

**PROFILE ON THE PRODUCTION OF PLASTER OF  
PARIS**

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## **I. SUMMARY**

This profile envisages the establishment of a plant for the production of plaster of Paris with a capacity of 600 tons per annum. It is widely used in the manufacture of models in pottery industry, for making ornamental castings, plaster boards, for building decoration as wall plaster and floor cement and as dentist & orthopedic plaster.

The demand for plaster of Paris is met through domestic production and import. The present (2012) unsatisfied demand for plaster of Paris is estimated at 5,784 tons. The demand for plaster of Paris is projected to reach 9,315 tons and 15,003 tons by the year 2017 and 2022, respectively.

The principal raw materials required is the dehydrated gypsum rock ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) which is available locally.

The total investment cost of the project including working capital is estimated at Birr 2.38 million. From the total investment cost, the highest share (Birr 1.78 million or 75.03%) is accounted by fixed investment cost followed by pre operation cost ( Birr 517.24 thousand or 21.70%) and initial working capital (Birr 78.04 thousand or 3.27%). From the total investment cost, Birr 285.66 thousand or 11.98% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 32.23% and a net present value (NPV) of Birr 2.68 million, discounted at 10%.

The project can create employment for 10 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 backward linkage with the mining sector and forward linkage with the pottery, education materials production, construction and medical instrument supplies sub sectors and also generates income for the Government in terms of tax revenue and payroll tax.

## **II. PRODUCT DESCRIPTION AND APPLICATION**

Plaster of Paris is produced from Gypsum, which is a naturally occurring crystal of calcium sulphate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ). Gypsum is created from the evaporation of sea water that is trapped in

lagoons of subsoil and is usually found in mountains. The impure gypsum (that it is found in the subsoil) can have different color variations, such as grey, brown or red. The pure however plaster color is white. It can be quarried in different parts of the world in slightly different forms. Plaster is made from gypsum by grinding it to powder and then gently heating it to drive off some, or all, of the water of crystallization.

Chemically, Plaster of Paris is calcium sulphate having molecular formula  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ . It is a white hygroscopic powder very slightly soluble in water particularly at high temperature. It is widely used in the manufacture of models in pottery industry, for making ornamental castings, plaster boards and chalk crayons, etc. Other uses of this cheap commodity are for building decoration as wall plaster and floor cement and dentist plaster. It is also used as orthopedic plaster in surgery for setting of broken bones, etc.

### **III. MARKET STUDY AND PLANT CAPACITY**

#### **A. MARKET STUDY**

##### **1. Past Supply and Present Demand**

Although some amount of the demand for Plaster of Paris for some uses like medical and decorative uses is met through import, the major volume of the demand for the product is met through local production in Ethiopia. Previously, the Education Materials Production and Distribution Agency of the Ministry of Education and a few private firms were the domestic suppliers. Now the Agency has stopped producing Plaster of Paris, and the local suppliers of the product are private firms. For the purpose of determining the unsatisfied demand import data of Plaster of Paris during the past twelve years (2000-2011) is shown in Table 3.1.

**Table 3.1**  
**IMPORTS OF PLASTER OF PARIS (TONS)**

<b>Year</b>	<b>Quantity</b>
2000	88.4

2001	35.5
2002	33.1
2003	0.75
2004	19.1
2005	23.3
2006	58.5
2007	-
2008	108.6
2009	37.4
2010	0.45
2011	153.7

**Source:-**Ethiopian Revenues & Customs Authority.

Table 3.1 shows that import of Plaster of Paris during the period under consideration is characterized by high fluctuations. The import data ranges from 0.45 tons and 0.75 tons in the year 2010 & year 2003 to 153.7 tons in 2011. In the remaining years it ranged from the lowest 19.1 tons to the highest 108.6 tons. The average import of the last four years was about 75 tons which is not that much significant compared to the locally produced Plaster of Paris.

A large part of domestic demand for Plaster of Paris is derived from its use for prime coating of new buildings and /or filling pores and cracks. Since transporting and selling Plaster of Paris over a long distance is not a profitable operation, the relevant market is the local or regional market. Data and information on the amount of public and private sector building construction activity is, thus, critical to determine the present effective demand as well as to project future demand.

According to the Three Year Strategic Plan (2009-2011) of Addis Ababa City Administration, 75 health centers, 2 hospitals, 58 primary schools, 14 secondary schools and 30,000 residential houses are envisaged to be built in different Sub-cities/ woredas during the planned period. Apart from these public investments, as a result of increased economic activity in the City Administration, the private sector has also been investing in the construction of schools, hospitals, commercial offices, hotels and residential buildings. Table 3.2 shows the detail of the

anticipated realization of the foregoing building construction activities over three years (2009-2011) period.

**Table 3.2**

**PROJECTED IMPLEMENTATION OF CONSTRUCTION PROJECTS**

Sr. No.	Type Of Construction Projects	Year			Total
		2009	2010	2011	
	<b>Public</b>				
1	Health center	25	25	25	75
2	Hospital	1	-	1	2
3	Primary school (CPS)	15	19	24	58
4	Secondary school	3	6	5	14
5	Residential house (G+0 –G+3)	10,000	10,000	10,00	30,000
	<b>Sub- total</b>	<b>10,044</b>	<b>10,050</b>	<b>10,055</b>	<b>30,149</b>
	<b>Private sector</b>				
6	Health Center/clinics	5	21	2	28
7	Hospital	-	2	1	3
8	Primary school	11	70	7	88
9	Secondary school	2	6	2	10
10	Commercial and Office Buildings	93	622	57	772
11	Industrial Buildings	27	139	15	181
12	Hotels	14	94	26	134
13	Residential Buildings	156	1953	231	2340
14	Others	65	1040	193	1298
	<b>Sub- total</b>	<b>372</b>	<b>3947</b>	<b>534</b>	<b>4854</b>
	<b>Grand Total</b>	<b>10,416</b>	<b>13,996</b>	<b>10,588</b>	<b>35,003</b>

**Sources:** - Calculated from Addis Ababa City Administration Three Year Strategic Plan Document and various CSA Annual Statistical Abstracts.

In order to establish the wall area of various types of buildings, the Education and Health Sub-sector Handbooks from previous studies were referred. For commercial and residential buildings a sample of bill of quantity of various buildings was assessed to establish the average wall area. According to the information obtained from knowledgeable people in the area, for one meter square area of wall, 7 kg of Plaster of Paris is required for prime coating.

The Plaster of Paris requirement calculated by type of building on the basis of the above information is provided in Table 3.3.

**Table 3.3**

**PLASTER OF PARIS REQUIREMENT IN ADDIS ABABA CITY ADMINISTRATION**

Sr. No.	Type of Building	Wall Area (m <sup>2</sup> )	Forecasted Number of Buildings			Forecasted Plaster of Paris Requirement (Tons)		
			2009	2010	2011	2009	2010	2011
1.	Health center	1145	30	46	27	58.20	89.24	52.38
2.	Hospital	2300	1	2	2	3.91	7.82	7.82
3.	Primary school	398	26	89	31	34.58	118.37	41.23
4.	<b>Secondary school</b>	1570	5	12	7	13.35	32.04	18.69
5.	Residential house							
	1) G+0	230	2031	1076	818	79.20	42.00	31.90
	2) G+1	460	1523	1793	1330	118.80	139.85	103.37
	3) G+2	690	1016	2391	2046	118.87	279.75	239.38
	4) G+3	920	5586	6693	7237	871.42	1044.11	1128.97
6	Commercial and all non-residential build.							
	a)G+0	800	24	257	51	3.26	34.95	6.94
	b)G+1	1600	26	145	49	70.72	394.40	133.28
	c) G+2	2400	20	342	48	81.60	1395.36	195.84
	d) G+3	3200	43	523	43	233.92	2845.12	233.92
	e) G+4	4000	39	357	45	265.20	2427.60	306.00
	f) G+5	4800	20	121	29	163.20	987.36	236.64
	g) G+6	5600	27	140	26	257.04	1332.80	247.52
	<b>Total</b>					<b>2,373.27</b>	<b>11,170.80</b>	<b>2,983.88</b>

As shown in Table 3.3, the total demand estimated for the year 2009 is about 2,373 tons of Plaster of Paris. However, due to large number of permits given to the private sector by the Addis Ababa City Administration, particularly for residential and non-residential building in 2010, the figure jumped from 2,373 tons in 2009 to 11,170 tons of Plaster of Paris in 2010, and again it declined to 2,983 tons in 2011. Hence, to estimate the present effective demand the average of the three years, which is 5,509 tons of Plaster of Paris has been considered. Assuming that there would be wastage during utilization, 5% allowance has been made and thus the present demand for the project to be established in Addis Ababa City Administration for the year 2012 is estimated at 5,784 tons of Plaster of Paris.

## 2. Demand Projection

The demand for Plaster Paris in Addis Ababa City Administration is forecasted on the basis of projected implementation of buildings construction projects as indicated in Table 3.3 (with 5% adjustment for waste). Taking into account the fast growing rate of the construction sector as well as the overall economic growth of the country, (which has been growing at an annual growth rate of about 11% for the recent past years), an annual average growth rate of 10% has been used for the demand projection. The projected demand for Plaster of Paris is given in Table 3.4.

**Table 3.4**

### **PROJECTED DEMAND FOR PLASTER OF PARIS**

<b>Year</b>	<b>Projected Demand (Tons)</b>
2013	6,362
2014	6,998
2015	7,698
2016	8,468
2017	9,315
2018	10,247
2019	11,272
2020	12,399
2021	13,639
2022	15,003
2023	16,503
2024	18,153

## 3. Pricing and Distribution

The current price of locally produced gypsum (Plaster of Paris) in Addis Ababa is Birr 375 per quintal and could be used as a base for financial analysis of the project.

The product can find its market outlet through the existing building materials distribution enterprises.

## B. PLANT CAPACITY AND PRODUCTION PROGRAM

### 1. Plant Capacity



Considering the market study and minimum economic scale, the plant is proposed to have a theoretical production capacity of 500 tons of Plaster of Paris per annum assuming 300 working days a year.

## 2. Production Program

The plant is assumed to start production at 70% of the full capacity due to the problem of market penetration with a 15% capacity build-up until it reaches 100% in the third year and then after.

## IV. RAW MATERIALS AND INPUTS

### A. RAW MATERIALS

The raw material required for the manufacture of Plaster of Paris is the dehydrated gypsum rock ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ). The plant will have its own gypsum quarry. It also needs water-proof bag for packing the product in 10kg, 20 kg and 50kg. The annual demand of raw materials and their costs at full capacity operation is depicted in Table 4.1.

**Table 4.1**

### **ANNUAL RAW MATERIAL REQUIREMENT AND COST**

<b>Sr. No.</b>	<b>Description</b>	<b>Consumption</b>	<b>Cost (Birr)</b>
1	Royalty	(3% of sales)	60,000
2	Packing material	12,000 pcs	80,000
	<b>Grand Total</b>		<b>140,000</b>

### B. UTILITIES

Electricity, fuel oil and water are the basic utilities required by the plant. Annual requirements of utilities at full capacity operation of the plant and their costs are depicted in Table 4.2.

**Table 4.2**

**ANNUAL UTILITIES REQUIREMENT AND ESTIMATED COSTS**

<b>Sr. No.</b>	<b>Description</b>	<b>Consumption</b>	<b>Total Cost (Birr)</b>
1	Electric power (kWh)	50,000	29,000
2	Fuel (lt)	15,500	224,750
3	Water (m <sup>3</sup> )	1,900	19,000
	<b>Grand Total</b>		<b>272,750</b>

**V. TECHNOLOGY AND ENGINEERING**

**A. TECHNOLOGY**

**1. Production Process**

The process for production of plaster of Paris consists of the following operations:

- Quarrying of gypsum
- Storage
- Calcinations
- Grinding of gypsum
- Heating in the iron retort
- Grinding and packing

Gypsum or calcium sulphate dehydrate is quarried from the quarry and then it is first ground to powder in a ball mill or roller mill. It is, then, charged into vertical retort. As soon as the powder gypsum strikes the hot bottom, dehydration begins. The mass is, then, heated to 120 to 130°C and the heating is continued. Agitator is used in the retort to facilitate the mixing of non-hydrated gypsum with the Plaster of Paris. Temperature rises rapidly and when the temperature reaches 160°C, the charge is thrown out. The product obtained is calcined gypsum or Plaster of Paris. It is cooled and stored. It is again ground in the same ball mill and then screened in a 200

mesh size screen. It is packed in 10 kg, 20 kg and 50 kg water proof bags in order to avoid contact with moisture.

## 2. Environmental Impact Assessment

The envisaged plant doesn't have any adverse impact to the environment.

## B. ENGINEERING

### 1. Machinery and Equipment

The list of machinery and equipment required by the project is shown in Table 5.1. The cost of machinery and equipment is estimated to be Birr 375,558 of which Birr 285,666 is required in foreign currency.

**Table 5.1**  
**LIST OF MACHINERY AND EQUIPMENT REQUIRED**

<b>Description</b>	<b>Qty</b>	<b>Price/Unit</b>	<b>Total Price</b>
Hammer Crusher	1	87,946	87,946
Roller Dryer with Blowers	2	57,397	114,793
Grinding Machine	2	18,515	37,030
Weighing Machine	1	1,018	1,018
Welding Plant	1	1,203	1,203
Generator (25KVA)	1	83,317	83,318
Electric Panel / Change over	1	9,258	9,258
Safety Switch Board	1	926	926
Transformer (25 KVA)	1	18,515	18,515
Hand Trolleys	4	296	1,185
Misc. Tools	1	1,851	1,852
Installation Cost		18,515	18,515
<b>Grand Total</b>			<b>375,558</b>

### 2. Land, Building and Civil Works

The total area of land required by the project is estimated to be 500 m<sup>2</sup>, out of which 87.5 m<sup>2</sup> will be built-up area. Construction cost, at a rate of Birr 3,200 per m<sup>2</sup>, is estimated to be Birr 800,000.

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<sup>2</sup>, 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<sup>2</sup>, 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<sup>2</sup>. 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<sup>2</sup>. 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<sup>2</sup> (see Table 5.2).

**Table 5.2**

**NEW LAND LEASE FLOOR PRICE FOR PLOTS IN ADDIS ABABA**

<b>Zone</b>	<b>Level</b>	<b>Floor Price/m<sup>2</sup></b>
Central Market District	1 <sup>st</sup>	1686
	2 <sup>nd</sup>	1535
	3 <sup>rd</sup>	1323
	4 <sup>th</sup>	1085
	5 <sup>th</sup>	894
Transitional zone	1 <sup>st</sup>	1035

<b>Zone</b>	<b>Level</b>	<b>Floor Price/m<sup>2</sup></b>
	2 <sup>nd</sup>	935
	3 <sup>rd</sup>	809
	4 <sup>th</sup>	685
	5 <sup>th</sup>	555
Expansion zone	1 <sup>st</sup>	355
	2 <sup>nd</sup>	299
	3 <sup>rd</sup>	217
	4 <sup>th</sup>	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<sup>2</sup> 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 criteria 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**

<b>Scored Point</b>	<b>Grace Period</b>	<b>Payment Completion Period</b>	<b>Down Payment</b>
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<sup>2</sup> is estimated at Birr 133,000 of which 10% or Birr 13,300 will be paid in advance. The remaining Birr 119,700 will be paid in equal installments with in 28 years i.e. Birr 4,275 annually

**NB:** The land issue in the above statement narrates or shows only Addis Ababa’s city administration land lease price, policy and regulations.

Accordingly the project profile prepared based on the land lease price of Addis Ababa region.

To know land lease price, police and regulation of other regional state of the country updated information is available at Ethiopian Investment Agency’s website [www.eia.gov.et](http://www.eia.gov.et) on the factor cost.

## **VI. HUMANRESOURCE AND TRAINING REQUIREMENT**

### **A. HUMANRESOURCE REQUIREMENT**

The total human resource requirement of the plant is 10 persons. Annual cost of labor is Birr 211,680. Details of human resource and estimated labor cost are indicated in Table 6.1.

**Table 6.1**

#### **HUMANRESOURCE REQUIREMENT AND LABOR COST (BIRR)**

<b>Sr. No.</b>	<b>Description</b>	<b>Req. No.</b>	<b>Salary</b>	
			<b>Monthly</b>	<b>Annual</b>
1	Supervisor	1	4000	48,000
2	Machine operator	2	3000	36,000
3	Mechanic/Electrician	1	2500	30,000
4	laborer	4	3200	38,400
5	Accountant & store keeper	1	1200	14,400
6	Guard	1	800	9,600
	<b>Sub-total</b>	<b>10</b>		<b>176,400</b>
	Employee's benefit (20%)			35,280
	<b>Total</b>	<b>10</b>		<b>211,680</b>

### **B. TRAINING REQUIREMENT**

The technology of production of Plaster of Paris is so simple that the production supervisor and operators will be trained on-site for one week by the equipment supplier expert during erection and commissioning. The cost of training is estimated to be Birr 90,000.

## VII. FINANCIAL ANALYSIS

The financial analysis of the plaster of Paris 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	5 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 2.38 million (see Table 7.1). From the total investment cost, the highest share (Birr 1.78 million or 75.03%) is accounted by fixed investment cost followed by pre operation cost ( Birr 517.24 thousand or 21.70%) and initial working capital (Birr 78.04 thousand or 3.27%). From the total investment cost, Birr 285.66 thousand or 11.98% is required in foreign currency.

**Table 7.1**  
**INITIAL INVESTMENT COST ('000 Birr)**

Sr. No.	Cost Items	Local Cost	Foreign Cost	Total Cost	% Share
<b>1</b>	<b>Fixed investment</b>				
1.1	Land Lease	13.30		13.30	0.56
1.2	Building and civil work	800.00		800.00	33.56
1.3	Machinery and equipment	89.90	285.66	375.56	15.75
1.4	Vehicles	450.00		450.00	18.87
1.5	Office furniture and equipment	150.00		150.00	6.29
	<b>Sub -total</b>	<b>1,503.20</b>	<b>285.66</b>	<b>1,788.86</b>	<b>75.03</b>
<b>2</b>	<b>Pre operating cost *</b>				
2.1	Pre operating cost	361.27		361.27	15.15
2.2	Interest during construction	155.97		155.97	6.54



	<b>Sub -total</b>	<b>517.24</b>		<b>517.24</b>	<b>21.70</b>
<b>3</b>	<b>Working capital**</b>	<b>78.04</b>		<b>78.04</b>	<b>3.27</b>
	<b>Grand Total</b>	<b>2,098.49</b>	<b>285.66</b>	<b>2,384.15</b>	<b>100</b>

\* 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 104.76 thousand. However, only the initial working capital of Birr 78.04 thousand during the first year of production is assumed to be funded through external sources. During the remaining years the working capital requirement will be financed by funds to be 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 1.38 million (see Table 7.2). The cost of raw material and utility account for 29.90% of the production cost. The other major components of the production cost are depreciation, labor and financial cost which account for 20.59, 12.74% and 9.32%, respectively. The remaining 27.44 % is the share of repair and maintenance, labor overhead, administration cost and depreciation. For detail production cost see Appendix 7.A.2.

**Table 7.2**

### **ANNUAL PRODUCTION COST AT FULL CAPACITY (YEAR FOUR)**

<b>Items</b>	<b>Cost ( 000 Birr)</b>	<b>%</b>
Raw Material and Inputs	140.00	10.14
Utilities	273.00	19.77
Maintenance and repair	19.00	1.38
Labor direct	176.00	12.74
Labor overheads	35.00	2.53
Administration Costs	125.00	9.05
Land lease cost	-	-
Cost of marketing and distribution	200.00	14.48
<b>Total Operating Costs</b>	<b>968.00</b>	<b>70.09</b>
Depreciation	284.37	20.59
Cost of Finance	128.68	9.32
<b>Total Production Cost</b>	<b>1,381.04</b>	<b>100</b>

## C. FINANCIAL EVALUATION

### 1. Profitability

Based on the projected profit and loss statement, the project will generate a profit through out its operation life. Annual net profit after tax will grow from Birr 291 thousand to Birr 599 thousand during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 5.68 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.

$$\text{Break- Even Sales Value} = \frac{\text{Fixed Cost} + \text{Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 820,403$$

$$\text{Break -Even Capacity utilization} = \frac{\text{Break- even Sales Value}}{\text{Sales revenue}} \times 100 = 44 \%$$

### 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 3 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 32.23% 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 2.68 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 10 persons. The project will generate Birr 1.21 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 pottery, education materials production, construction and medical instrument supplies sub sectors and also generate other income for the Government.



## **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	24.50	28.00	31.50	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Accounts receivable	61.47	67.87	74.27	80.67	81.02	81.02	81.02	81.02	81.02	81.02
Cash-in-hand	3.45	3.94	4.44	4.93	4.99	4.99	4.99	4.99	4.99	4.99
<b>CURRENT ASSETS</b>	<b>89.42</b>	<b>99.81</b>	<b>110.20</b>	<b>120.60</b>	<b>121.01</b>	<b>121.01</b>	<b>121.01</b>	<b>121.01</b>	<b>121.01</b>	<b>121.01</b>
Accounts payable	11.38	13.00	14.63	16.25	16.25	16.25	16.25	16.25	16.25	16.25
<b>CURRENT LIABILITIES</b>	<b>11.38</b>	<b>13.00</b>	<b>14.63</b>	<b>16.25</b>	<b>16.25</b>	<b>16.25</b>	<b>16.25</b>	<b>16.25</b>	<b>16.25</b>	<b>16.25</b>
<b>TOTAL WORKING CAPITAL</b>	<b>78.04</b>	<b>86.81</b>	<b>95.58</b>	<b>104.35</b>	<b>104.76</b>	<b>104.76</b>	<b>104.76</b>	<b>104.76</b>	<b>104.76</b>	<b>104.76</b>

**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	98	112	126	140	140	140	140	140	140	140
Utilities	191	218	246	273	273	273	273	273	273	273
Maintenance and repair	13	15	17	19	19	19	19	19	19	19
Labour direct	123	141	158	176	176	176	176	176	176	176
Labour overheads	25	28	32	35	35	35	35	35	35	35
Administration Costs	88	100	113	125	125	125	125	125	125	125
Land lease cost	0	0	0	0	4	4	4	4	4	4
Cost of marketing and distribution	200	200	200	200	200	200	200	200	200	200
<b>Total Operating Costs</b>	<b>738</b>	<b>814</b>	<b>891</b>	<b>968</b>	<b>972</b>	<b>972</b>	<b>972</b>	<b>972</b>	<b>972</b>	<b>972</b>
Depreciation	284	284	284	284	284	47	47	47	47	47
Cost of Finance	0	172	150	129	107	86	64	43	21	0
<b>Total Production Cost</b>	<b>1,022</b>	<b>1,270</b>	<b>1,326</b>	<b>1,381</b>	<b>1,364</b>	<b>1,105</b>	<b>1,084</b>	<b>1,062</b>	<b>1,041</b>	<b>1,019</b>

**Appendix 7.A.3**  
**NET 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	1,313	1,594	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875
Less variable costs	538	614	691	768	768	768	768	768	768	768
<b>VARIABLE MARGIN</b>	<b>775</b>	<b>980</b>	<b>1,184</b>	<b>1,107</b>	<b>1,107</b>	<b>1,107</b>	<b>1,107</b>	<b>1,107</b>	<b>1,107</b>	<b>1,107</b>
in % of sales revenue	59.06	61.46	63.14	59.04	59.04	59.04	59.04	59.04	59.04	59.04
Less fixed costs	484	484	484	484	489	251	251	251	251	251
<b>OPERATIONAL MARGIN</b>	<b>291</b>	<b>495</b>	<b>699</b>	<b>623</b>	<b>618</b>	<b>856</b>	<b>856</b>	<b>856</b>	<b>856</b>	<b>856</b>
in % of sales revenue	22.17	31.07	37.30	33.21	32.98	45.64	45.64	45.64	45.64	45.64
Financial costs		172	150	129	107	86	64	43	21	0
<b>GROSS PROFIT</b>	<b>291</b>	<b>324</b>	<b>549</b>	<b>494</b>	<b>511</b>	<b>770</b>	<b>791</b>	<b>813</b>	<b>834</b>	<b>856</b>
in % of sales revenue	22.17	20.31	29.30	26.34	27.26	41.06	42.21	43.35	44.49	45.64
Income (corporate) tax	0	0	0	0	0	231	237	244	250	257
<b>NET PROFIT</b>	<b>291</b>	<b>324</b>	<b>549</b>	<b>494</b>	<b>511</b>	<b>539</b>	<b>554</b>	<b>569</b>	<b>584</b>	<b>599</b>
in % of sales revenue	22.17	20.31	29.30	26.34	27.26	28.74	29.55	30.35	31.15	31.95



**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
<b>TOTAL CASH INFLOW</b>	<b>2,150</b>	<b>1,558</b>	<b>1,596</b>	<b>1,877</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>754</b>
Inflow funds	2,150	245	2	2	0	0	0	0	0	0	0	0
Inflow operation	0	1,313	1,594	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	0
Other income	0	0	0	0	0	0	0	0	0	0	0	754
<b>TOTAL CASH OUTFLOW</b>	<b>2,150</b>	<b>983</b>	<b>1,211</b>	<b>1,266</b>	<b>1,322</b>	<b>1,294</b>	<b>1,504</b>	<b>1,488</b>	<b>1,473</b>	<b>1,458</b>	<b>1,229</b>	<b>0</b>
Increase in fixed assets	2,150	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	89	10	10	10	0	0	0	0	0	0	0
Operating costs	0	538	614	691	768	772	772	772	772	772	772	0
Marketing and Distribution cost	0	200	200	200	200	200	200	200	200	200	200	0
Income tax	0	0	0	0	0	0	231	237	244	250	257	0
Financial costs	0	156	172	150	129	107	86	64	43	21	0	0
Loan repayment	0	0	214	214	214	214	214	214	214	214	0	0
<b>SURPLUS (DEFICIT)</b>	<b>0</b>	<b>575</b>	<b>385</b>	<b>610</b>	<b>553</b>	<b>581</b>	<b>371</b>	<b>387</b>	<b>402</b>	<b>417</b>	<b>646</b>	<b>754</b>
<b>CUMULATIVE CASH BALANCE</b>	<b>0</b>	<b>575</b>	<b>960</b>	<b>1,571</b>	<b>2,124</b>	<b>2,705</b>	<b>3,076</b>	<b>3,463</b>	<b>3,864</b>	<b>4,281</b>	<b>4,927</b>	<b>5,681</b>

**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
<b>TOTAL CASH INFLOW</b>	<b>0</b>	<b>1,313</b>	<b>1,594</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>1,875</b>	<b>754</b>
Inflow operation	0	1,313	1,594	1,875	1,875	1,875	1,875	1,875	1,875	1,875	1,875	0
Other income	0	0	0	0	0	0	0	0	0	0	0	754
<b>TOTAL CASH OUTFLOW</b>	<b>2,228</b>	<b>746</b>	<b>823</b>	<b>900</b>	<b>968</b>	<b>972</b>	<b>1,203</b>	<b>1,210</b>	<b>1,216</b>	<b>1,223</b>	<b>1,229</b>	<b>0</b>
Increase in fixed assets	2,150	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	78	9	9	9	0	0	0	0	0	0	0	0
Operating costs	0	538	614	691	768	772	772	772	772	772	772	0
Marketing and Distribution cost	0	200	200	200	200	200	200	200	200	200	200	0
Income (corporate) tax		0	0	0	0	0	231	237	244	250	257	0
<b>NET CASH FLOW</b>	<b>-2,228</b>	<b>567</b>	<b>771</b>	<b>975</b>	<b>907</b>	<b>903</b>	<b>672</b>	<b>665</b>	<b>659</b>	<b>652</b>	<b>646</b>	<b>754</b>
<b>CUMULATIVE NET CASH FLOW</b>	<b>-2,228</b>	<b>-1,662</b>	<b>-891</b>	<b>84</b>	<b>991</b>	<b>1,894</b>	<b>2,565</b>	<b>3,231</b>	<b>3,890</b>	<b>4,542</b>	<b>5,188</b>	<b>5,942</b>
Net present value	-2,228	515	637	733	619	561	379	341	307	277	249	291
Cumulative net present value	-2,228	-1,713	-1,076	-343	276	836	1,215	1,557	1,864	2,141	2,390	2,681

NET PRESENT VALUE                    2,681  
INTERNAL RATE OF RETURN            32.23%  
NORMAL PAYBACK                        3 years

