62.   PROFILE ON THE PRODUCTION OF HIGH DESNSITY POLYETHYLENE (HDPE)

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I.   SUMMARY

This profile envisages the establishment of a plant for the production of high density polyethylene (HDPE) with a capacity of 30,000 tons per annum. HDPE is a thermoplastic material obtained through the polymerization of ethylene gas. The mechanical, electrical and chemical properties of HDPE make it suitable for many applications.

The country`s requirement of HDPE resin is met through import. The present (2012) demand for HDPE resin is estimated at 17,534 tons. The demand for the product is projected to reach 28,239 tons and 60,532 tons by the years 2017 and 2022, respectively.

The principal raw material required is ethylene gas which has to be imported.

The total investment cost of the project including working capital is estimated at Birr 1.075 billion (see Table 7.1). From the total investment cost, the highest share (Birr 830.60 million or 77.26%) is accounted by fixed investment cost followed by initial working capital (Birr 135.43 million or 12.22%) and pre operation cost (Birr 109.035 million or 10.14%). From the total investment cost Birr 687.33 million or 63.93% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 21.82% and a net present value (NPV) of Birr 624.80 million, discounted at 10%.

The project can create employment for 72 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 plastic products manufacturing sub sector and also generates income for the Government in terms of tax revenue and payroll tax.

II.   PRODUCT DESCRIPTION AND APPLICATION

High Density Polyethylene (HDPE) is a thermoplastic material obtained through the polymerization of ethylene gas. The mechanical, electrical and chemical properties of HDPE make it suitable for many applications. Because of its toughness, resistance to cracking and creeping and high softening temperature, it is used for making blow moulded containers and bottles as well as injection moulded crates.

It can also be used as insulation materials for electrical wires and cables. Its resistance to chemicals makes it also an appropriate material for low pressure pipes used for conveying water, gas and corrosive chemical such as acids.

HDPE is also widely used for producing film bags and non-filament yarn for cord (rope) construction. Its' good mechanical properties, and the ease with which it is pigmented, makes it suitable for construction articles such as chairs, toys and similar household products

III.   MARKET STUDY AND PLANT CAPACITY

A.   MARKET STUDY

1.   Past Supply & Present Demand

At present, the sources of supply to the local market for HDPE resins are import. The product is imported by the local plastic products manufacturers and processed in to various goods. The data source for import statistics i.e. Ethiopian Revenue and Customs Authority classifies import of PE resins under the following headings.

  ➢ Polyethylene having a specific gravity < 0.94, in primary forms; and
  ➢ Polyethylene having a specific gravity >= 0.94, in primary forms.

Therefore, since the available import data does not show import of PE by type, the trend in the aggregate import of PE is used as a base and then desegregated in to HDPE and LDPE. Accordingly, the total import of PE during the period 2002 – 2011 is shown in Table 3.1.

Table 3.1

IMPORT OF PE RESINS (IN TONS)

Year	Imported Quantity
2002	13,491
2003	18,491
2004	19,533
2005	19,635
2006	22,383
2007	27,006
2008	27,839
2009	28,382
2010	25,648
2011	27,725

Source: *–Ethiopian Revenue & Customs Authority.*

As can be seen from Table 3.1 ,import of PE resins during the period under consideration have shown a noticeable increasing trend except a slight decline in the year 2010 compared to the previous three years i.e. year 2007--2009. During the first nine years of the data set i.e. 2002 – 2009 import of PE resins has shown a consistent increase. The imported quantity which was 13,491 tons during year 2002 has increased to 28,382 tons in 2009. During year 2010 the imported quantity of PE resins has declined to 25,648 tons, registering a decrease of about 9.63% compared to the previous year (2009). This could be due to the stock carry over from the year 2009 which has shown the highest level of import in the past 10 years. However, during 2011 import has increased to 27,725 tons. During the period under consideration (2002--2011) import of PE resin has registered an average annual growth rate of 9.04%.

Considering the nature of the import or apparent consumption trend for PE resin, it is assumed that the growth rate registered in the past will also continue in the near future. Accordingly, taking the apparent consumption for year 2011 as a base and applying a growth rate of 9.04% the present effective demand for PE resin is estimated at 30,231 tons.

According to a study conducted by IPS " Feasibility Study for the Establishment of PE resin Manufacturing Plan, IPS, 2012" on average from the total amount of PE resin consumed by local manufacturers of PE products, the highest majority (58%) is accounted by HDPE followed by LLDPE (21%) and LDPE (17%). The remaining 4% is accounted by other type of PE resins such as MDPE and VLDPE. Accordingly, the present effective demand for HDPE is estimated at 17,534 tons.

2.   Demand Projection

The demand for HDPE resins depend mainly on the performance of its end-user (i.e. the plastic products manufacturing sub - sector).   Therefore, the demand for HDPE resins is a derived demand, which depends directly on the performance of its major end - user.

On the other hand, the performance of the HDPE products manufacturing sub - sector is dependant on the performance of the end users of HDPE products. HDPE is used predominantly for the manufacturing of blow molded and injection molded products such as pipes and rigid containers. Hence, the end users of HDPE products are mainly the construction and agriculture sectors.

Consequently, the demand for HDPE resins depends on the growth of the above HDPE products end users. The performance of the HDPE products end users is dependant on a number of inter-related variables. Accordingly, the variables that are essential in determining the magnitude and trend of demand for HDPE resins are:

- Performance of the national economy;
- Performance of the construction sector;
- Demand for housing and housing construction activities;
- Performance of the agricultural sector; and
- Rate of population growth and urbanization.

Accordingly, the following two scenarios are considered.

Scenario 1:   GDP of the country is expected to grow at an average annual growth rate of 11.2% during the GTP period (2011 – 2015).

Scenario 2:   The industrial sector, which includes the construction sector, is expected to grow at an average annual growth rate of 20% during the GTP period (2011 – 2015).

Since the demand for HDPE resin is highly affected by both factors i.e. performance of GDP and the construction sector, the assumptions are valid. However, in order to be conservative a growth rate of 10% which is slightly lower than the expected growth rate of GDP during the GTP period is used to project the local demand for HDPE resin. Accordingly, the projected demand for HDPE resin estimated on the basis of the above assumption and using the estimated present demand as a base is presented in Table 3.2.

Table 3.2

PROJECTED DEMAND FOR HDPE RESIN (TONS)

Year	Quantity
2013	19,287
2014	21,216
2015	23,338
2016	25,672
2017	28,239
2018	31,063
2019	34,169
2020	37,586
2021	41,344
2022	45,479
2023	50,027
2024	55,029
2025	60,532

3.   Pricing and Distribution

The current FOB price of HDPE resins is USD 1,410 per ton or Birr 25,375. Accordingly, allowing 30% for freight, insurance, inland transport, transit charges, bank charges and other costs the recommended factory gate price is Birr 32,988 per ton.

The product of the envisaged factory is an intermediate product used in the manufacturing other products and the end users are limited in number and their geographical distribution is limited and are mostly located in or around major cities and towns of the country. Accordingly, by taking the nature of the product and the characteristics of the end users direct distribution to end users is selected as the most appropriate distribution channel.

B.   PLANT CAPACITY AND PRODUCTION PROGRAM

1.   Plant Capacity

The minimum available capacity which is 30,000 tons per annum is proposed. Similar to the most chemical plants, the HDPE plant has to operate continuously, i.e. 16 hours per day (two shifts per day of 8 hrs). Annual working days of 300 have been assumed.

2.   Production Program

The production will start with a capacity of 70% of the plant full capacity production, grow to 85% in the second year and finally will reach the pant full capacity (100%) production in the third year of the plant operation.

IV.   MATERIALS AND INPUTS

A.   MATERIALS

The basic raw material used is ethylene gas as a monomer. The setting up of an HDPE plant, therefore, presupposes that an ethylene gas plant will be available at a nearby location for a constant supply. Ethylene gas is transported through a pipe line from the source of supply to HDPE plant. It is estimated that to produce 1 ton of HDPE, it requires 1.02 ton of ethylene gas. Thus, annual requirement of ethylene at full capacity production will be 30,600.00 tons. The unit cost of ethylene is estimated at about Birr 23,483.00 per tons. The annual ethylene gas is therefore is Birr 557.49 million. The total cost of additives and catalyst is Birr 2.74 million. The total annual raw material cost is Birr 560.23 million.

The product will be packed in a 25 kg paper bag. The annual cost of packaging materials is estimated at about Birr 7.20 million.

B.   UTILITIES

The utilities required for the envisaged plant are electricity, cooling water, fuel, inert gas, and process water. The total annual cost of utility is Birr 70 million. The annual consumption of utilities and the cost breakdown is shown in the Table 4.1.

Table 4.1
ANNUAL CONSUMPTION OF UTILITIES & COST(BIRR)

Utilities	UOM	Qty.	Unit Cost	Total Cost
Power	kWh	16,000,000	0.65	10,400,000
Fuel Oil	tons	35,000	1,560.00	54,600,000
Cooling Water	m^3	1,000	10.00	10,000
Nitrogen Gas	Nm3	2,000,000	2.50	5,000,000
Total				**70,010,000**

V.   TECHNOLOGY AND ENGINEERING

A.   TECHNOLOGY

1.   Production Process

The polymerization process proposed is the Gas Phase Polymerization. The process operates on a fluidized bed principle.

Pure ethylene is fed to a fluidized bed of polymer particles maintained at 85-105C and 20 bar according to the polymer grade. Catalyst is injected continuously. Conversion of 2-3% is reached with an average residence time of 3-5 hrs. The obtained powder is mixed with stabilizers and generally extruded into pellets.

The advantages of Gas Phase Polymerization over Suspension (Slurry) Polymerization and Solution Processes are it requires lower capital investment and lower production costs, have very direct process with a simple process flow, achieves a high space time yield, and it is flexible and can accommodate a large variety of catalysts.

2. Environmental Impact

The envisaged plant produces HDPE resin using ethylene gas derived from ethanol obtained from sugar plant by using tubular polymerization process. The plastic produced material that will be produced is called bio-plastic as compared from PE plastic produced from ethylene that is obtained from fossil fuel.

Besides, strict emission control will be followed to reduce the emission of hazardous gases like ethylene, VOC etc from the polymerization process in to the atmosphere. The chosen technology is integrated with emission control systems.

B. ENGINEERING

1. Machinery and Equipment

The total estimated cost of machinery and equipment of the envisaged plant is Birr 756.07 million, of which Birr 687.33 million is required in foreign currency. The list of machinery and equipment required for the envisaged project is shown in Table 5.1.

Table 5.1

LIST OF MACHINERY AND EQUIPMENTS REQUIRED

Sr. No.	Machinery/Equipment	Quantity
1	Ethylene feed Purification column	1
2	Catalyst feeder	1
3	Feed gas booster and compressor	1
4	Fluidized Bed Reactor/spherical top	1
5	Cyclone separator	1
6	Filter	1
7	Purge bin	1
8	Dryer	1
9	Recycling compressor	1
10	Recycle gas cooler	1
11	Additive bins and Misc. Bins	set
12	Extruder	1
13	Auxiliary Units	1
14	Laboratory unit	set
15	Workshop and Garage	1

2.   Land, Building and Civil Works

The total area of land required for the envisaged plant is 20,000 square meters, out of which 12,000 is building area and the rest is free space. The building comprises production hall, power house, water treatment plant, store for raw materials and products, offices etc. The total cost of civil works is estimated at Birr 72 million with an assumption of construction rate of Birr 6,000/m^2.

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
Central Market District	1st	1,686
	2nd	1,535
	3rd	1,323
	4th	1,085
	5th	894
Transitional zone	1st	1,035
	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 5,320,000 of which 10% or Birr 532,000 will be paid in advance. The remaining Birr 4,788,000 will be paid in equal installments with in 28 years i.e. Birr 171,000 annually.

VI. HUMAN RESOURCE AND TRAINING REQUIREMENT

A. HUMAN RESOURCE REQUIREMENT

The total human resource requirement of the plant is estimated at 72 persons. Details of human resource requirement and the estimated annual labor cost including the fringe benefits are shown in Table 6.1.

Table 6.1

HUMAN RESOURCE REQUIREMENT AND ESTIMATED COST

Sr.No.	Position	No. of Persons	Monthly Salary	Monthly Total Salary	Annual Salary
1	G. Manager	1	10,000.00	10,000.00	120,000.00
2	Production Manager	1	8,000.00	8,000.00	96,000.00
3	Supervisors	4	5,000.00	20,000.00	240,000.00
4	Operators	18	3,000.00	54,000.00	648,000.00
5	Assistants	18	12,500.00	225,000.00	2,700,000.00
6	Laborers	8	1,500.00	12,000.00	144,000.00
7	Mechanics	4	2,500.00	10,000.00	120,000.00
8	Electricians	3	2,500.00	7,500.00	90,000.00
9	Chemists	3	3,000.00	9,000.00	108,000.00
10	Secretary	1	3,000	3,000.00	36,000.00
11	Accountant	1	4,000	4,000.00	48,000.00
12	Clerk	2	2,500	5,000.00	60,000.00
13	Cashier	1	2,000	2,000.00	24,000.00
14	Salesman	1	3,000	3,000.00	36,000.00
15	General Services	2	2,500	5,000.00	60,000.00
16	Guards	6	1,000	6,000.00	72,000.00
	Total	**74**		**383,500.00**	**4,602,000.00**

B.   TRAINING REQUIREMENT

Being a new technology to the country, foreign training is required for key technical personnel. A minimum of three months' training is required for six technical personnel. The training cost is estimated at about Birr 720,000.

VII.   FINANCIAL ANALYSIS

The financial analysis of the HDPE 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

Raw material imported	120 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 1.075 billion (see Table 7.1). From the total investment cost ,the highest share (Birr 830.60 million or 77.26%) is accounted by fixed investment cost followed by initial working capital (Birr 135.43 million or 12.22%) and pre operation cost (Birr 109.035 million or 10.14%). From the total investment cost Birr 687.33 million or 63.93% 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	532.00		532.00	0.05
1.2	Building and civil work	72,000.00		72,000.00	6.70
1.3	Machinery and equipment	68,740.00	687,330.00	756,070.00	70.33
1.4	Vehicles	1,500.00		1,500.00	0.14
1.5	Office furniture and equipment	500.00		500.00	0.05
	Sub total	**143,272.00**	**687,330.00**	**830,602.00**	**77.26**
2	**Pre operating cost ***				
2.1	Pre operating cost	38,703.40		38,703.40	3.60
2.2	Interest during construction	70,331.42		70,331.42	6.54
	Sub total	**109,034.82**		**109,034.82**	**10.14**
3	**Working capital ****	**135,429.20**		**135,429.20**	**12.60**
	Grand Total	**387,736.02**	**687,330.00**	**1,075,066.02**	**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 194.43 million. However, only the initial working capital of Birr 135.42 million 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 905.42 million (see Table 7.2).   The cost of raw material account for 61.87% of the production cost. The other major components of the production cost are depreciation, utility and financial cost, which account for 17.91%, 7.73% and 7.48%, respectively. The remaining 5.01% 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 (000 Birr)	%
Raw Material and Inputs	560,230.00	61.
Utilities	70,010.00	7.7
Maintenance and repair	37,803.50	4.1
Labour direct	4,602.00	0.5
Labour overheads	1,150.50	0.1
Administration Costs	750.00	0.0
Land lease cost	-	-
Cost of marketing and distribution	1,000.00	0.1
Total Operating Costs	**675,546.00**	**74.**
Depreciation	162,184.68	17.
Cost of Finance	67,693.99	7.4
Total Production Cost	**905,424.67**	**10**

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 65.72 million to Birr 217.69 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 1.629 billion. 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.

Break - Even Sales Value   = $\dfrac{\text{Fixed Cost + Financial Cost}}{\text{Variable Margin ratio (\%)}}$ =   Birr 415,648,800

Break -Even Capacity utilization   = $\dfrac{\text{Break -even Sales Value}}{\text{Sales revenue}}$ X 100 = 51.79%

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 5 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 21.82% 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 624.80 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 72 persons. The project will generate Birr 496.66 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 plastic products manufacturing sub sector and also generates income for the Government in terms of 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	98,040.25	119,048.88	140,057.50	140,057.50	140,057.50	140,057.50	140,057.50	140,057.50	140,057.50	140,057.50
Accounts receivable	39,431.85	47,863.68	56,295.50	56,295.50	56,309.75	56,309.75	56,309.75	56,309.75	56,309.75	56,309.75
Cash-in-hand	430.75	523.06	615.36	615.36	617.74	617.74	617.74	617.74	617.74	617.74
CURRENT ASSETS	**137,902.85**	**167,435.61**	**196,968.36**	**196,968.36**	**196,984.99**	**196,984.99**	**196,984.99**	**196,984.99**	**196,984.99**	**196,984.99**
Accounts payable	2,473.65	3,003.72	3,533.79	3,533.79	3,533.79	3,533.79	3,533.79	3,533.79	3,533.79	3,533.79
CURRENT LIABILITIES	**2,473.65**	**3,003.72**	**3,533.79**	**3,533.79**	**3,533.79**	**3,533.79**	**3,533.79**	**3,533.79**	**3,533.79**	**3,533.79**
TOTAL WORKING CAPITAL	**135,429.20**	**164,431.88**	**193,434.57**	**193,434.57**	**193,451.19**	**193,451.19**	**193,451.19**	**193,451.19**	**193,451.19**	**193,451.19**

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	392,161	476,196	560,230	560,230	560,230	560,230	560,230	560,230	560,230	560,230
Utilities	49,007	59,509	70,010	70,010	70,010	70,010	70,010	70,010	70,010	70,010
Maintenance and repair	26,462	32,133	37,804	37,804	37,804	37,804	37,804	37,804	37,804	37,804
Labour direct	3,221	3,912	4,602	4,602	4,602	4,602	4,602	4,602	4,602	4,602
Labour overheads	805	978	1,151	1,151	1,151	1,151	1,151	1,151	1,151	1,151
Administration Costs	525	638	750	750	750	750	750	750	750	750
Land lease cost	0	0	0	0	171	171	171	171	171	171
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	**473,182**	**574,364**	**675,546**	**675,546**	**675,717**	**675,717**	**675,717**	**675,717**	**675,717**	**675,717**
Depreciation	162,185	162,185	162,185	162,185	162,185	2,930	2,930	2,930	2,930	2,930
Cost of Finance	0	77,365	67,694	58,023	48,353	38,682	29,012	19,341	9,671	0
Total Production Cost	**635,367**	**813,913**	**905,425**	**895,754**	**886,255**	**717,329**	**707,659**	**697,988**	**688,318**	**678,647**

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	692,748	841,194	989,640	989,640	989,640	989,640	989,640	989,640	989,640	989,640
Less variable costs	472,182	573,364	674,546	674,546	674,546	674,546	674,546	674,546	674,546	674,546
VARIABLE MARGIN	**220,566**	**267,830**	**315,094**	**315,094**	**315,094**	**315,094**	**315,094**	**315,094**	**315,094**	**315,094**
in % of sales revenue	31.84	31.84	31.84	31.84	31.84	31.84	31.84	31.84	31.84	31.84
Less fixed costs	163,185	163,185	163,185	163,185	163,356	4,101	4,101	4,101	4,101	4,101
OPERATIONAL MARGIN	**57,381**	**104,645**	**151,909**	**151,909**	**151,738**	**310,993**	**310,993**	**310,993**	**310,993**	**310,993**
in % of sales revenue	8.28	12.44	15.35	15.35	15.33	31.42	31.42	31.42	31.42	31.42
Financial costs		77,365	67,694	58,023	48,353	38,682	29,012	19,341	9,671	0
GROSS PROFIT	**57,381**	**27,281**	**84,215**	**93,886**	**103,385**	**272,311**	**281,981**	**291,652**	**301,322**	**310,993**
in % of sales revenue	8.28	3.24	8.51	9.49	10.45	27.52	28.49	29.47	30.45	31.42
Income (corporate) tax	0	0	0	28,166	31,016	81,693	84,594	87,496	90,397	93,298
NET PROFIT	**57,381**	**27,281**	**84,215**	**65,720**	**72,370**	**190,618**	**197,387**	**204,156**	**210,926**	**217,695**
in % of sales revenue	8.28	3.24	8.51	6.64	7.31	19.26	19.95	20.63	21.31	22.00

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	869,305	900,982	841,724	990,170	989,640	989,640	989,640	989,640	989,640	989,640	989,640	307,515
Inflow funds	869,305	208,234	530	530	0	0	0	0	0	0	0	0
Inflow operation	0	692,748	841,194	989,640	989,640	989,640	989,640	989,640	989,640	989,640	989,640	0
Other income	0	0	0	0	0	0	0	0	0	0	0	307,515
TOTAL CASH OUTFLOW	869,305	681,416	777,967	869,478	858,441	851,808	892,798	886,029	879,259	872,490	769,015	0
Increase in fixed assets	869,305	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	137,903	29,533	29,533	0	17	0	0	0	0	0	0
Operating costs	0	472,182	573,364	674,546	674,546	674,717	674,717	674,717	674,717	674,717	674,717	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	28,166	31,016	81,693	84,594	87,496	90,397	93,298	0
Financial costs	0	70,331	77,365	67,694	58,023	48,353	38,682	29,012	19,341	9,671	0	0
Loan repayment	0	0	96,706	96,706	96,706	96,706	96,706	96,706	96,706	96,706	0	0
SURPLUS (DEFICIT)	0	219,566	63,757	120,692	131,199	137,832	96,842	103,611	110,381	117,150	220,625	307,515
CUMULATIVE CASH BALANCE	0	219,566	283,323	404,014	535,213	673,046	769,887	873,499	983,879	1,101,029	1,321,654	1,629,169

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**	**692,748**	**841,194**	**989,640**	**989,640**	**989,640**	**989,640**	**989,640**	**989,640**	**989,640**	**989,640**	**307,515**
Inflow operation	0	692,748	841,194	989,640	989,640	989,640	989,640	989,640	989,640	989,640	989,640	0
Other income	0	0	0	0	0	0	0	0	0	0	0	307,515
TOTAL CASH OUTFLOW	**1,004,735**	**502,185**	**603,367**	**675,546**	**703,728**	**706,733**	**757,410**	**760,311**	**763,213**	**766,114**	**769,015**	**0**
Increase in fixed assets	869,305	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	135,429	29,003	29,003	0	17	0	0	0	0	0	0	0
Operating costs	0	472,182	573,364	674,546	674,546	674,717	674,717	674,717	674,717	674,717	674,717	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	28,166	31,016	81,693	84,594	87,496	90,397	93,298	0
NET CASH FLOW	**- 1,004,735**	**190,563**	**237,827**	**314,094**	**285,912**	**282,907**	**232,230**	**229,329**	**226,427**	**223,526**	**220,625**	**307,515**
CUMULATIVE NET CASH FLOW	**- 1,004,735**	**- 814,171**	**- 576,344**	**- 262,250**	**23,661**	**306,569**	**538,798**	**768,127**	**994,555**	**1,218,081**	**1,438,706**	**1,746,221**
Net present value	- 1,004,735	173,239	196,551	235,984	195,281	175,663	131,088	117,682	105,630	94,797	85,060	118,560
Cumulative net present value	- 1,004,735	- 831,495	- 634,944	- 398,961	- 203,679	-28,016	103,072	220,753	326,383	421,180	506,241	624,801

NET PRESENT VALUE   624,801
INTERNAL RATE OF RETURN   21.82%
NORMAL PAYBACK   5 years