

**34. PROFILE ON THE PRODUCTION OF
CARBON BLACK**

TABLE OF CONTENTS

		<u>PAGE</u>
I.	SUMMARY	34-2
II.	PRODUCT DESCRIPTION & APPLICATION	34-3
III.	MARKET STUDY AND PLANT CAPACITY	34-4
	A. MARKET STUDY	34-4
	B. PLANT CAPACITY & PRODUCTION PROGRAM	34-6
IV.	MATERIALS AND INPUTS	34-7
	A. RAW & AUXILIARY MATERIALS	34-7
	B. UTILITIES	34-8
V.	TECHNOLOGY & ENGINEERING	34-8
	A. TECHNOLOGY	34-8
	B. ENGINEERING	34-9
VI.	MANPOWER & TRAINING REQUIREMENT	34-13
	A. MANPOWER REQUIREMENT	34-13
	B. TRAINING REQUIREMENT	34-14
VII.	FINANCIAL ANALYSIS	34-15
	A. TOTAL INITIAL INVESTMENT COST	34-15
	B. PRODUCTION COST	34-16
	C. FINANCIAL EVALUATION	34-17
	D. ECONOMIC & SOCIAL BENEFITS	34-19

I. SUMMARY

This profile envisages the establishment of a plant for the production of carbon black with a capacity of 1,500 tons of per annum. Carbon black is used as pigmentation, ultraviolet (UV) stabilization and conductive agents in the production of tires and Industrial Rubber Products, plastics, electrostatic Discharge (ESD) Compounds, high performance coatings and toners and printing inks.

Since there are no local producers of carbon black, the demand for the product is entirely met through import. The present (2012) demand for the products is estimated at 1,262 tons per annum. The demand is projected to reach 2,003 tons and 2,942 tons by the year 2018 and year 2023, respectively.

The principal raw material required is crackers residue cycle oil (aromatic residue) which has to be imported.

The total investment cost of the project including working capital is estimated at Birr 21.14 million. From the total investment cost, the highest share (Birr 11.17 million or 52.83%) is accounted by fixed investment cost, followed by initial working capital (8.06 million or 38.14%) and pre operation cost (Birr 1.91 million or 9.03%). From the total investment cost, Birr 4.43 million or 16.69% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 25.50% and a net present value (NPV) of Birr 20.04 million, discounted at 10%.

The project can create employment opportunities for 82 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 by supplying the inputs required by the sector and also generates income for the Government in terms of tax revenue and payroll tax.

II. PRODUCT DESCRIPTION AND APPLICATION

Carbon black is a material produced by the incomplete combustion of heavy petroleum products such as FCC tar, coal tar, ethylene cracking tar, and a small amount from vegetable oil. Carbon black is a form of amorphous carbon that has a high surface-area-to-volume ratio, although its surface-area-to-volume ratio is low compared to that of activated carbon.

Traditionally, carbon black has been used as a reinforcing agent in tires. Today, because of its unique properties, the uses of carbon black have expanded to include pigmentation, ultraviolet (UV) stabilization and conductive agents in a variety of everyday and specialty high performance products, including:

- **Tires and Industrial Rubber Products:** Carbon black is added to rubber as both a filler and as a strengthening or reinforcing agent. For various types of tires, it is used in inner liners, carcasses, sidewalls and treads utilizing different types based on specific performance requirements. Carbon black is also used in many molded and extruded industrial rubber products, such as belts, hoses, gaskets, diaphragms, vibration isolation devices, bushings, air springs, chassis bumpers, and multiple types of pads, boots, wiper blades, fascia, conveyor wheels, and grommets.
- **Plastics:** Carbon blacks are now widely used for conductive packaging, films, fibers, moldings, pipes and semi-conductive cable compounds in products such as refuse sacks, industrial bags, photographic containers, agriculture mulch film, stretch wrap, and thermoplastic molding applications for automotive, electrical/electronics, household appliances and blow-molded containers.
- **Electrostatic Discharge (ESD) Compounds:** Carbon blacks are carefully designed to transform electrical characteristics from insulating to conductive in products such as electronics packaging, safety applications, and automotive parts.
- **High Performance Coatings:** Carbon blacks provide pigmentation, conductivity, and UV protection for a number of coating applications including automotive (primer basecoats and clearcoats), marine, aerospace, decorative, wood, and industrial coatings.
- **Toners and Printing Inks:** Carbon blacks enhance formulations and deliver broad flexibility in meeting specific color requirements.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Carbon black has wide application in the manufacture of various products. Despite its wide application, the country's requirement of the product is entirely met through imports. The quantity of carbon black imported during the period 2000-2011 shown in Table 3.1.

Table 3.1
IMPORT OF CARBON BLACK

Year	Quantity (Tons)	Value (‘000 Birr)
2000	2,218	9,203
2001	1,274	6,852
2002	1,233	6,270
2003	1,644	9,048
2004	1,497	9,870
2005	1,778	11,848
2006	1,349	13,436
2007	1,510	13,692
2008	1,597	19,513
2009	1,386	19,137
2010	1,305	25,243
2011	1,096	28,194

Source: - Ethiopian Revenues and Customs Authority.

As can be seen from Table 3.1, the quantity supplied through import fluctuates from year to year but on the average 1,490 tons of carbon black has been supplied to the domestic market annually during the period 2000-2011. The maximum level of import is 2,218 tons in the year 2000 and the minimum 1,096 tons in the year 2011. In the remaining nine years the imported quantity ranged from 1,233 tons to 1,778 tons.

The demand for carbon blacks is influenced among other things by the growth of rubber and plastic industries, production of printing ink, carbon paper, paint pigments and the like. Assuming supply was driven by demand, the import data is considered as a proxy in estimating

the current effective demand. Accordingly, by taking the recent three years average import, current effective demand is estimated at 1,262 tons.

2. Demand Projection

The demand for carbon black is mainly influenced by the growth of the user industries and their respective production. Taking this into consideration, annual average growth rate of 8% which is slightly lower than the past growth of the manufacturing sector is applied to forecast the future demand. The forecasted demand up to the year 2023 is provided in Table 3.2.

Table 3.2
PROJECTED DEMAND FOR CARBON BLACK (TONS)

Year	Quantity
2013	1,363
2014	1,472
2015	1,590
2016	1,717
2017	1,854
2018	2,003
2019	2,163
2020	2,336
2021	2,523
2022	2,724
2023	2,942

The demand for carbon black will grow from 1,363 tons in the year 2013 to 2,003 tons and 2,942 tons by the year 2018 and year 2023, respectively.

3. Pricing and Distribution

Taking the recent year (2011) average price of import and considering customs duty and other expenses, a factory gate price of Birr 33,868 per ton is recommended.

The product is mainly an industrial input. Hence, it can be sold directly delivered to the end users, mainly to the chemical industries such as rubber, plastic, paint and the like.

B. PLANT CAPACITY AND PRODUCTION PROGRAM

1. Plant Capacity

The main end users of carbon black are rubber and rubber related industries. The level of development of these industries has a significant impact on the profitability of the manufacture of carbon black since profitability is highly tied up to the quantity of product. The reason behind this is that the manufacture of carbon black is energy intensive. Nevertheless, Far East countries have experienced capacities as low as 1 tonne per day. This indicates the possibility of erecting a small plant against the European minimum economy of scale.

The market study shows demand for carbon black increase from 1,363 tons in the year 2013 to 2,924 tons per annum in the year 2013. Considering the market demand and period required for implementation of the project and full capacity attainment, the annual plant capacity for the envisaged carbon black plant is proposed to be 1,500 tons. The plant will operate three shifts of 8 hours per day for 300 days in a year.

2. Production Program

The production program is worked out by deducting Sundays and public holidays and assuming that maintenance works will be carried out during off-production hours. It is also assumed that the plant start its operation at 65% of rated capacity and progressively develop into full capacity operation in the fourth year and then after. This is due to time requirement for skill development and market penetration. The detail of the production programme is provided in Table 3.3.

Table 3.3
PRODUCTION PROGRAM

Year	1	2	3	4-10
Capacity Utilization (%)	65	75	85	100
Production (tons)	975	1,125	1,275	1500

IV. MATERIALS AND INPUTS

A. RAW AND AUXILIARY MATERIALS

The only raw material needed is crackers residue cycle oil (aromatic residue) which will be imported from neighbouring countries with oil refineries. The only auxiliary material required by

the envisaged plant is packing, which is sacks lined with polyethylene bag. The total annual cost of raw material is estimated at Birr 35, 781,000. The annual requirement and cost of raw material is given in Table 4.1.

Table 4.1
ANNUAL REQUIREMENT OF RAW MATERIAL AND COST (TONS)

Sr.No.	Raw Material	Annual Consumption	Cost ('000 Birr)
1	Oil (tons)	3,310	35,748
2	Packing material (50kg)	3,300	33
	Total		35,781

B. UTILITIES

The required utilities for this project are electricity, water and fuel oil. Details Of utility consumption and cost is given in Table 4.3. The total annual cost of utilities is estimated at Birr 4,243,260.

Table 4.3
ANNUAL UTILITIES CONSUMPTION AND COST

Sr. No.	Description	UOM	Annual Consumption	Cost '000 Birr
1	Electricity	kWh	419,874	243.50
2	Water	m ³	25,000	250.00
3	Fuel oil	lt.	252,000	3,749.76
	Total			4,243.26

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

Two carbon black manufacturing processes (furnace black and thermal black) produce nearly all of the world's carbon blacks, with the furnace black process being the most common. The furnace black process uses heavy aromatic oils as feedstock.

The feed stock oil is injected into a high temperature high energy density zone of the oil furnace plant as an atomized spray. The high temperature zone is created by burning light fuel such as natural gas or oil in the absence of sufficient oxygen. The air which is deficient with respect to the fuel oil (energy source) is not sufficient for complete combustion of the feed stock which therefore is pyrolyzed to form carbon black at a temperature of 1200⁰c to 1900⁰c. After the reaction the carbon black mixture is quenched with water and further cooled in heat exchangers. The carbon black is separated from the tail gas. Then this product goes to a pulverizer to reduce its size pneumatically. The ground carbon black, after being separated from the gas with cyclone will be led to a pelletizer. Wet pellets from the pelletizer goes to drier and then to storage tanks.

2. Environmental Impact Assessment

The major environmental impact in relation to carbon black production process using the furnace black technology is dust pollution. The dust pollution shall be controlled by employing different dust arresting technologies such as cyclones, wet scrubber, bag filter, etc. The investment cost of the dust controlling equipment is included in the cost of machinery and equipment.

B. ENGINEERING

1. Machinery and Equipment

The total cost of machinery and equipment is estimated at Birr 5,915,800, out of which Birr 4,436,850 is required in foreign currency. The cost of the required machinery and equipment are presented in Table 5.1.

Table 5.1
COST OF MACHINERY AND EQUIPMENT REQUIRED

Sr.No.	Item Description	Quantity
--------	------------------	----------

1	Reactor with pre-heater and cooler	1
2	Drier	1
3	Gas solid separator	1
4	Pulverizer	1
5	Pelletizer	1
6	Materials handling equipment	Set
7	Storage silo	2
8	Dust controlling equipment	Set

2. Land, Building and Civil Works

The total land requirement is about 2,000 m², of which 1,000 m² is a built up area for the production plant, office, canteen and other facilities. The construction cost is estimated at Birr 4,000,000.

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 m², 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 m², 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 m². 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 m². 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 m² (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	1 st	1686
	2 nd	1535
	3 rd	1323
	4 th	1085
	5 th	894
Transitional zone	1 st	1035
	2 nd	935
	3 rd	809
	4 th	685
	5 th	555
Expansion zone	1 st	355
	2 nd	299
	3 rd	217
	4 th	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 m² 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

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 m² is estimated at Birr 532,000 of which 10% or Birr 53,200 will be paid in advance. The remaining Birr 478,800 will be paid in equal installments with in 28 years i.e. Birr 17,100 annually.

VI. HUMAN RESOURCE AND TRAINING REQUIREMENTS

A. HUMAN RESOURCE REQUIREMENT

The total human resource requirement of the plant will be 82 persons. The total annual cost of human resource is estimated at Birr 1,707,000. Details of human resource and salaries are presented in Table 6.1.

Table 6.1
HUMAN RESOURCE REQUIREMENT AND LABOR COST(BIRR)

Sr.No.	Description	No. of Persons	Monthly Salary	Annual Salary
1	General Manager	1	8,000	96,000
2	Finance Manager	1	6,000	72,000
3	Technical Manager	1	6,000	72,000
4	Commercial manager	1	6,000	72,000
5	Accountants	3	7,500	90,000
6	Sales/Purchase	3	6,000	72,000
7	Store keeper	2	2,400	28,800
8	Secretary	2	2,400	28,800
9	Clerk	3	2,400	28,800
10	Production Manager	1	6,000	72,000
11	Operators	12	18,000	216,000
12	Senior Mechanic	3	4,500	54,000
13	Mechanic	3	3,000	36,000
14	Senior Electrician and instrument	3	4,500	54,000
15	Electrician and instrument	3	3,000	36,000
16	Production supervisors	3	6,000	72,000
17	Assistant operators	12	9,600	115,200
18	Unskilled workers	12	4,800	57,600
19	Personnel	1	2,500	30,000
20	Time keeper	2	1,600	19,200
21	Messenger and cleaner	4	1,600	19,200
22	Guard	6	2,000	24,000
	Sub -total	82	113,800	1,365,600
	Employees benefit(25% of basic salary)		28,450	341,400
	Total		142,250	1,707,000

B. TRAINING REQUIREMENT

On-the-job training is carried out during plant erection and commissioning by the experts of machinery suppliers for one month. The cost of training is estimated at Birr 80,000.

VII. FINANCIAL ANALYSIS

The financial analysis of the carbon black 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 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 21.14 million (see Table 7.1). From the total investment cost, the highest share (Birr 11.17 million or 52.83%) is accounted by fixed investment cost, followed by initial working capital (8.06 million or 38.14%) and pre operation cost (Birr 1.91 million or 9.03%). From the total investment cost, Birr 4.43 million or 16.69% 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	53.20		53.20	0.25
1.2	Building and civil work	4,000.00		4,000.00	18.92
1.3	Machinery and equipment	1,478.95	4,436.85	5,915.80	27.98
1.4	Vehicles	900.00		900.00	4.26
1.5	Office furniture and equipment	300.00		300.00	1.42
	Sub total	6,732.15	4,436.85	11,169.00	52.83
2	Pre operating cost *				
2.1	Pre operating cost	525.79		525.79	2.49
2.2	Interest during construction	1,383.11		1,383.11	6.54
	Sub total	1,908.90		1,908.90	9.03
3	Working capital **	8,063.93		8,063.93	38.14
	Grand Total	16,704.98	4,436.85	21,141.83	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 15.47 million. However, only the initial working capital of Birr 10 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 45.43 million (see Table 7.2). The cost of raw material account for 78.77% of the production cost. The other major

components of the production cost are utility, depreciation and financial cost which account for 9.34%, 3.65% and 2.51%, respectively. The remaining 5.73% is the share of direct 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 FOUR)

Items	Cost (in 000 Birr)	%
Raw Material and Inputs	35,781	78.77
Utilities	4,243	9.34
Maintenance and repair	296	0.65
Labor direct	1,366	3.01
Labor overheads	341	0.75
Administration Costs	250	0.55
Land lease cost	0	0.00
Cost of marketing and distribution	350	0.77
Total Operating Costs	42,627	93.84
Depreciation	1,658	3.65
Cost of Finance	1,141	2.51
Total Production Cost	45,426	100.00

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 3.73 million to Birr 5.55 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 50.09 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.

$$\text{Break -Even Sales Value} = \frac{\text{Fixed Cost} + \text{Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 21,317,940$$

$$\text{Break -Even Capacity utilization} = \frac{\text{Break -even Sales Value}}{\text{Sales revenue}} \times 100 = 23.68\%$$

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 25.50% 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 20.04 million which is acceptable. For detail discounted cash flow see Appendix 7.A.5.

D. ECONOMIC AND SOCIAL BENEFITS

The project can create employment opportunities for 82 persons. The project will generate Birr 14.56 million in terms of tax revenue and also generates income for the Government in terms payroll tax. 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 by supplying the inputs required by the sector.

Appendix 7.A

FINANCIAL ANALYSES SUPPORTING TABLES

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	23,258	26,836	30,414	35,781	35,781	35,781	35,781	35,781	35,781	35,781
Utilities	2,758	3,182	3,607	4,243	4,243	4,243	4,243	4,243	4,243	4,243
Maintenance and repair	192	222	251	296	296	296	296	296	296	296
Labour direct	888	1,024	1,161	1,366	1,366	1,366	1,366	1,366	1,366	1,366
Labour overheads	222	256	290	341	341	341	341	341	341	341
Administration Costs	163	188	213	250	250	250	250	250	250	250
Land lease cost	0	0	0	0	17	17	17	17	17	17
Cost of marketing and distribution	350	350	350	350	350	350	350	350	350	350
Total Operating Costs	27,830	32,058	36,285	42,627	42,644	42,644	42,644	42,644	42,644	42,644
Depreciation	1,658	1,658	1,658	1,658	1,658	190	190	190	190	190
Cost of Finance	0	1,521	1,331	1,141	951	761	571	380	190	0
Total Production Cost	29,488	35,238	39,275	45,426	45,253	43,595	43,405	43,215	43,024	42,834

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	32,992	38,068	43,144	50,757	50,757	50,757	50,757	50,757	50,757	50,757
Less variable costs	27,480	31,708	35,935	42,277	42,277	42,277	42,277	42,277	42,277	42,277
VARIABLE MARGIN	5,512	6,360	7,208	8,480	8,480	8,480	8,480	8,480	8,480	8,480
in % of sales revenue	16.71	16.71	16.71	16.71	16.71	16.71	16.71	16.71	16.71	16.71
Less fixed costs	2,008	2,008	2,008	2,008	2,025	557	557	557	557	557
OPERATIONAL MARGIN	3,504	4,352	5,200	6,472	6,455	7,923	7,923	7,923	7,923	7,923
in % of sales revenue	10.62	11.43	12.05	12.75	12.72	15.61	15.61	15.61	15.61	15.61
Financial costs		1,521	1,331	1,141	951	761	571	380	190	0
GROSS PROFIT	3,504	2,830	3,868	5,331	5,504	7,162	7,352	7,542	7,733	7,923
in % of sales revenue	10.62	7.43	8.97	10.50	10.84	14.11	14.49	14.86	15.23	15.61
Income (corporate) tax	0	0	0	1,599	1,651	2,149	2,206	2,263	2,320	2,377
NET PROFIT	3,504	2,830	3,868	3,731	3,853	5,013	5,147	5,280	5,413	5,546
in % of sales revenue	10.62	7.43	8.97	7.35	7.59	9.88	10.14	10.40	10.66	10.93

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	11,695	42,529	38,082	43,157	50,757	50,757	50,757	50,757	50,757	50,757	50,757	16,228
Inflow funds	11,695	9,537	14	14	0	0	0	0	0	0	0	0
Inflow operation	0	32,992	38,068	43,144	50,757	50,757	50,757	50,757	50,757	50,757	50,757	0
Other income	0	0	0	0	0	0	0	0	0	0	0	16,228
TOTAL CASH OUTFLOW	11,695	37,367	36,731	40,768	49,144	47,150	47,455	47,322	47,189	47,056	45,021	0
Increase in fixed assets	11,695	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	8,154	1,250	1,250	1,875	2	0	0	0	0	0	0
Operating costs	0	27,480	31,708	35,935	42,277	42,294	42,294	42,294	42,294	42,294	42,294	0
Marketing and Distribution cost	0	350	350	350	350	350	350	350	350	350	350	0
Income tax	0	0	0	0	1,599	1,651	2,149	2,206	2,263	2,320	2,377	0
Financial costs	0	1,383	1,521	1,331	1,141	951	761	571	380	190	0	0
Loan repayment	0	0	1,902	1,902	1,902	1,902	1,902	1,902	1,902	1,902	0	0
SURPLUS (DEFICIT)	0	5,162	1,351	2,389	1,613	3,607	3,302	3,435	3,568	3,701	5,736	16,228
CUMULATIVE CASH BALANCE	0	5,162	6,513	8,902	10,515	14,122	17,424	20,859	24,427	28,128	33,864	50,092

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	32,992	38,068	43,144	50,757	50,757	50,757	50,757	50,757	50,757	50,757	16,228
Inflow operation	0	32,992	38,068	43,144	50,757	50,757	50,757	50,757	50,757	50,757	50,757	0
Other income	0	0	0	0	0	0	0	0	0	0	0	16,228
TOTAL CASH OUTFLOW	19,759	29,066	33,294	38,140	44,228	44,295	44,793	44,850	44,907	44,964	45,021	0
Increase in fixed assets	11,695	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	8,064	1,236	1,236	1,854	2	0	0	0	0	0	0	0
Operating costs	0	27,480	31,708	35,935	42,277	42,294	42,294	42,294	42,294	42,294	42,294	0
Marketing and Distribution cost	0	350	350	350	350	350	350	350	350	350	350	0
Income (corporate) tax		0	0	0	1,599	1,651	2,149	2,206	2,263	2,320	2,377	0
NET CASH FLOW	-19,759	3,926	4,774	5,004	6,529	6,462	5,964	5,907	5,850	5,793	5,736	16,228
CUMULATIVE NET CASH FLOW	-19,759	15,833	-11,059	-6,055	474	6,936	12,900	18,807	24,657	30,450	36,186	52,415
Net present value	-19,759	3,569	3,945	3,759	4,459	4,012	3,367	3,031	2,729	2,457	2,211	6,257
Cumulative net present value	-19,759	16,190	-12,244	-8,485	-4,025	-13	3,353	6,385	9,114	11,571	13,782	20,039

NET PRESENT VALUE 20,039
INTERNAL RATE OF RETURN 25.50%
NORMAL PAYBACK 5 years

