped by a knife and fed in the form of a continuous sheet which is beaten to small pieces by a beater. The flakes are transferred in bags to disintegrator where they are crushed to 1/16" size and then packed in polythene lined jute gummy bags.

4.3 Engineering

- ***List of Machinery & Equipments***

  For the suggested plant of 300 tons capacity per annum, the following are the major equipments :

  Emulsifier
  Evaporator
  Drying unit
  Disintegrator
  Boiler
  Air compressor

Boiling tanks & accessories
Collecting tanks
Slaking tank
Soaking vats
Air washer
Blending pit
Weighing machine

- ***Cost of Machinery & Equipment***

The cost of machinery and equipment as per CIF Addis is estimated to be Birr 456700 excluding foundation and installation charges.

4.4 **Layout**

In housing the plant equipment, it is estimated that a covered area of 400 m^2 will be required.

4.5 **Civil Works**

The construction cost of the building is about 240,000 Birr.

5. MANPOWER & TRAINING

5.1 **Manpower Requirement**

The manpower requirement for operating the plant in three shifts shall be as indicated below :

Category	*No. Required*	*Salary/Person/ month Birr*	*Total Salary/ annum in Birr*
Managerial	1	1,200	14400
Supervisory	8	900	86400
Skilled	8	250	24000
Semi-skilled	10	150	18000
Unskilled	18	100	21600
Total	45	13700	164400

The total manpower expenditure shall be Birr 164400 per year.

5.2 **Training**

Training could be organized at a running factory abroad at least for the technical manager (mechanical engineer) and one supervisory personnel. It is expected that the training facilities shall be provided by the plant and machinery supplier free of cost but the transportation charges and local expenditure for boarding, lodging, incidental etc. for the trainees shall have to be met locally.This is estimated to be about Birr 12,000.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis : Production capacity : 300 TPA : 3 shifts
300 days operation

6.1 **Total Capital Investment**

	F.C.	*L.C.*	*Total*
Plant and machinery	333500	123200	456700
Office Equipment & Furniture		4000	4000
Preproduction expenses		41000	41000
Technology fees	35000		35000
Buildings		240000	240000
Working Capital		42500	42500
Total	368500	450700	819200

6.2 **Production Costs**

The total production cost works out to be 1196535 Birr out of which raw material account for 36%, energy and other manufacturing costs 27% and labour and supervision charges account for 14% of the total cost.

Sl.No.	Particulars	Total Amount Birrs
1.	Raw materials	432145
2.	Energy & other manufacturing costs	324525
3.	Labour & Supervision	164400
4.	General Overheads	100000
5.	Sales & Advertising	52500
6.	Depreciation on plant & machinery	46065
7.	Depreciation on building	12000
8.	Interest on long term loan	59340
9.	Interest on Short term loan	5560
10.	Total production cost	1196535
11.	Production cost per ton	4000

6.3 Financial Evaluation

If the product is sold at Birr 4.75 per Kg.

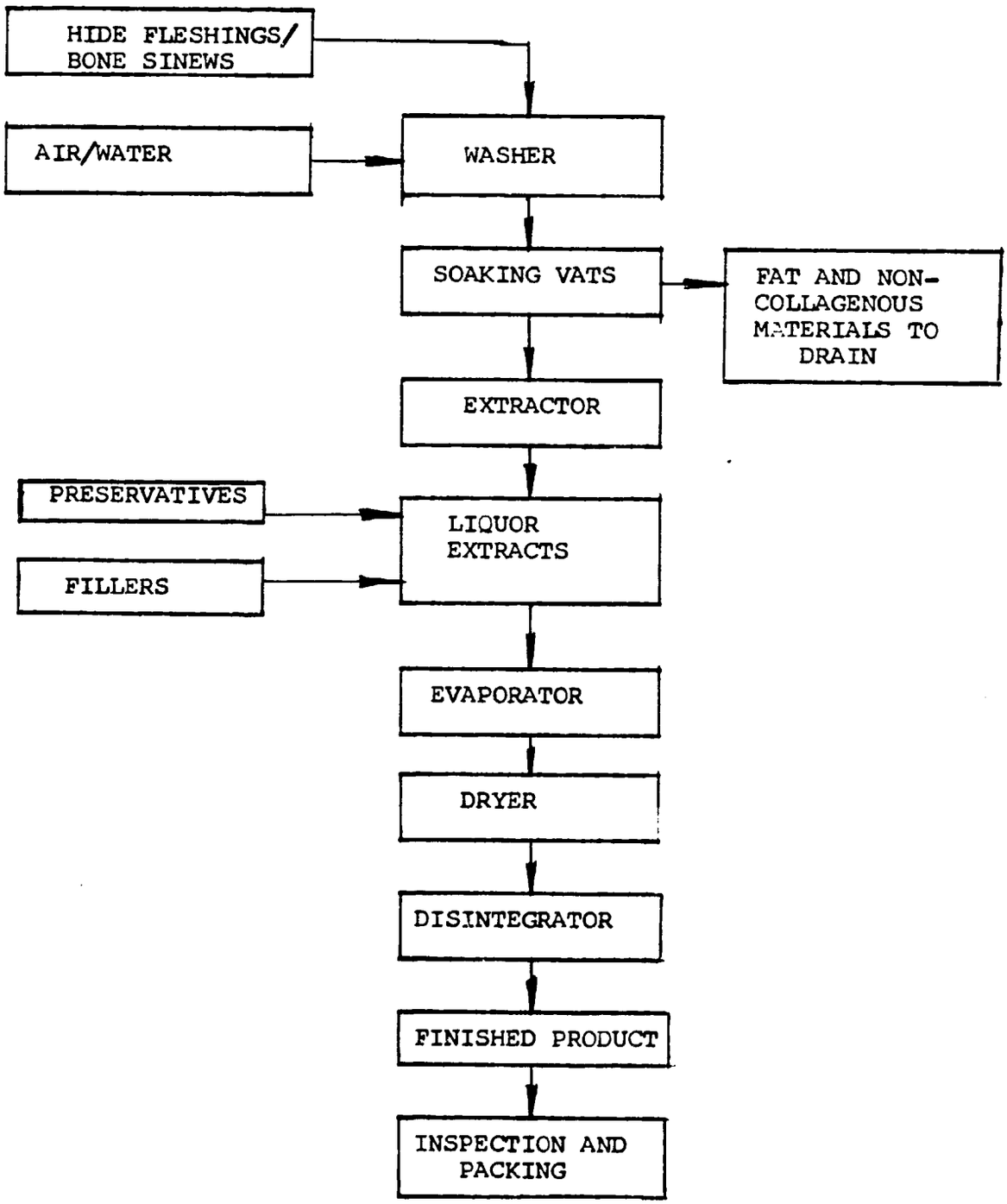
Sales realisation	:	1425000
Profit before taxes	:	228465
Return on investment	:	28%
Break-even point	:	63%
Pay-back period	:	3.4 years

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	791950	712500	- 79450	46065	- 33385
2nd	994243	1068750	+ 74507	46065	+ 87187
3rd	1196535	1425000	+ 228465	46065	+ 361717
4th	1196535	1425000	+ 228465	46065	+ 636247

Pay-back period : 3.4 years

ANIMAL GLUE


HIDE FLESHINGS/ BONE SINEWS
AIR/WATER
WASHER
SOAKING VATS
FAT AND NON-COLLAGENOUS MATERIALS TO DRAIN
EXTRACTOR
PRESERVATIVES
FILLERS
LIQUOR EXTRACTS
EVAPORATOR
DRYER
DISINTEGRATOR
FINISHED PRODUCT
INSPECTION AND PACKING

43. PRINTING INK

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 **Summary of the Project**

The proposal envisages setting up a unit for manufacturing 1 ton per day of printing ink. The investment on plant and machinery is estimated to be about 0.5 million Birr. Such a unit is capable of generating employment for about 70 persons. The annual sales realisation at full capacity is expected to be 2.835 million Birr and the return on investment works out to 26.6%. The plant shall break even at 55.0%, of its installed capacity.

1.2 **Description and Specification of the Product**

Printing inks are paints in a dispersed form and are not inks in the real sense. These are mixtures of pigments or dyes dissolved or dispersed in a vehicle or carrier. The pastes could be applied on the surface of paper, cloth, paper boards, metal sheets, metal foil, plastic sheets, moulded plastic articles, glass, etc. The printing inks are classified under two basic groups, i.e., letter press and lithopress inks and flexographic and rotagravure inks. The first group of inks are called oil or paste inks, while the second group is called solvent inks.

Printing inks are utilised in the graphic industry and serve the communicative decorative or protective functions. Manufacture of printings inks is mostly regulated by national standard specifications in all the developed countries of the world and these cover a large variety of printing and duplicating inks. The formulation, chemical composition and physical characteristics of printing inks vary from application to application. Few formulations are indicated below :

Letter Press Newsprint Black

Carbon black	15%
Indulin Toner	3%
Mineral oil (IOP)	67%
Mineral oil (low viscosity)	15%

Litho & Offset Blue

Pthalocyamine Blue	8%
30-40 Paise Medium Bodies Litho Varnish	42%
Extender Calcium Carbonate	48%
Jell type stand oil	2%

Rotogravure Ink

Pthalocyamine Blue	11%
Clay	17%
Metallated Rosin	35%
Lactone Spirit	37%

Duplicating Ink

Carbon Black	10%
Mineral Oil	39%
Emulsifier	0.5%
Wetting Agent	10%
Resin	1%
Turpentine & Water	35%
Vegetable Oil	4.5%

2. MARKET AND PLANT CAPACITY

2.1 Market Demand

The application and demand of printing inks is ever growing in the world due to rapid growth in population, literacy, publicity, advertisement and mass media. The demand for printing inks can be directly correlated to the demand for paper and other packing media. Though no import data is available on this item, in view of the above observations, it is proposed that a unit with a manufacturing capacity of 1 ton per day of printing ink - mainly the oil or paste inks - be set up in the industrial estate.

2.2 Plant Capacity

The plant proposed shall be capable of manufacturing 270 tons of

printing ink per annum and shall operate for 270 days in a year on single shift basis. The products shall be letter press News print Black and Litho and offset Blue in equal quantities.

2.3 **Production Programme**

It may take considerable time for selection of technology and suppliers of equipment as well as the agency for implementing the project as a total turnkey package. After these formalities of selection are completed, the equipments could be delivered in one year and installation, testing and commissioning completed in 6 months. During the first year after commissioning 50% production could be anticipated, during second year 75% and full sales realisation amounting to 2.835 million Birr could be achieved from third year onwards.

3. MATERIAL INPUTS AND UTILITIES

3.1 **Raw Materials**

The major raw materials that are required for manufacture of printing inks are carbon black, Indulin Toner, Mineral oil, Pthalocyamine blue, Lithovarnish, Calcium carbonate and Jell type stand oil. The requirements of raw materials and their CIF Addis cost are given in Table 'A'.

Table A

S.No.	*Items*	*Unit Price in Birr/Kg*	*Requirements per day (kgs)*
1.	**Letter Press News Print Black**		
	Carbon Black	1.9	75
	Indulin Toner	26.3	15
	Mineral Oil (IOP)	3.15	335
	Mineral Oil (Low Viscosity)	2.90	75
2.	**Litho and Offset Blue**		
	Pthalocyamine Blue	46.86	40
	30-40 Poise Medium Bodied Litho Varnish	10.88	210
	Extender Calcium Carbonate	1.00	240
	Jell Type Stand Oil	5.00	10

The total expenditure on the procurement of the above mentioned raw materials is estimated to be 1.70 million per annum out of which raw materials for letter press Newsprint black would cost about 0.50 million Birr and for Litho and Offset Blue raw material cost would be 1.20 Million Birr.

3.2 Utilities

The utilities that are required for this plant are power and water. The requirements of these items are given below :

Power	1000 KW Hr Per day
Water	30 Kilo Litres per day

The annual expenditure on power and water works out to 36450 Birr. In addition, towards procurement of consumable and expenditure on repairs and maintenance a sum of Birr 60,000 is required per annum. Hence, the total expenditure on energy and other manufacturing costs is estimated to be 96450 Birrs per year.

4. TECHNOLOGY AND ENGINEERING

4.1 Process Description

Printing Ink manufacturing process primarily involves mixing of various pigments and dyes with vehicles and other chemicals and then grinding it into a finely dispersed matter. The quality control of the raw material and the intermediate and finished products is of utmost importance in the production process.

The various ingredients as per the required formulation are first mixed and the whole mass is ground. While mixing initially semi viscous paste is prepared by mixing pigment in some amount of vehicle and then in this semi viscous paste other ingredients are mixed. This mixing is carried out either in paddle mixer or dough mixer. After the mixing operation, the paste is ground in water cooled steel roller mill or Pebble mill when the pigment is thoroughly dispersed in the vehicle. Since heat is evolved during grinding, water cooling is required. When

the printing inks have been ground in paste or semi paste form, the vehicle is incorporated for mixing the finished product. The finished product is packed in suitable metallic containers.

4.2 **List of Equipments**

i.	Mixer Lead Lined	150 Kg./batch	1
ii.	Mixer, dough type	100 Kg./batch	2
iii.	Triple Roll Mills	50 Kg/hr	5
iv.	Formulation set of Triple Roll Mill and Mixer	-	1 set
v.	Ball Mill	150 Kg./batch	1
vi.	Micro Pulveriser	50 Kg./Hr.	1
vii.	Filling Machine	-	3
viii.	Weighing machine	-	3
ix.	Storage Tanks for solvents oils, water, etc.	-	1 set
x.	Pipings, fittings, etc.	-	1 set

The CIF Addis Cost of the plant and machinery indicated above is estimated to be 0.5 Million Birr.

4.3 **Layout**

The covered area required for housing the equipments is estimated to be 1500 M^2.

4.4 **Civil Works**

The Building Construction cost works out to Birr 0.9 Million.

5. MANPOWER & TRAINING

5.1 **Manpower Requirements and Expenditure**

For operating the plant for 270 days in a year on single shift basis, the requirement of personnel is given below in Table 'B' :

Table 'B'

S.No.	Category	No. Reqd.	Salary/Month/ person (Birr)	Annual Expenditure (Birr)
1.	Managerial	1	1200	14400
2.	Technical	3	900	32400
3.	Skilled	12	250	36000
4.	Semi-skilled	16	150	28800
5.	Unskilled	36	90	38880
6.	Others	2	350	8400
	Total	70	13240	158880

5.2 **Training**

Though the manufacture of printing inks involve simple operations like mixing and grinding yet since the process involves human judgement to a very great extent, initial involvement of highly skilled technicians is essential. It is, therefore, suggested that 2 technical personnel and 2 skilled persons are trained for a month in a running unit. An expenditure of Birr 30,000 may have to be kept apart by the project Authorities for the expenses connected with travel, boarding, lodging and incidentals of the personnel deputed for such training.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basic :	Production Capacity	:	1 TPD
	No. of Shifts/day	:	One
	No. of working days/year	:	270

6.1 Total Capital Investment

Particulars	*FC (Birr)*	*LC (Birr)*	*Total (Birr)*
Plant & Machinery	434400	60800	495200
Office equipment and furniture	-	4000	4000
Technology Fees	40000	-	40000
Pre-production expenses	-	44200	44200
Buildings	-	900000	900000
Working Capital	72800	43200	116000
Total	547200	1052200	1599400
		Say	1600,000

6.2 Production Cost

The total production cost works out to Birr 2408340 out of which raw materials account for 70.0%, energy and other manufacturing costs 4% and the expenditure towards payment of salaries and wages to operating personnel accounts for 6.6% as given below :

S.No.	*Particulars*	*Amount in Birr*
1.	Raw Materials	1689780
2.	Energy and other manufacturing costs	96450
3.	Labour & Supervision	158880
4.	General Overheads	95330
5.	Advertising/Sales	100000
6.	Depreciation on plant and machinery	50000
7.	Depreciation on Buildings	45000
8.	Interest on Long Term Loan	144300
9.	Interest on Short Term Loan	28600
10.	Total Production Cost	2408340
11.	Unit Cost (Per Ton)	8920

6.3 Financial Evaluation

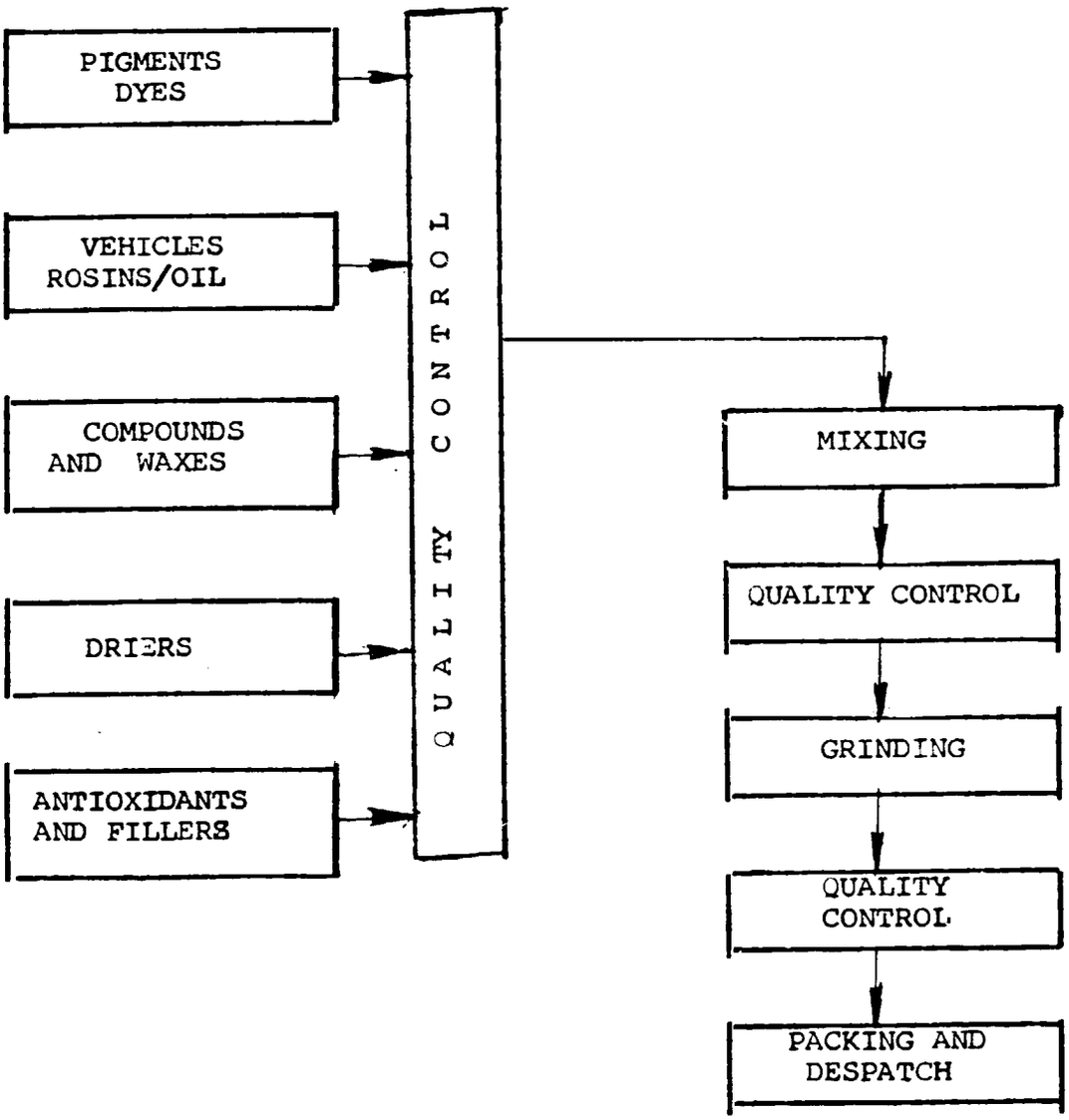
Total Sales Realisation at Birr 10500/Ton	2835000
Profit before taxes	426660
Return on investment	26.6%
Break-even point	55.0%
Pay-back period	2 years 5 months

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Realisation*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	1465145	1417500	- 47645	+ 50,000	+ 2355
2nd	1936700	2126250	+ 189550	+ 50,000	+ 241905
3rd	2408340	2835000	+ 426660	+ 50,000	+ 718565

Pay-back period : 2.5 Years

PRINTING INK



44. CALCIUM CARBIDE

1. SCOPE OF THE PROJECT AND PRODUCT DESCRIPTION

1.1 Summary of the Project

The proposal envisages setting up a calcium carbide unit in the industrial estate which would be capable of producing 750 tons per annum of this product. The annual turnover at full capacity would be Birr 1.69 million. The return on investment in estimated to be about 15%. The plant is capable of generating employment for about 49 persons.

1.2 Product Description

Calcium carbide is widely employed for the production of acetylene gas used for illumination, oxyacetylene welding and cutting of metals and for the manufacture of synthetic organic chemicals like acetic acid, acetaldehyde, vinylacetate, polyvinyl compounds, butanol and chlorinated derivatives. It is also used as a nitrogen fixative in the production of dicyandiamide which is a fertilizer and a starting material for the production diamide, melamine etc.

Calcium carbide finds application in metallurgy as desulphurizing and deoxidizing agent, as a nodulising agent for the production of nodular graphite in iron and as a finishing slag component in ferrous and non-ferrous refining. It is also sometimes used in certain industrial processes as a reducing and dehydrating agent.

In Ethiopia, calcium carbide is at present exclusively used for manufacture of acetylene gas and as such it is imported. There is no unit in the country manufacturing calcium carbide.

1.3 Product Specification

The quality of the calcium carbide depends on the yield of acetylene gas produced per unit quantity of calcium carbide. Theoretically, 1 Kg of 100% pure calcium carbide yields 350 litres of acetylene gas.

As per Indian standard (IS 1040/1960), the specification of different grades of calcium carbide is given below :

Gas Yield of Calcium Carbide

Graded Size MM	*Gas Yield*	
	Quality A	*Quality B*
	L/kg	L/kg
1-2	257	236
2-4	273	251
4-7	287	267
4-15	287	267
4-15	301	276
4-80	303	281
15-25	311	288
25-50	311	288
25-80	311	288
50-80	311	288
80-120	311	288

Source : Indian Standards (IS 1040/1960)

The quality specification of calcium carbide does not only depend on the yield of acetylene gas produced per unit quantity of calcium carbide but also on the purity of acetylene gas generated. Thus the following grades of acetylene gas are given as per Indian standards :

Quality Specification of Acetylene Gas

Characteristics	*Quality A*	*Quality B*
Phosphorous compounds (as PH_3) % by volume max.	0.06	0.08
Sulphur compounds (as H_2S) percent by volume max.	0.15	0.15

2. MARKET AND PLANT CAPACITY

2.1 Demand

In order to forecast the demand for calcium carbide, past import figures of seven consecutive years (1976-1982) have been considered & analysed. The import figures are obtained from the annual trade statistics and are tabulated below :

Import Data of Calcium Carbide

Year	*Quantity ('000 Kg)*	*Value ('000 Birr)*
1976	168.4	160.6
1977	187.2	168.6
1978	424.4	546.4
1979	371.3	376.7
1980	483.6	576.5
1981	49.6	107.4
1982	517.0	317.0

As can be seen from the above table, the import figures are erratic. In order to project the demand a time trend analysis has been conducted. This has indicated that the importation of calcium carbide has been increasing both in quantity and value at the rate of 29,600 Kgs. and 13,500 Birr per year respectively as indicated in the following table.

Projected Demand of Calcium Carbide

Year	*Quantity ('000 Kg)*	*Value ('000 Birr)*
1986	522.0	415.0
1987	551.5	428.5
1988	581.2	442.0
1989	610.8	445.5
1990	640.4	469.0

(Contd.)		
1991	670.0	482.5
1992	699.6	490.0
1993	729.2	509.5
1994	758.8	523.0
1995	788.4	284.5

As shown in the above table, the import of Calcium carbide has been to the order of 315 tons annually on an average during the last seven years and it is expected that the annual demand would be of the order of 800 tons during the next 10 years.

2.2 **Plant Capacity**

It has been indicated earlier that the annual demand in year 1995 would be in the order of 800 tons. It is therefore proposed to consider installation of a plant with an annual capacity of 750 tons which would be adequate to meet the demand for the next 10 years.

2.3 **Production Programme**

The programme of implementation of this project depends on several factors, such as selection of technology, the selection of the suppliers of equipments and the services available to implement the project as a total turnkey package. However, once a decision is taken to set up this plant, it would take about one year for fabrication and supply of equipment installation would take 3 months. In such a case, the plant would normally go into 50% production (rated capacity) during the 1st year, 75% of rated capacity in second year and full production of 750 tons/annum could commence from the beginning of the third year, if not earlier.

3. MATERIALS INPUT AND UTILITIES

3.1 **Raw Materials**

The major raw materials for the production of calcium carbide are

lime stone and charcoal. These materials are locally available without any reason of doubts. The others like Soderberg paste and MS Sheets are to be imported.

The raw materials requirements per ton of productare given below

Raw Material Requirement and the Unit Cost

Material	*Unit Rate Birr/Ton*	*Requirement (Ton) per ton of product*
Lime Stone	40	2.0
Charcoal	300	0.8
Soderberg Paste	2000	0.08
MS Sheet for Electrode Casting	2400	0.1
Packing Drums	100	As required

The annual expenditure towards procurement of raw materials is estimated to be 615400 Birrs.

3.2 **Utilities**

The utility requirement per ton of product is :

Electricity	:	4500 KWH/ton of product.
Water	:	8 M^3/Ton of product

The annual expenditure for electricity and water works out to Birr 408000. In addition, provision is made for yearly consumables and annual expenses towards repairs and maintenance. The total annual expenses works out to 492565 Birr.

4. TECHNOLOGY & ENGINEERING

4.1 **Technology**

The technology involved in the manufacture of calcium carbide is simple technology involving reaction of quick lime with carbonaceous material at a temperature of 2000°C in a submerged electric arc furnace.

4.2 Process Description

Lime stone required for the manufacture of quick lime should be rocky type containing not less than 95 to 97% calcium carbonate content and capable of yielding a very tough quick lime on burning it in lime kiln. Impurities such as magnesia, alumina, iron oxide and silica should not exceed 1 to 1.5% individually in the lime stone as they interfere in the furnace operation, if they are more. Phorphorus should be less than 0.06% in the lime stone while sulphur should be present only in traces.

The quick lime for the production of calcium carbide must confirm to CaO 92% (min), magnesium oxide 1.75% (max), silica 2.0% (max), iron oxide and aluminium oxide 1.0% (max), sulphur 0.2% (max) and phosphorus 0.2% (max).

The carbonaceous materials for the production of calcium carbide must contain high fixed carbon content of 91% while its ash content should not exceed 8%. The phosphorus impurity should not be more than 0.008% to 0.01% and sulphur must be present only in traces, charcoal, hard coke, petroleum coke are the usual carbonaceous materials used in blended form for the manufacture of calcium carbide.

Calcium oxide or calcium carbonate and charcoal in the right proportion are mixed and crushed. The crushed mixture is then screened to uniform size. The mixed ground mass is smelted in an electric arc furnace to a temperature of 2000°C. It is then cooled, ground, graded, packed and sealed in drums.

4.3 Engineering

Plant & Machinery

For the suggested plant of 750 tons capacity per annum, the following are the major equipments :

Furr.) ıell

Tapho.)

Air Compressor with 1 HP Motor.
Spout
Tapping laddles
Monorail hoist
Control panel
Electrode hoist
Chimney
Welding Transformer
Jaw crusher
Weighing machine
Water circulating pumps
Cooling tower
Refractories
Sheet bending machine
Transformer & reactor
Current transformers
Bus bars, circuit breaker panel
Cables, hardware, pipes & fittings

The cost of machinery and equipment including insurance and freight is estimated to be 565420 Birrs on CIF Addis basis excluding foundation and installation.

4.4 **Layout**

For housing the plant equipment, it is estimated that a covered area of 600 m^2 will be required.

4.5 **Civil Works**

The construction cost of the building is about 360000 Birrs.

5. MANPOWER & TRAINING

5.1 **Manpower Requirement**

The manpower requirement for operating the plant in three shifts shall be as indicated below :

Category	*No. Required*	*Salary/month/ Person in Birr*	*Total salary per year Birr*
Managerial	1	1200	14400
Technical	2	900	21600
Skilled	2	250	6000
Semi-skilled	8	200	19200
Unskilled	36	90	38880
Total	49	8340	100080

5.2 **Training**

Training could be organised at the running factories abroad at least for the technical personnel (Mechanical Engineer) and one operator for the furnace. These personnel could also be associated with the project implementation agency. It is expected that the training facilities shall be provided by the plant & machinery supplier free of cost but the transportation charges and local expenditure for boarding, lodging, incidental etc. for the trainees shall have to be met locally. This is estimated to be about 10,000 Birr.

6. FINANCIAL AND ECONOMIC ANALYSIS

Basis : Production Capacity : 750 TPA
No. of shifts/day : 3
No. of working days/year : 300

6.1 **Total Capital Investment**

Particulars	*F.C. (Birr)*	*L.C. (Birr)*	*Total (Birr)*
Plant and Machinery	500370	65050	565420
Office equipment & furniture		5000	5000
Preproduction Cost		56380	56380
Technology Fees	50000		50000
Buildings		360000	360000
Working Capital	75000	8920	83920
Total	625370	495350	1120720

6.2 Production Cost

The annual production cost works out to Birr 1525100 out of which raw materials account for 40%, energy and other manufacturing costs 33% and expenditure on manpower accounts for 6.6%.

	Birr
Raw Materials	615400
Energy & other manufacturing cost	492565
Labour and supervision	100080
General Overheads	60050
Sales and advertising	82500
Depreciation on plant & machinery	56375
Depreciation on buildings	18000
Interest on long term loan	78945
Interest on short term loan	21185
Total Production Cost	1525100
Production cost/ton	2033

6.3 Financial Evaluation

If the product is sold at 2250 Birr/Ton :

Sales realisation	:	1687500
Profit before taxes	:	162400
Return on investment	:	14.5%
Break-even point	:	67%
Pay-back period	:	6 years 3 months

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*

The cost of the soderberg paste (CIF Addis) is calculated keeping the imported cost of this item in India as basis and adding local taxes etc. However, it might be possible to import this item directly to Ethiopia in which case the CIF value is likely to come down considerably.

CASH FLOW STATEMENT

Year	*Production Cost*	*Sales Revenue*	*Profit*	*Depreciation*	*Net Cash Flow*
1st	1266500	843800	- 422700	56400	- 366300
2nd	1345800	1265600	- 80200	56400	- 390100
3rd	1525100	1687500	+ 162400	56400	- 171300
4th	1525100	1687500	+ 162400	56400	+ 47500
5th	1525100	1687500	+ 162400	56400	+ 266300
6th	1525100	1687500	+ 162400	56400	+ 485100
7th	1525100	1687500	+ 162400	56400	+ 703900

Pay-back period : 6.3 Years

CALCIUM CARBIDE