46. PROFILE ON THE PRODUCTION OF FERTILIZER

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I. SUMMARY

This profile envisages the establishment of a plant for the production of fertilizer with a capacity of 20,000 tones or 200,000 quintals per annum. Fertilizers are chemical compounds spread on or worked into soil to increase its capacity to support plant growth.

The demand for fertilizer is met through import. The present (2012) demand for fertilizer is estimated at 209,969 tons. The demand for fertilizeris projected to reach 242,926 tons and 284,361tons by the year 2017 and 2022, respectively.

The principal raw materials required are chemicals (like sulfur, iron, vanadium pent oxide, etc.), bags, sewing thread, elastic labels, polyethylene bags, needle sinkers, and buttons. The chemicals have to be totally imported while bags, sewing thread, elastic labels, and polyethylene bags are available locally.

The total investment cost of the project including working capital is estimated at Birr 221.65 million. From the total investment cost the highest share (Birr 175.94 million or 79.38%) is accounted by fixed investment cost followed by pre operation cost (Birr 22.92 million or 10.34%) and initial working capital (Birr 22.78 million or 10.28%). From the total investment cost, Birr 140.40 million or 63.34% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 26.79% and a net present value (NPV) of Birr 178.52 million, discounted at 10%.

The project can create employment for 60 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 sector and also generates income for the Government in terms of tax revenue and payroll tax.

II. PRODUCT DESCRIPTION AND APLICATION

Fertilizers are chemical compounds spread on or worked into soil to increase its capacity to support plant growth. Fertilizers are food that plants need. Just as human beings need different

nutritional elements such as proteins, vitamins and carbohydrates, plants need different nutrients and minerals for healthy growth.

There are different types of fertilizers, among them urea ($CO(NH_2)_2$, which is Nitrogenous fertilizer is considered in the envisaged project. Urea has the highest nitrogen content of all solid nitrogenous fertilizers in common use. Urea, when chemically pure, is a colorless, crystalline material analyzing 46.6% Nitrogen by weight. Its production is based on the reaction of ammonia with carbon dioxide.

II. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Fertilizers are natural or synthetic chemical substances or mixtures used to enrich soil so as to promote plant growth. They are applied *via* the soil and provide safe and healthy supply of food and nutrient. The three elements (nutrients) that most commonly must be supplied from fertilizers for the proper growth and development of the plant are nitrogen, phosphorous and potassium.

The Ethiopian economy is dominated by the agricultural sector and it is mainly dependent on rainfall. The sector in turn depends on intermediate inputs like fertilizers. The available data shows recently the agriculture sector is consuming fertilizers at a very high quantity as compared with previous times. The total demand for fertilizers is met through import. The total imported supply of fertilizer (urea) during 2001-2011 is shown in Table 3.1.

Table 3.1

IMPORT OF FERTILIZER

Year	Quantity (Tons)	Value (Birr)
2001	225,038	101,276,087
2002	313,992	190,669,850
2003	208,993	120,255,755
2004	362,769	180,102,189
2005	96,559	263,735,575
2006	135,849	372,187,325
2007	74,978	278,305,367
2008	135,550	635,764,832
2009	216,363	910,408,657
2010	188,557	1,020,872,012
2011	167,725	1,403,726,581
Total	**2,126,3731**	**5,477,304,230**
Average	193,307	497,936,748

Source: - *Ethiopian Revenues & Customs Authority.*

Table 3.1 shows that during the period 2001-2011 the import figure in 2004 which was 362,769 tons appears to be the highest record in eleven years. But there were fluctuations in the import data throughout the period. During 2001- 2004, the data ranges from the lowest 208,993 tons to the highest figure 362,769 tons with an average of 277,698 tons. It declined from 362,769 tons in 2004 to 96,559 tons in 2005, which is about a four times decline. During 2005--2008 the figure shows ups and downs varying from the lowest 74,978 tons to the highest of 135,849 tons with an average figure of 110,734 tons. During the period 2009--2011 the average import figure of

fertilizer was 190,881 tons while the annual average of the whole period (2001--2011) was 193,307 tons.

For the projection of present demand for the product, to be more realistic the average import of the last three years (2009--2011) which is 190,881 tons has been taken as a current demand. The annual average growth rate of the whole period (2001--2011), which is 10%, has also been considered. Accordingly, the current effective demand for 2012 for fertilizer has been estimated at 209,969 tons.

2. Demand Projection

The demand for Fertilizer has a direct relationship with the growth in population and the resulting demand for food. Hence, it is possible to project the demand of fertilizer in Ethiopia based on the growth rate of population. The recent (2011) growth rate of population is about 3.2%. Assuming this growth rate will be constant for years to come, the rate has been taken for this study.

Table 3.2

PROJECTED DEMAND FOE FERTILIZERS (TONS)

Year	Projected Demand
2013	216,688
2014	223,622
2015	230,778
2016	238,163
2017	242,926
2018	250,699
2019	258,721
2020	267,000
2021	275,544
2022	284,361
2023	293,460

3. Pricing and Distribution

According to the data obtained from the Ethiopian Customs Authority External Trade Statistics, the average of recent year (2011) CIF price of Fertilizer (urea) has been calculated to be Birr 7,369 per ton. Assuming 35% of this price for import duty, port handling, inland transport bank service, and other clearing expenses, the factory gate price for the plant to be established is estimated to be Birr 9,211 per ton.

Regarding the distribution of the product, it could be sold through agents, and it is recommended that fertilizer as a seasonal, input, providing users (farmers) at the right time is extremely important which needs the capacity of the agent to handle the required stock.

B. PLANT CAPACITY AND PRODUCTION PROGRAM

1. Plant Capacity

Based on the demand projection indicated in the market analysis part, and considering technological aspect of the project an annual production of 20,000 tones or 200,000 quintals fertilizer would be established. The plant will operate double shift 16 hours a day and 300 days a year.

2. Production Program

Production is intended to start at 75% of capacity during the initial period due to time requirement for establishing potential market outlets. Production will then rise to 85% and 100% in the second and third year, respectively. Production build-up program is shown in Table 3.3 below.

Table 3.3

PRODUCTION PROGRAM

Year	1	2	3 and above
Capacity utilization (%)	75	85	100
Production (tons)	15,000	17,000	20,000

IV. MATERIALS AND INPUT

A. RAW AND AUXILIARY MATERIALS

- **Ammonia**

Ammonia, which is the essential raw material for nitrogen base fertilizers, is produced inside the facility itself. Ammonia is produced by catalytic reaction of H_2 and N_2. Hydrogen can be produced by electrolysis of water (very limited), from steam reforming of natural gas and partial oxidation of naphtha and fuel oil.

Since nitrogen makes up a significant portion of the earth's atmosphere, a process was developed to produce ammonia from air. In this process, natural gas and steam are pumped into a large vessel. Next, air is pumped into the system, and oxygen is removed by the burning of natural gas and steam. This leaves primarily nitrogen, hydrogen, and carbon dioxide. The carbon dioxide is removed and ammonia is produced by introducing an electric current into the system. Catalysts such as magnetite (Fe) have been used to improve the speed and efficiency of ammonia synthesis.

- **Acid (Sulphuric, Nitric)**

Large quantities of acids are also used, namely sulphuric acid, nitric acid and phosphoric acid. In all fertilizers plants those acids are produced on-site. Raw sulphur is considered the main raw material for the production of sulphuric acid. The production of nitric acid is based on the on-site produced ammonia.

- **Catalysits**

The involved catalysts in the fertilizers industry are as follows:

In ammonia production:

CoO, MoO_3 and ZnO for sulphur removal.

NiO for primary and secondary reformers.

Iron oxide and chromium for CO high shift conversion and copper oxide and zinc oxide for low shift.

NiO catalyst for methanation.

Iron promoted catalyst for ammonia synthesis.

In nitric acid production: platinum/ rhodium catalyst.

In sulphuric acid production: vanadium pentoxide catalyst.

These catalysts are usually not considered as inputs; instead they are considered part of the equipments. This is related to nature of the reactors in this industry, which are fixed bed reactors. Hence the catalysts only aid the reaction, without reacting themselves. According to several factors, catalysts lose their activity after long operating hours which defer from a catalyst to another. Consequently, they need to be regenerated, usually on-site except for the very expensive catalysts such as platinum alloy catalyst which is regenerated in the manufacturing company.

- **Others**

Solvents, carbon dioxide, ground dolomite as coating materials and limestone are also used in fertilizers industry.

Therefore, annual requirement of raw material at full capacity operation and their corresponding cost of Birr 87.41 million are indicated in Table 4.1.

Table 4.1

ANNUAL RAW & AUXILIARY MATERIALS REQUIREMENT AND COST

Sr.No.	Description	Qty	UOM	Average Unit Price	Cost ('000 Birr)		
					FC	LC	TC
1	Chemicals (like sulfur, iron, vanadium pentoxide, etc.)	225,000	Quintals	260	58,500.00		58,500.00
2	Bags	201,000	pcs	15		3,015.00	3,015.00
3	Sewing thread, elastic labels, polyethylene bags, etc.	LS	-	-	-	9,130.00	9,130.00
4	Needle sinkers, buttons, etc	LS	-	-	6,640.00	2,656.00	9,296.00
5	Miscellaneous	LS	-	-	5,810.00	1,660.00	7,470.00
Grand Total Cost					**70,950.00**	**16,461.00**	**87,411.00**

B. UTILITIES

Large quantities of water are consumed for several purposes involving cooling, process, steam generating, floor washing and cleaning etc. Steam is generated in these plants in huge quantities for heating, reforming, stripping and other purposes. This steam is generated in boilers by furnace oil combustion. Air is also necessary for some operations such as drying and cooling. Annual cost of utilities, including electricity, at full capacity production is estimated at Birr 11.21 million, as shown in Table 4.2.

Table 4.2

ANNUAL REQUIREMENT OF UTILITIES AND COST

Sr.No.	Description	Annual Consumption	UOM	Unit Cost (Birr)	Total Cost ("000) Birr
1	Electricity	150,000	kWh	0.65	97.50
2	Water	12,000	M^3	10.00	120.00
3	Furnace oil	550,000	Lt.	20.00	11,000.00
Grand Total Cost					**11,217.50**

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

Fertilizers industry is considered one of the complex chemical sectors, which includes several production lines and service units. The production lines unit for Nitrogenous fertilizers is for example summarized here under:

- Ammonia production,
- Nitric acid production,
- Ammonium nitrate production,
- Diammonium phosphate production,
- Ammonium sulphate production, and
- Urea production.

While ammonia itself is sometimes used as a fertilizer, it is often converted to other substances for ease of handling. Nitric acid is produced by first mixing ammonia and air in a tank. In the presence of a catalyst, a reaction occurs which converts the ammonia to nitric oxide. The nitric oxide is further reacted in the presence of water to produce nitric acid. Nitric acid and ammonia are used to make ammonium nitrate. This material is a good fertilizer component because it has a high concentration of nitrogen. The two materials are mixed together in a tank and a neutralization reaction occurs, producing ammonium nitrate. This material can then be stored until it is ready to be granulated and blended with the other fertilizer components.

To produce fertilizer in the most usable form, each of the different compounds, ammonium nitrate, potassium chloride, ammonium phosphate, and triple superphosphate are granulated and blended together. One method of granulation involves putting the solid materials into a rotating drum which has an inclined axis. As the drum rotates, pieces of the solid fertilizer take on small spherical shapes. They are passed through a screen that separates out adequately sized particles. A coating of inert dust is then applied to the particles, keeping each one discrete and inhibiting moisture retention. Finally, the particles are dried, completing the granulation process.

The different types of particles are blended together in appropriate proportions to produce a composite fertilizer. The blending is done in a large mixing drum that rotates a specific number of turns to produce the best mixture possible. After mixing, the fertilizer is emptied onto a conveyor belt, which transports it to the bagging machine.

2. Environmental impact

Environmental issues concerning the production of fertilizers include potential pollution of air, water and land. There are hazards to be avoided in each part of the production chain, as well as questions of occupational health and safety for all those who work in close proximity to these products.

Atmospheric pollutants emitted by the fertilizer industry can include gaseous ammonia (NH_3) and ammonium salt aerosols, nitric and nitrous oxides (NO and N_2O), carbon dioxide (CO_2) fluorine – as silicon fluoride (SiF_4) and hydrogen fluoride (HF) – sulphur oxides (SO_x), fertilizer dust and acid mists. Naturally occurring radiation (from phosphogypsum) may also be present.

Waste waters from fertilizer manufacturing plant can include compounds of nitrogen, phosphate, potassium, sodium, silica, sulphur, fluorine as well as sludges and polluted wash water.

Solid wastes or by-products, which may or may not be reprocessed, can include phosphogypsum, pyrite ashes, calcium carbonate, soluble salts from potash refining, sand and, not least, the plastic bags used to transport the fertilizer. Several chemical residues are generated from the catalysts and other associated operations, and they require special management procedures. In addition, the fertilizer product itself can carry impurities to the soil, mostly in negligible amounts.

Building a fertilizer production facility is a major investment that is intended to last for decades. New plants are able to incorporate innovative technologies with better environmental performances. Accordingly, for the envisaged plant the cost of waste and emission treatment system is included in the cost of machinery and equipment.

B. ENGINEERING

1. Plant Machinery and Equipment

According to the recent fertilizer production plant price data, 20,000 tons of urea it estimated at a total cost of Birr 161.46 million. Table 5.1 below shows the details of machinery and equipment required for urea fertilizer manufacturing plant.

Table 5 .1

LIST OF MACHINERY AND EQUIPMENT AND COST

Description	Qty.	Total Cost ('000 Birr)		
		FC	LC	TC
Urea production plant with a basic specifications of: 1.Nitrogen: 46.0% Min 2.Biuret: 1.0% Max 3.Moisture: 0.5% Max 4.Size(0.85-2.80mm): 90% Min **&** **Comprising the followings:** 1. Urea reaction autoclave 2. Pre-heater 3. Evaporator 4.Pilling headers 5. Melt tank 6. Pumps 7. Conveyor systems 8. Cooling towers 9. Boilers 10. Pelletizing equipment 11. Auxiliary equipment	Set	140,400.00	-	140,400.00
12. Waste and emission treatment system				
CIF (15%)		-	21,060.00	21,060.00
Total Cost		**140,400.00**	**21,060.00**	**161,460.00**

2. Land, Building and Civil Works

Nitrogen fertilizer processing plant requires land for open storage of raw materials, a shed for storage of finished product, land for processing plant, for office building and general purpose buildings. It is proposed that a total land area of 5,000 square meters, including land for future expansion, will be required. The built-up area is estimated to be 2,500 m^2, and at the rate of Birr 5,000 per m^2, the expenditure on building will be Birr 12.5 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.

VII. HUMAN RESOURCE AND TRAINING REQUIREMENT

A. HUMAN RESOURCE REQUIREMENT

The processing plant requires a total of 60 employees for direct production, and administration staff. Details of human resource required for the plant, including a total annual salary of Birr 1,255,680 is given in Table 6.1.

Table 6.1

HUMAN RESOURCE REQUIREMENT AND LABOR COST

Sr.No.	Description	No. of Persons	Monthly Salary (Birr)	Annual salary ("000) Birr
1	Plant manager	1	6,000.00	72.0
2	Secretary	1	1,500.00	18.0
3	Administration and finance	1	3,500.00	42.0
4	Accountant	1	2,000.00	24.0
5	Mechanic	2	2,200.00	52.8
6	Electrician	2	2,200.00	52.8
7	operators	30	1,400.00	504.0
8	production foreman	2	3,000.00	72.0
11	Clerk	1	800.00	9.6
12	Cashier	1	1,000.00	12.0
13	Assistant operator	10	700.00	84.0
14	Quality supervisor	2	1,600.00	38.4
15	store keeper	1	1,400.00	16.8
16	time keeper	1	1,200.00	14.4
17	Guards	4	700.00	33.6
Sub-total		**60**	**29,200.00**	**1,046.4**
18	Employment benefits and allowances 20%		**5,840.00**	**209.3**
Total Annual Labor Cost (Direct +Indirect)				**1,255.68**

B. TRAINING REQUIREMENT

Some specialized training is required as for technical operators and quality controllers/laboratory experts with a lump-sum estimate of Birr 180,000.00

VII. FINANCIAL ANALYSIS

The financial analysis of the fertilizer 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
Raw material imported	120 days
Work in progress	3 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 221.65 million (see Table 7.1). From the total investment cost the highest share (Birr 175.94 million or 79.38%) is accounted by fixed investment cost followed by pre operation cost (Birr 22.92 million or 10.34%) and initial working capital (Birr 22.78 million or 10.28%). From the total investment cost, Birr 140.40 million or 63.34% 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	0.06
1.2	Building and civil work	12,500.00		12,500.00	5.64
1.3	Machinery and equipment	21,060.00	140,400.00	161,460.00	72.84
1.4	Vehicles	1,500.00		1,500.00	0.68
1.5	Office furniture and equipment	350.00		350	0.16
	Sub -total	**35,543.00**	**140,400.00**	**175,943.00**	**79.38**
2	**Pre operating cost ***				
2.1	Pre operating cost	8,423.00		8,423.00	3.80
2.2	Interest during construction	14,500.49		14,500.49	6.54
	Sub -total	**22,923.49**		**22,923.49**	**10.34**
3	**Working capital ****	**22,783.89**		**22,783.89**	**10.28**
	Grand Total	**81,250.38**	**140,400.00**	**221,650.38**	**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 30.35 million. However, only the initial working capital of Birr 22.78 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 158.22 million (see Table 7.2). The cost of raw material account for 55.24% of the production cost. The other major components of the production cost are depreciation, financial cost and utility which account for 22.0%, 8.82% and 7.09% respectively. The remaining 6.84% is the share of labor, 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 THREE)

Items	Cost	%
Raw Material and Inputs	87,411.00	55.24
Utilities	11,217.50	7.09
Maintenance and repair	8,073.00	5.10
Labor direct	1,046.40	0.66
Labor overheads	209.30	0.13
Administration Costs	500.00	0.32
Land lease cost	-	-
Cost of marketing and distribution	1,000.00	0.63
Total Operating Costs	**109,457.20**	**69.18**
Depreciation	34,811.60	22.00
Cost of Finance	13,956.72	8.82
Total Production Cost	**158,225.52**	**100**

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 12.69 million to Birr 51.91 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 407.87 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.

$$\text{Break -Even Sales Value} = \frac{\text{Fixed Cost + Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 87{,}090{,}713$$

$$\text{Break- Even Capacity utilization} = \frac{\text{Break -even Sales Value}}{\text{Sales revenue}} \times 100 = 47\%$$

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 4 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 26.79% 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 178.52 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 60 persons. The project will generate Birr 122.63 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 agricultural sector and also generates 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	16,389.56	18,574.84	21,852.75	21,852.75	21,852.75	21,852.75	21,852.75	21,852.75	21,852.75	21,852.75
Accounts receivable	6,861.91	7,765.72	9,121.43	9,121.43	9,125.00	9,125.00	9,125.00	9,125.00	9,125.00	9,125.00
Cash-in-hand	102.38	116.03	136.51	136.51	137.10	137.10	137.10	137.10	137.10	137.10
CURRENT ASSETS	**23,353.85**	**26,456.59**	**31,110.69**	**31,110.69**	**31,114.85**	**31,114.85**	**31,114.85**	**31,114.85**	**31,114.85**	**31,114.85**
Accounts payable	569.96	645.96	759.95	759.95	759.95	759.95	759.95	759.95	759.95	759.95
CURRENT LIABILITIES	**569.96**	**645.96**	**759.95**	**759.95**	**759.95**	**759.95**	**759.95**	**759.95**	**759.95**	**759.95**
TOTAL WORKING CAPITAL	**22,783.89**	**25,810.63**	**30,350.74**	**30,350.74**	**30,354.90**	**30,354.90**	**30,354.90**	**30,354.90**	**30,354.90**	**30,354.90**

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	65,558	74,299	87,411	87,411	87,411	87,411	87,411	87,411	87,411	87,411
Utilities	8,413	9,535	11,218	11,218	11,218	11,218	11,218	11,218	11,218	11,218
Maintenance and repair	6,055	6,862	8,073	8,073	8,073	8,073	8,073	8,073	8,073	8,073
Labour direct	785	889	1,046	1,046	1,046	1,046	1,046	1,046	1,046	1,046
Labour overheads	157	178	209	209	209	209	209	209	209	209
Administration Costs	375	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	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Total Operating Costs	**82,343**	**93,189**	**109,457**	**109,457**	**109,500**	**109,500**	**109,500**	**109,500**	**109,500**	**109,500**
Depreciation	34,812	34,812	34,812	34,812	34,812	535	535	535	535	535
Cost of Finance	0	15,951	13,957	11,963	9,969	7,975	5,981	3,988	1,994	0
Total Production Cost	**117,155**	**143,951**	**158,226**	**156,232**	**154,281**	**118,010**	**116,016**	**114,023**	**112,029**	**110,035**

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	138,150	156,570	184,200	184,200	184,200	184,200	184,200	184,200	184,200	184,200
Less variable costs	81,343	92,189	108,457	108,457	108,457	108,457	108,457	108,457	108,457	108,457
VARIABLE MARGIN	**56,807**	**64,381**	**75,743**	**75,743**	**75,743**	**75,743**	**75,743**	**75,743**	**75,743**	**75,743**
in % of sales revenue	41.12	41.12	41.12	41.12	41.12	41.12	41.12	41.12	41.12	41.12
Less fixed costs	35,812	35,812	35,812	35,812	35,854	1,578	1,578	1,578	1,578	1,578
OPERATIONAL MARGIN	**20,996**	**28,570**	**39,931**	**39,931**	**39,888**	**74,165**	**74,165**	**74,165**	**74,165**	**74,165**
in % of sales revenue	15.20	18.25	21.68	21.68	21.65	40.26	40.26	40.26	40.26	40.26
Financial costs		15,951	13,957	11,963	9,969	7,975	5,981	3,988	1,994	0
GROSS PROFIT	**20,996**	**12,619**	**25,974**	**27,968**	**29,919**	**66,190**	**68,184**	**70,177**	**72,171**	**74,165**
in % of sales revenue	15.20	8.06	14.10	15.18	16.24	35.93	37.02	38.10	39.18	40.26
Income (corporate) tax	0	0	0	8,390	8,976	19,857	20,455	21,053	21,651	22,250
NET PROFIT	**20,996**	**12,619**	**25,974**	**19,578**	**20,944**	**46,333**	**47,729**	**49,124**	**50,520**	**51,916**
in % of sales revenue	15.20	8.06	14.10	10.63	11.37	25.15	25.91	26.67	27.43	28.18

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	**184,366**	**176,004**	**156,646**	**184,314**	**184,200**	**184,200**	**184,200**	**184,200**	**184,200**	**184,200**	**184,200**	**52,488**
Inflow funds	184,366	37,854	76	114	0	0	0	0	0	0	0	0
Inflow operation	0	138,150	156,570	184,200	184,200	184,200	184,200	184,200	184,200	184,200	184,200	0
Other income	0	0	0	0	0	0	0	0	0	0	0	52,488
TOTAL CASH OUTFLOW	**184,366**	**120,197**	**132,180**	**148,006**	**149,749**	**148,387**	**157,270**	**155,875**	**154,479**	**153,083**	**131,749**	**0**
Increase in fixed assets	184,366	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	23,354	3,103	4,654	0	4	0	0	0	0	0	0
Operating costs	0	81,343	92,189	108,457	108,457	108,500	108,500	108,500	108,500	108,500	108,500	0
Marketing and Distribution cost	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0
Income tax	0	0	0	0	8,390	8,976	19,857	20,455	21,053	21,651	22,250	0
Financial costs	0	14,500	15,951	13,957	11,963	9,969	7,975	5,981	3,988	1,994	0	0
Loan repayment	0	0	19,938	19,938	19,938	19,938	19,938	19,938	19,938	19,938	0	0
SURPLUS (DEFICIT)	**0**	**55,807**	**24,466**	**36,308**	**34,451**	**35,813**	**26,930**	**28,325**	**29,721**	**31,117**	**52,451**	**52,488**
CUMULATIVE CASH BALANCE	**0**	**55,807**	**80,273**	**116,581**	**151,032**	**186,845**	**213,775**	**242,100**	**271,821**	**302,938**	**355,388**	**407,876**

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**	**138,150**	**156,570**	**184,200**	**184,200**	**184,200**	**184,200**	**184,200**	**184,200**	**184,200**	**184,200**	**52,488**
Inflow operation	0	138,150	156,570	184,200	184,200	184,200	184,200	184,200	184,200	184,200	184,200	0
Other income	0	0	0	0	0	0	0	0	0	0	0	52,488
TOTAL CASH OUTFLOW	**207,150**	**85,370**	**97,729**	**109,457**	**117,852**	**118,476**	**129,357**	**129,955**	**130,553**	**131,151**	**131,749**	**0**
Increase in fixed assets	184,366	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	22,784	3,027	4,540	0	4	0	0	0	0	0	0	0
Operating costs	0	81,343	92,189	108,457	108,457	108,500	108,500	108,500	108,500	108,500	108,500	0
Marketing and Distribution cost	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	0
Income (corporate) tax		0	0	0	8,390	8,976	19,857	20,455	21,053	21,651	22,250	0
NET CASH FLOW	**-207,150**	**52,780**	**58,841**	**74,743**	**66,348**	**65,724**	**54,843**	**54,245**	**53,647**	**53,049**	**52,451**	**52,488**
CUMULATIVE NET CASH FLOW	**-207,150**	**-154,370**	**-95,528**	**-20,785**	**45,563**	**111,287**	**166,130**	**220,375**	**274,022**	**327,071**	**379,521**	**432,009**
Net present value	-207,150	47,982	48,629	56,155	45,317	40,810	30,958	27,836	25,027	22,498	20,222	20,237
Cumulative net present value	-207,150	-159,168	-110,539	-54,383	-9,067	31,743	62,701	90,537	115,563	138,061	158,283	178,520

NET PRESENT VALUE	178,520
INTERNAL RATE OF RETURN	26.79%
NORMAL PAYBACK	4 years