PROFILE ON THE PRODUCTION OF CALCIUM CARBONATE AND LIME

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I. SUMMARY

This profile envisages the establishment of a plant for the production of precipitated calcium carbonate and lime with a capacity of 10,000 tons and 5,000 tons per annum respectively. Precipitated calcium carbonate is used as filler and coating pigment in the manufacturing of paper, plastic products and paint while lime widely used in construction industry in the preparation of mortar and plasters.

Since there are no local producers of precipitated calcium carbonate, the demand for the product is entirely met through import while the demand for lime is met through both import and local production. The present (2012) demand for precipitated calcium carbonate and lime is estimated at 7,655 tons and 6,050 tons, respectively. The demand for calcium carbonate is projected reach 13,561 tons and 21,840 tons by the year 2018 and year 2023, respectively. Similarly, the unsatisfied demand (supply shortage) for lime is projected reach 8,442 tons and 17,544 tons by the year 2018 and year 2023, respectively.

The principal raw material required is limestone which is locally available.

The total investment cost of the project including working capital is estimated at Birr 60.34 million (see Table 7.1). From the total investment cost, the highest share (Birr 39.33 million or 65.19%) is accounted by fixed investment cost followed by initial working capital (Birr 15.66 million or 25.96%) and pre operation cost (Birr 5.34 million or 8.85%). From the total investment cost Birr 19.35 million or 32.07% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 20.02% and a net present value (NPV) of Birr 33.70 million, discounted at 10%.

The project can create employment for 69 persons. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports. The project will also create forward linkage with the manufacturing and construction sectors and back ward linkage with the mining sector and also generates income for the Government in terms of tax revenue and payroll tax.

II. PRODUCT DESCRIPTION AND APPLICATION

Precipitated calcium carbonate is an in organic chemical obtained by calcining naturally occurring lime stone, slaking and carbonation. Precipitated calcium carbonate is pure form of lime stone used in the chemical industries.

Precipitated calcium carbonate (PPC) is used as filler & coating pigment for premium quality paper products. PCC improves optical properties and print characterized of paper products, improves paper machine productivity & reduces paper making costs through the replacement of more expensive Pulp fiber & optical brightening agent.

PCC also finds many industrial uses, based on the ability to achieve small particle size and special crystal shapes. In rigid PVC, such as vinyl siding and fencing, PCC increases impact strength, with some of the smaller particles able to replace expensive impact modifiers. Nano PCCs (less than 0.1 micron in size) control viscosity and sag in automotive and construction sealants, such as PVC plastisols, polysulfide, urethanes and silicones. In paint, PCC's unique particle shapes improve hiding and allow reductions in titanium dioxide levels.

An Effective acid neutralizer, PCC is often used in calcium-based antacid tablets and liquids. Being high in calcium content, PCC enables the formulation of high dosage calcium supplements and multi-vitamin/mineral tablets. The small particle sizes and special particle shape contribute to the development of good tasting calcium fortified.

In paint, which is another important applications, calcium carbonate has now established it self as the main extender. Fineness and particle-size distribution determine the opacity. Moreover, calcium carbonate offers interesting properties as regard to weather resistance, low abrasiveness, low electrolyte content, pH stabilizing effect, and improved anti-corrosion and rheological properties of coatings. Calcium carbonate is also important in water-based system, in which it contributes to the shortening of the drying time with - for example - important implications in road - line markings.

Lime is inorganic chemical compound, which is usually known as quick lime or non-slaked lime obtained from a naturally occurring compound called limestone. Quick lime that is chemically expressed as calcium oxide, is a strong caustic ingredient widely used in construction industry in the preparation of mortar and plasters.

It is also used for white washing of houses and building. Iron and steel plants and foundries use lime as fluxing agent in considerable quantities. Some drugs and pharmaceuticals, paper mills, pesticides formulation plants, and other chemical processing industries use it as additives. Moreover, it has a considerable contribution in agriculture as an agent for removal of excess soil acidity.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Present Supply and Demand

The demand for calcium carbonate in Ethiopia is entirely met through import, while the source of supply for lime is domestic production and import. The two factories that supply lime to the domestic market are Dire Dawa Cement Factory and Ethio-Lime Factory of Senkele. Wonji Shoa Sugar Factory and Caustic Soda S.C located at Zuway also produce lime entirely for their own consumption. The historical import data of calcium carbonate and the domestic production & import of lime is shown in Table 3.1 and Table 3.2, respectively.

Table 3.1

IMPORT OF CALCIUM CARBONATE

Year	Quantity (Tons)	Value (`000 Birr)
2000	1,204.5	1,704
2001	879.1	1,496
2002	1,011.3	1,655
2003	1,604.7	3,009
2004	1,842.2	4,190
2005	2,589.0	6,252
2006	3,517.6	8,426
2007	4,892.7	11,118
2008	6,083.2	20,069
2009	4,933.6	22,779
2010	9,210.0	43,326
2011	6,099.5	43,315

Source: - *Ethiopian Revenues & Customs Authority.*

Table 3.2

DOMESTIC PRODUCTION AND IMPORT OF LIME (TONS)

Year	Domestic Production[1]	Import[2]	Total (1 +2)
2000/01	11,350	-	11,350
2001/02	7,805	-	7,805
2002/03	10,532	4	10,536
2003/04	15,679	94	15,773
2004/05	11,850	29	11,879
2005/06	8,141	584	8,725
2006/07	4,461	2,029	6,490
2007/08	4,068	1,739	5,807
2008/09	3,829	2,416	6,245
2009/10	3,254	111	3,365

Source: *- 1.Central Statistical Agency.*

2. Ethiopian Revenues & Customs Authority.

As shown in Table 3.1, import of calcium carbonate has been growing from year to year with minor fluctuations. The yearly average level of import which was only about 1,000 tons during the period 2000--2003 has increased to a yearly average of 2,012 tons during the period 2003 - 2005. Similarly, the yearly average imported quantity has increased to 4,831 tons during the period 2006--2008, which is more than double of the preceding three years average. In the recent three years (2009--2011) the yearly average level of import has reached to a level of 6,747 tons.

Compared to the preceding years (2006--2008) the total increase is about 40% or annual average growth rate of 10%.

In terms of value, the country was on the average spending only 1.5 million Birr during the period 2000-2002. The expenditure for importing calcium carbonate has increased to annual average of Birr 4.5 million and Birr 13.2 million during the period 2003-2005 and 2006-2008, respectively. During the recent two years (2010 & 2011), the annual expenditure for importing calcium carbonate has reached to a level of Birr 43.3 million. The huge increase for the demand of calcium carbonate is believed to be due to the establishment of a number of end user industries, mainly in the chemical sub-sector.

With regard to lime domestic production it has generally shown a declining trend. The production level which was in the range of 7,805 tons and 15,679 tons during the period 2000/01 to 2005/06 has declined to a range of 3,254 tons and 4,461 tons during the period 2006/07 to 2009/10. Information gathered reveals that the major reason for the decline of domestic production is due to old age the existing factories. Due to lack of adequate domestic production many users are forced to wait for a long time and the country is forced to import from abroad to meet the unsatisfied demand.

Unlike the trend in the domestic production, imported quantity has been increasing tremendously in the past years. Import was almost nil during the period 2000 to 2003 and registered an annual average of about 62 tons during the period 2004/05. By the year 2006 the imported quantity reached at a level of 584 tons, which is almost ten times higher compared to the previous two years average. A huge increase of import is again registered during the three consecutive years of 2007--2009 with annual average of 2,061 tons. Generally, domestic production which was satisfying the local demand before 2005 is currently satisfying only about 70% of the demand and the balance is met through import. As a result, import has substantially increased to meet the gap.

In estimating the current effective demand for calcium carbonate, it is considered as reasonable to assume that the present demand for the product would be the average of the imported quantity of the recent two years i.e. year 2010 and 2011. Accordingly the present (year 2012) effective

demand for calcium carbonate is estimated at 7,655 tons. With regard to lime the recent four years supply from import and domestic production (excluding Wonji Shoa Sugar Factory and Caustic Soda S.C which fully produce for their own consumption) , which is about 5,000 tons is taken as the effective demand for year 2010. By applying a 10% annual growth rate year 2012 demand is estimated at 6,050 tons.

2. Demand Projection

The future demand for calcium carbonate depends mainly on the growth of the chemical and allied industries, which are using it to produce paints and as filler in different chemical and rubber products. During the past ten years, the annual average growth of demand has been more than 15% per annum. As per the data of the Ethiopian Investment Agency there are a number of chemical projects which are licensed for implementation. When the projects become operational the demand for the product will undoubtedly increase significantly. By considering the past trend, which was 15% annual growth rate, and future prospects of the industrial sector demand for calcium carbonate is assumed conservatively to grow by 10% per annum.

Demand for lime is believed to grow parallel with the development of the user industries such as the construction sector, water and sewerage treatment plants, chemical industries, tanneries, sugar factories, metallurgical industries as well as the agricultural sector and the like. By considering the combined effect of the various influencing factors demand for lime in the country is conservatively assumed to grow at an annual average rate of 12%.

The total demand projection and the supply gap worked based on the above assumptions are presented in Table 3.3.

Table 3.3

PROJECTED DEMAND FOR CALCIUM CARBONATE AND LIME (TONS)

Year	Calcium Carbonate	Lime		
		Total Forecast	**Domestic Production***	**Supply Gap (Shortage)**
2013	8,420	6,776	3,500	3,276
2014	9,262	7,589	3,500	4,089
2015	10,189	8,500	3,500	5,000
2016	11,208	9,520	3,500	6,020
2017	12,328	10,662	3,500	7,162
2018	13,561	11,942	3,500	8,442
2019	14,917	13,375	3,500	9,875
2020	16,409	14,980	3,500	11,480
2021	18,050	16,777	3,500	13,277
2022	19,855	18,790	3,500	15,290
2023	21,840	21,044	3,500	17,544

***** *Average of the past two years is assumed as the existing domestic production excluding the amount produced by Wonji Sugar & Zuway Caustic Soda factories.*

The demand projection, executed in Table 3.2 reveals that the demand for calcium carbonate will grow from 8,420 tons in the year 2013 to 13,561 tons and 21,840 tons by the year 2018 and year 2023, respectively. Similarly, the unsatisfied demand (supply shortage) for lime will grow from

3,276 tons in the year 2013 to 8,442 tons and 17,544 tons by the year 2018 and year 2023, respectively.

3. Pricing and Distribution

As per the calculations made on the data obtained from the Ethiopian Revenue and Customs Authority, the recent average CIF value (excluding duty) of imported calcium carbonate is Birr 7,102 per tone. Allowing 20% for customs duty and other import related expenses a factory gate price of Birr 8,522 per tone is recommended for the purpose of sales revenue projection and financial analysis.

The current retail price of lime per quintal (100 kg) is Birr 340. Allowing 30 percent for profit margin and distribution costs a factory gate price Birr 262 per quintal or Birr 2,620 per tone is recommended as a factory gate price.

The major end users of calcium carbonate are mainly industrial establishment. Most of them are bulk purchasers and their number as well as geographical distribution is limited. By considering the number and geographical distribution of the end users direct sale to the end users is recommended as an appropriate distribution channel for the envisaged project. With regard to lime, direct sale to bulk consumers such as construction companies and sugar mills and the use of existing building material shops for small quantity purchasers is recommended as an appropriate channel. The factory can appoint agents/distributors in the major cities of the country.

B. PLANT CAPACITY AND PRODUCTION PROGRAM

1. Plant Capacity

In determining the plant capacity of the calcium carbonate and lime production plant, the future demands of the product and the economies of scale of the available technologies were taken into consideration. According to the data obtained from the market study, the demand for precipitated

calcium carbonate and lime raises from 8,420 and 3,276 tons to 21,840 and 17,544 tons from years 2013 to 2023, respectively.

Hence, based on the demand gap and the minimum economic of scale for precipitated calcium carbonate and lime production, a plant with a capacity of 10,000 of precipitated calcium carbonate and 5,000 tons of lime per annum is proposed.

2. Production Program

It is assumed that the precipitated calcium carbonate and lime plant will start at 70% in the first year, and then raise its production by 85% in the second year and finally operates at 100% capacity in the third year and then after. The production program of the envisaged plant is given in Table 3.4.

Table 3.4

PRODUCTION PROGRAM

Year of Production	**1st Year**	**2nd Year**	**3rd-10th Year**
Capacity utilization (%)	70	85	100
Precipitated calcium carbonate(tons)	7,000	8,500	10,000
Lime (tons)	3,500	4,250	5,000

IV. MATERIALS AND INPUTS

A. MATERIALS

The principal raw material for the production of precipitated calcium carbonate and lime is limestone. This raw material is a sedimentary rock dominantly composed of carbonate minerals, particularly carbonates of calcium and magnesium. The commonly known chemical composition of limestone is calcium oxide (CaO) and carbon dioxide (CO_2). However, small amounts of impurities such as silica and aluminum may be present in lime stone mineral. The total annual cost of raw material is estimated at Birr 63,000,000, which is locally available. The annual requirement of this raw material is shown in Table 4.1.

Table 4.1

ANNUAL RAW & AUXILIARY MATERIALS REQUIREMENT& COST

Sr. No.	Description	Unit	Qty	Total cost (`000 Birr)
1	Lime Stone	Tons	30,000	60,000
2	Packing material, 50 kg HDPE lined bag	Pcs	300,000	3,000
	Total			**63,000**

B. UTILITIES

The utilities required are light oil, electric power, and water for process as well as for general purpose. The total cost of utilities is estimated at Birr 14,052,000. The annual requirement of these utilities at full capacity operation is indicated in Table 4.2.

Table 4.2

ANNUAL REQUIREMENT OF UTILITIES &COST

Sr. No.	Description	Unit of Measure	Qty.	Cost ('000 Birr)
1.	Electricity	kWh	400,000	232
2.	Water	m^3	50,000	500
3.	Fuel oil/Mazut	lt	740,000	13,320
	Total			**14,052**

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Process Description

The production process of precipitated calcium carbonate involves the following steps i.e. calcination, slaking, carbonation, drying and packing while the production of lime involves calcination and packaging.

The Calcinations Process:

Limestone is converted into calcium oxide and carbon dioxide by means of calcinations at temperatures in excess of 900°C. To ensure a high level of purity, the calcinations process is carried out using natural gas.

$$CaCO_3 \longrightarrow CaO + CO_2$$

The temperature, flow of Natural Gas and Fresh Air has to be controlled properly to ensure the high quality Calcium Oxide. Unless the calcinations process is done properly, the quality of the product cannot be maintained. The first and the foremost important process of manufacturing Calcium Carbonate is Calcinations.

Milk of Lime / Calcium Hydroxide:

The Calcium Oxide (Calcined Lime) derived through the Calcinations process is then slacked with water to obtain Calcium Hydroxide (Milk of Lime). The resultant slurry contains some impurities and to remove the impurities it is passed through wire mess which removes some un burnt or over burnt lime hence a better quality is ensured.

Slacking of Quicklime $CaO + H_2O$ $Ca(OH)_2$

Carbonation:

The purified milk of lime is then carbonated with Carbon Dioxide which is derived during the first process of Calcinations. This process ensures the Calcium Carbonate and water. Proper temperature and concentration has to be maintained during this process to ensure desired product. The resultant mixture of calcium carbonate and water is again passed through the wire mesh to remove any impurity if still left.

Carbonation $\longrightarrow$ $Ca(OH)_2 + CO_2$ $CaCO_3 + H_2O$

Drying:

The drying is a physical process and no chemical changes to the material are made at this stage. The final stage of the process is water solid separation; water is to be removed from calcium carbonate. This process is completed in two stages viz. making cake by use of centrifuge which contains around 30% moisture. The cake then is dried through spindle dryer where the material travels with hot air at a temperature of more than $300^{O}C$.

The material is then packed in HDPE bags at the outlet. The material is packed in inner laminated HDPE bags to ensure no further quality problems to the material.

2. Environmental Impact Assessment

The prevailing adverse impact associated with precipitated calcium carbonate and lime production plant is dust pollution. The dust to be generated during the production process starting from storage and transport of raw material to packaging of the finished product shall be prevented from going to the atmosphere by using a combination of appropriate technology such as cyclone, bag filter, wet scrubber, etc. The investment cost for the dust control unit is included in the cost of machinery and equipment.

B. ENGINEERING

1. Machinery and Equipment

One of the core machines in precipitated calcium carbonate and lime production is the kiln. Others such as slacker, carbonator, centrifuge, dryer, wire mesh, crusher, elevator, belt conveyor are secondary equipments which augment the kiln by preparing and transporting both the raw and finished materials to and out of the same. The total cost of machinery and equipment is estimated at about Birr 25.8 million, out of which 19.35 million is required in foreign currency. Lists of required machinery and equipment are shown in Table 5.1.

Table 5.1
LIST OF MACHINERY AND EQUIPMENT

Description	Qty.
1. Crusher	1
2. Vertical Kiln	1
3. Water tanker	1
4. Slaking unit	1
5. Slaked lime storage tank	1
6. Carbonation column	2
7. Calcium carbonate suspension storage tank	1
8. Drum Filter	1
9. Centrifuge	1
10. Dryer	1
11. Mill	1
12. Belt Conveyer	2
12. Elevator	2

Description	Qty.
13. Pumps	2
14. Fan	1
15. Cyclone	1
16. Mist Eliminator	1
17. Storage Silo	2
18. Burners	1
19. Packing Machine	1
20. Dust control equipment	1

2. Land, Building and Civil Works

The plant requires a total of 5,000 m^2 area of land, out of which 3,000 m^2 is built-up area which includes Processing area, raw material stock area, offices etc. Assuming construction rate of Birr 4,000 per m^2, the total cost of construction is estimated to be Birr 12 million.

According to the Federal Legislation on the Lease Holding of Urban Land (Proclamation No 721/2004) in principle, urban land permit by lease is on auction or negotiation basis, however, the time and condition of applying the proclamation shall be determined by the concerned regional or city government depending on the level of development.

The legislation has also set the maximum on lease period and the payment of lease prices. The lease period ranges from 99 years for education, cultural research health, sport, NGO , religious and residential area to 80 years for industry and 70 years for trade while the lease payment period ranges from 10 years to 60 years based on the towns grade and type of investment.

Moreover, advance payment of lease based on the type of investment ranges from 5% to 10%.The lease price is payable after the grace period annually. For those that pay the entire

amount of the lease will receive 0.5% discount from the total lease value and those that pay in installments will be charged interest based on the prevailing interest rate of banks. Moreover, based on the type of investment, two to seven years grace period shall also be provided. However, the Federal Legislation on the Lease Holding of Urban Land apart from setting the maximum has conferred on regional and city governments the power to issue regulations on the exact terms based on the development level of each region.

In Addis Ababa, the City's Land Administration and Development Authority is directly responsible in dealing with matters concerning land. However, regarding the manufacturing sector, industrial zone preparation is one of the strategic intervention measures adopted by the City Administration for the promotion of the sector and all manufacturing projects are assumed to be located in the developed industrial zones.

Regarding land allocation of industrial zones if the land requirement of the project is below 5,000 m^2, the land lease request is evaluated and decided upon by the Industrial Zone Development and Coordination Committee of the City's Investment Authority. However, if the land request is above 5,000 m^2, the request is evaluated by the City's Investment Authority and passed with recommendation to the Land Development and Administration Authority for decision, while the lease price is the same for both cases.

Moreover, the Addis Ababa City Administration has recently adopted a new land lease floor price for plots in the city. The new prices will be used as a benchmark for plots that are going to be auctioned by the city government or transferred under the new "Urban Lands Lease Holding Proclamation."

The new regulation classified the city into three zones. The first Zone is Central Market District Zone, which is classified in five levels and the floor land lease price ranges from Birr 1,686 to Birr 894 per m^2. The rate for Central Market District Zone will be applicable in most areas of the city that are considered to be main business areas that entertain high level of business activities.

The second zone, Transitional Zone, will also have five levels and the floor land lease price ranges from Birr 1,035 to Birr 555 per m^2 .This zone includes places that are surrounding the city

and are occupied by mainly residential units and industries. The last and the third zone, Expansion Zone, is classified into four levels and covers areas that are considered to be in the outskirts of the city, where the city is expected to expand in the future. The floor land lease price in the Expansion Zone ranges from Birr 355 to Birr 191 per m^2 (see Table 5.2).

Table 5.2

NEW LAND LEASE FLOOR PRICE FOR PLOTS IN ADDIS ABABA

Zone	Level	Floor Price/m^2
Central Market District	1st	1686
	2nd	1535
	3rd	1323
	4th	1085
	5th	894
Transitional zone	1st	1035
	2nd	935
	3rd	809
	4th	685
	5th	555
Expansion zone	1st	355
	2nd	299
	3rd	217
	4th	191

Accordingly, in order to estimate the land lease cost of the project profiles it is assumed that all new manufacturing projects will be located in industrial zones located in expansion zones.

Therefore, for the profile a land lease rate of Birr 266 per m^2 which is equivalent to the average floor price of plots located in expansion zone is adopted.

On the other hand, some of the investment incentives arranged by the Addis Ababa City Administration on lease payment for industrial projects are granting longer grace period and extending the lease payment period. The criterions are creation of job opportunity, foreign exchange saving, investment capital and land utilization tendency etc. Accordingly, Table 5.3 shows incentives for lease payment.

Table 5.3

INCENTIVES FOR LEASE PAYMENT OF INDUSTRIAL PROJECTS

Scored Point	Grace Period	Payment Completion Period	Down Payment
Above 75%	5 Years	30 Years	10%
From 50 - 75%	5 Years	28 Years	10%
From 25 - 49%	4 Years	25 Years	10%

For the purpose of this project profile, the average i.e. five years grace period, 28 years payment completion period and 10% down payment is used. The land lease period for industry is 60 years.

Accordingly, the total land lease cost at a rate of Birr 266 per m^2 is estimated at Birr 1,330,000 of which 10% or Birr 133,000 will be paid in advance. The remaining Birr 1,197,000 will be paid in equal installments with in 28 years i.e. Birr 42,750 annually.

VI. HUMAN RESOURCE AND TRAINING REQUIREMENT

A. HUMAN RESOURCE REQUIREMENT

Total human resource required is 69 persons. The total annual cost of human resource is estimated at Birr 1,623,000. The details of the human resource requirement and the estimated annual labor cost, including employees' benefit, are given in Table 6.1.

Table 6.1

HUMAN RESOURCE REQUIREMENT AND ESTIMATED COST

Sr. No.	Description	No. of Persons	Monthly Salary (Birr)	Annual Salary (Birr)
1	General Manager	1	8,000	96,000
2	Executive Secretary	1	2,500	30,000
3	Production & Technical Head	1	6,000	72,000
4	Commercial Head	1	5,000	60,000
5	Finance & Administration Head	1	5,000	60,000
6	Accountant	2	3,000	36,000
7	Accounts Clerk	1	1,200	14,400
8	Cashier	1	1,500	18,000
9	Purchaser	2	6,000	72,000
10	Store Keeper	2	2,400	28,800
11	Chemist	3	9,000	108,000
12	Shift Leader	3	9,000	108,000
13	Operator	12	18,000	216,000
14	Assistant Operator	12	10,800	129,600
15	Laborer	12	7,200	86,400
16	Mechanic	3	4,500	54,000
17	Electrician	3	4,500	54,000
18	Driver	2	1,600	19,200
19	Guard	6	3,000	36,000

Sr. No.	Description	No. of Persons	Monthly Salary (Birr)	Annual Salary (Birr)
	Sub- total	**69**	**108,200**	**1,298,400**
	Employees benefit (25% of basic salary)		27,050	324,600
	Total		**135,250**	**1,623,000**

B. TRAINING REQUIREMENT

The production and technical head, mechanic, electrician and quality control worker need at least two weeks training on the technology, maintenance and quality control. For the rest, on-the-job training will be sufficient in the time of installation and commissioning by the specialists. Total training cost is estimated at about Birr 55,000.

VII. FINANCIAL ANALYSIS

The financial analysis of the calcium carbonate and lime project is based on the data presented in the previous chapters and the following assumptions:-

Construction period	1 year
Source of finance	30 % equity
	70 % loan
Tax holidays	3 years
Bank interest	10%
Discount cash flow	10%
Accounts receivable	30 days
Raw material local	30 days

Work in progress	1 day
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days
Repair and maintenance	5% of machinery cost

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 60.34 million (see Table 7.1). From the total investment cost, the highest share (Birr 39.33 million or 65.19%) is accounted by fixed investment cost followed by initial working capital (Birr 15.66 million or 25.96%) and pre operation cost (Birr 5.34 million or 8.85%). From the total investment cost Birr 19.35 million or 32.07% is required in foreign currency.

Table 7.1

INITIAL INVESTMENT COST ('000 Birr)

Sr. No	Cost Items	Local Cost	Foreign Cost	Total Cost	% Share
1	**Fixed investment**				
1.1	Land Lease	133.00		133.00	0.22
1.2	Building and civil work	12,000.00		12,000.00	19.89
1.3	Machinery and equipment	6,450.00	19,350.00	25,800.00	42.76
1.4	Vehicles	900.00		900.00	1.49
1.5	Office furniture and equipment	500.00		500.00	0.83
	Sub total	**19,983.00**	**19,350.00**	**39,333.00**	**65.19**
2	**Pre operating cost ***				
2.1	Pre operating cost	1,395.00		1,395.00	2.31
2.2	Interest during construction	3,947.40		3,947.40	6.54
	Sub total	**5,342.40**		**5,342.40**	**8.85**
3	**Working capital ****	**15,663.48**		**15,663.48**	**25.96**
	Grand Total	**40,988.89**	**19,350.00**	**60,338.89**	**100**

* *N.B Pre operating cost include project implementation cost such as installation, startup, commissioning, project engineering, project management etc and capitalized interest during construction.*

** *The total working capital required at full capacity operation is Birr 22.59 million. However, only the initial working capital of Birr 15.66 million during the first year of production is assumed be funded through external sources. During the remaining years the working capital requirement will be financed by funds generated internally (for detail working capital requirement see Appendix 7.A.1).*

B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 91.16 million (see Table 7.2). The cost of raw material account for 69.11% of the production cost. The other major components of the production cost are utility, depreciation and financial cost which account for 15.41%, 6.75% and 4.17%, respectively. The remaining 4.56% is the share of repair and maintenance, labor overhead and administration cost. For detail production cost see Appendix 7.A.2.

Table 7.2

ANNUAL PRODUCTION COST AT FULL CAPACITY (YEAR FOUR)

Items	Cost	%
Raw Material and Inputs	63,000.00	69.11
Utilities	14,052.00	15.41
Maintenance and repair	1,290.00	1.42
Labour direct	1,298.40	1.42
Labour overheads	324.60	0.36
Administration Costs		0.55

	500.00	
Land lease cost	-	-
Cost of marketing and distribution	750.00	0.82
Total Operating Costs	**81,215.00**	**89.09**
Depreciation	6,149.00	6.75
Cost of Finance	3,799.38	4.17
Total Production Cost	**91,163.38**	**100**

C. FINANCIAL EVALUATION

1. Profitability

Based on the projected profit and loss statement, the project will generate a profit throughout its operation life. Annual net profit after tax will grow from Birr 5.24 million to Birr 11.42 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 97.16 million. For profit and loss statement and cash flow projection see Appendix 7.A.3 and 7.A.4, respectively.

2. Ratios

In financial analysis financial ratios and efficiency ratios are used as an index or yardstick for evaluating the financial position of a firm. It is also an indicator for the strength and weakness of the firm or a project. Using the year-end balance sheet figures and other relevant data, the most important ratios such as return on sales which is computed by dividing net income by revenue, return on assets (operating income divided by assets), return on equity (net profit divided by equity) and return on total investment (net profit plus interest divided by total investment) has been carried out over the period of the project life and all the results are found to be satisfactory.

3. Break-even Analysis

The break-even analysis establishes a relationship between operation costs and revenues. It indicates the level at which costs and revenue are in equilibrium. To this end, the break-even point for capacity utilization and sales value estimated by using income statement projection are computed as followed.

$$\text{Break- Even Sales Value} = \frac{\text{Fixed Cost + Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 41{,}202{,}000$$

$$\text{Break- Even Capacity utilization} = \frac{\text{Break- even Sales Value}}{\text{Sales revenue}} \times 100 = 39.12\%$$

4. Pay-back Period

The pay- back period, also called pay – off period is defined as the period required for recovering the original investment outlay through the accumulated net cash flows earned by the project. Accordingly, based on the projected cash flow it is estimated that the project's initial investment will be fully recovered within 6 years.

5. Internal Rate of Return

The internal rate of return (IRR) is the annualized effective compounded return rate that can be earned on the invested capital, i.e., the yield on the investment. Put another way, the internal rate of return for an investment is the discount rate that makes the net present value of the investment's income stream total to zero. It is an indicator of the efficiency or quality of an investment. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments or putting the money in a bank account. Accordingly, the IRR of this project is computed to be 20.02% indicating the viability of the project.

6. Net Present Value

Net present value (NPV) is defined as the total present (discounted) value of a time series of cash flows. NPV aggregates cash flows that occur during different periods of time during the life of a project in to a common measuring unit i.e. present value. It is a standard method for using the time value of money to appraise long-term projects. NPV is an indicator of how much value an

investment or project adds to the capital invested. In principle, a project is accepted if the NPV is non-negative. Accordingly, the net present value of the project at 10% discount rate is found to be Birr 33.70 million which is acceptable. For detail discounted cash flow see Appendix 7.A.5.

D. ECONOMIC AND SOCIAL BENEFITS

The project can create employment for 69 persons. The project will generate Birr 27.48 million in terms of tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports. The project will also create forward linkage with the manufacturing and construction sectors and back ward linkage with the mining sector and also generates income for the Government in terms of tax revenue and payroll tax.

Appendix 7.A

FINANCIAL ANALYSES SUPPORTING TABLES

Appendix 7.A.1

NET WORKING CAPITAL (in 000 Birr)

Items	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Total inventory	11,025.00	13,387.50	15,750.00	15,750.00	15,750.00	15,750.00	15,750.00	15,750.00	15,750.00	15,750.00
Accounts receivable	4,756.29	5,762.10	6,767.92	6,767.92	6,771.48	6,771.48	6,771.48	6,771.48	6,771.48	6,771.48
Cash-in-hand	33.18	40.29	47.40	47.40	48.00	48.00	48.00	48.00	48.00	48.00
CURRENT ASSETS	**15,814.47**	**19,189.90**	**22,565.32**	**22,565.32**	**22,569.48**	**22,569.48**	**22,569.48**	**22,569.48**	**22,569.48**	**22,569.48**
Accounts payable	150.99	183.35	215.70	215.70	215.70	215.70	215.70	215.70	215.70	215.70
CURRENT LIABILITIES	**150.99**	**183.35**	**215.70**	**215.70**	**215.70**	**215.70**	**215.70**	**215.70**	**215.70**	**215.70**
TOTAL WORKING CAPITAL	**15,663.48**	**19,006.55**	**22,349.62**	**22,349.62**	**22,353.78**	**22,353.78**	**22,353.78**	**22,353.78**	**22,353.78**	**22,353.78**

Appendix 7.A.2

PRODUCTION COST (in 000 Birr)

Item	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Raw Material and Inputs	44,100	53,550	63,000	63,000	63,000	63,000	63,000	63,000	63,000	63,000
Utilities	9,836	11,944	14,052	14,052	14,052	14,052	14,052	14,052	14,052	14,052
Maintenance and repair	903	1,097	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
Labour direct	909	1,104	1,298	1,298	1,298	1,298	1,298	1,298	1,298	1,298
Labour overheads	227	276	325	325	325	325	325	325	325	325
Administration Costs	350	425	500	500	500	500	500	500	500	500
Land lease cost	0	0	0	0	43	43	43	43	43	43
Cost of marketing and distribution	750	750	750	750	750	750	750	750	750	750
Total Operating Costs	**57,076**	**69,145**	**81,215**	**81,215**	**81,258**	**81,258**	**81,258**	**81,258**	**81,258**	**81,258**
Depreciation	6,149	6,149	6,149	6,149	6,149	530	530	530	530	530
Cost of Finance	0	4,342	3,799	3,257	2,714	2,171	1,628	1,086	543	0
Total Production Cost	**63,225**	**79,636**	**91,163**	**90,621**	**90,121**	**83,959**	**83,416**	**82,873**	**82,331**	**81,788**

Appendix 7.A.3
INCOME STATEMENT (in 000 Birr)

Item	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Sales revenue	68,670	83,385	98,100	98,100	98,100	98,100	98,100	98,100	98,100	98,100
Less variable costs	56,326	68,395	80,465	80,465	80,465	80,465	80,465	80,465	80,465	80,465
VARIABLE MARGIN	**12,345**	**14,990**	**17,635**	**17,635**	**17,635**	**17,635**	**17,635**	**17,635**	**17,635**	**17,635**
in % of sales revenue	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98	17.98
Less fixed costs	6,899	6,899	6,899	6,899	6,942	1,323	1,323	1,323	1,323	1,323
OPERATIONAL MARGIN	**5,446**	**8,091**	**10,736**	**10,736**	**10,693**	**16,312**	**16,312**	**16,312**	**16,312**	**16,312**
in % of sales revenue	7.93	9.70	10.94	10.94	10.90	16.63	16.63	16.63	16.63	16.63
Financial costs		4,342	3,799	3,257	2,714	2,171	1,628	1,086	543	0
GROSS PROFIT	**5,446**	**3,749**	**6,937**	**7,479**	**7,979**	**14,141**	**14,684**	**15,227**	**15,769**	**16,312**
in % of sales revenue	7.93	4.50	7.07	7.62	8.13	14.42	14.97	15.52	16.07	16.63
Income (corporate) tax	0	0	0	2,244	2,394	4,242	4,405	4,568	4,731	4,894
NET PROFIT	**5,446**	**3,749**	**6,937**	**5,236**	**5,586**	**9,899**	**10,279**	**10,659**	**11,039**	**11,419**
in % of sales revenue	7.93	4.50	7.07	5.34	5.69	10.09	10.48	10.87	11.25	11.64

Appendix 7.A.4
CASH FLOW FOR FINANCIAL MANAGEMENT (in 000 Birr)

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Scrap
TOTAL CASH INFLOW	**40,728**	**88,432**	**83,417**	**98,132**	**98,100**	**98,100**	**98,100**	**98,100**	**98,100**	**98,100**	**98,100**	**33,634**
Inflow funds	40,728	19,762	32	32	0	0	0	0	0	0	0	0
Inflow operation	0	68,670	83,385	98,100	98,100	98,100	98,100	98,100	98,100	98,100	98,100	0
Other income	0	0	0	0	0	0	0	0	0	0	0	33,634
TOTAL CASH OUTFLOW	**40,728**	**76,837**	**82,290**	**93,817**	**92,143**	**91,797**	**93,099**	**92,719**	**92,339**	**91,959**	**86,151**	**0**
Increase in fixed assets	40,728	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	15,814	3,375	3,375	0	4	0	0	0	0	0	0
Operating costs	0	56,326	68,395	80,465	80,465	80,508	80,508	80,508	80,508	80,508	80,508	0
Marketing and Distribution cost	0	750	750	750	750	750	750	750	750	750	750	0
Income tax	0	0	0	0	2,244	2,394	4,242	4,405	4,568	4,731	4,894	0
Financial costs	0	3,947	4,342	3,799	3,257	2,714	2,171	1,628	1,086	543	0	0
Loan repayment	0	0	5,428	5,428	5,428	5,428	5,428	5,428	5,428	5,428	0	0

SURPLUS (DEFICIT)	**0**	**11,595**	**1,127**	**4,315**	**5,957**	**6,303**	**5,001**	**5,381**	**5,761**	**6,141**	**11,949**	**33,634**
CUMULATIVE CASH BALANCE	**0**	**11,595**	**12,721**	**17,036**	**22,993**	**29,296**	**34,297**	**39,678**	**45,439**	**51,580**	**63,529**	**97,163**

Appendix 7.A.5

DISCOUNTED CASH FLOW (in 000 Birr)

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Scrap
TOTAL CASH INFLOW	**0**	**68,670**	**83,385**	**98,100**	**98,100**	**98,100**	**98,100**	**98,100**	**98,100**	**98,100**	**98,100**	**33,634**
Inflow operation	0	68,670	83,385	98,100	98,100	98,100	98,100	98,100	98,100	98,100	98,100	0
Other income	0	0	0	0	0	0	0	0	0	0	0	33,634
TOTAL CASH OUTFLOW	**56,391**	**60,419**	**72,488**	**81,215**	**83,463**	**83,652**	**85,500**	**85,663**	**85,826**	**85,989**	**86,151**	**0**
Increase in fixed assets	40,728	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	15,663	3,343	3,343	0	4	0	0	0	0	0	0	0
Operating costs	0	56,326	68,395	80,465	80,465	80,508	80,508	80,508	80,508	80,508	80,508	0
Marketing and Distribution cost	0	750	750	750	750	750	750	750	750	750	750	0
Income (corporate) tax		0	0	0	2,244	2,394	4,242	4,405	4,568	4,731	4,894	0
NET CASH FLOW	**-56,391**	**8,251**	**10,897**	**16,885**	**14,637**	**14,448**	**12,600**	**12,437**	**12,274**	**12,111**	**11,949**	**33,634**
CUMULATIVE NET CASH FLOW	**-56,391**	**-48,140**	**-37,243**	**-20,358**	**-5,721**	**8,727**	**21,327**	**33,764**	**46,038**	**58,150**	**70,098**	**103,732**
Net present value	-56,391	7,501	9,006	12,686	9,997	8,971	7,112	6,382	5,726	5,136	4,607	12,967
Cumulative net present value	-56,391	-48,890	-39,885	-27,199	-17,201	-8,230	-1,118	5,264	10,990	16,127	20,734	33,701

NET PRESENT VALUE	33,701
INTERNAL RATE OF RETURN	20.02%
NORMAL PAYBACK	6 years