

**5. PROFILE ON PRODUCTION OF  
BARBED WIRE**

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## **I. SUMMARY**

This profile envisages the establishment of a plant for the production of barbed wire with a capacity of 375 tonnes per annum.

The present demand for the proposed product is estimated at 226.36 tonnes per annum. The demand is expected to reach at 545 tonnes by the year 2020.

The plant will create employment opportunities for 51 persons.

The total investment requirement is estimated at Birr 2.71 million, out of which Birr 824,100 is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 24.65 % and a net present value (NPV) of Birr 1.80 million, discounted at 8.5%.

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

Barbed wire is a fencing material consisting of a metal cable with regularly spaced sharp projections. The cable usually consists of two wires twisted around each other to add strength and to allow the cable to expand and contract with temperature changes without breaking. The sharp points, called barbs, usually consist of short pieces of wire twisted around one or both of the cable wires.

Barbed wire afforded protection against untamed cattle and safeguarded property improvements. It is durable, easy to install, flexible, and inexpensive.

Moreover, barbed wire is used for military and security purposes and on the top prison fences.

### III. MARKET STUDY AND PLANT CAPACITY

#### A. MARKET STUDY

##### 1. Present Supply And Demand

The demand for barbed wires in Ethiopia is being met from two sources: imports and domestic production by importing the billet and processing it in local factories. The historical data on the unsatisfied demand for the product which met through, spanning the years 2000-2006 is provided in Table 3.1.

**Table 3.1**  
**IMPORT OF BARBED WIRE( TONNES)**

<b>Year</b>	<b>Import</b>
2000	261.88
2001	263.65
2002	22.07
2003	108.10
2004	490.80
2005	266.94
2006	171.09

*Source: Customs Authority, External Trade Statistics, annual Issues.*

Scrutiny of Table 3.1 reveals that imports of barbed wire during the period of analysed years ranged from 22.07 tonnes (2002) to 490.80 tonnes (2004). The mean import over the same span of time was 226.36 tonnes.

The average import during the period 2000 – 2006, i.e., 226.36 tonnes is considered to represent current (2007) unsatisfied demand for the product.

## 2. Projected Demand

The future demand for barbed wire is contingent upon the growth of the national economy, especially the construction sector. Assuming that the construction sector will grow by 7% annually, the future demand for the product is forecasted to range from 242 tonnes in 2008 to 545 tonnes by the year 2020 (see Table 3.2).

**Table 3.2**  
**PROJECTED DEMAND FOR BARBED WIRE (TONNES)**

<b>Year</b>	<b>Projected Demand</b>
2008	242
2009	259
2010	277
2011	297
2012	317
2013	340
2014	363
2015	389
2016	416
2017	445
2018	476
2019	510
2020	545

## 3. Pricing and Distribution

A kilogramme of barbed wire sells currently Birr 16 in the retail market. Allowing a margin of 55%, the factory can sell the product for 10.4 Birr per kilogramme.

**B. PLANT CAPACITY AND PRODUCTION PROGRAMME****1. Plant Capacity**

Based on the market study indicated above, the envisaged plant for manufacturing of Barber wire plant with a capacity of 375 tonnes per annum.

**2. Production Programme**

The plant is expected to operate in 3 shifts of 8 hours per day for a total of 300 working days a year. It is anticipated that the plant will run at 70%, 85% and 100% in the first, second and third years, respectively.

**IV. MATERIALS AND INPUTS****1. RAW MATERIALS**

The diameter of wire rod, as a starting material, is mostly 5-6 mm. In this project, it is presumed that wire rod having a diameter of 5.5mm, which is most popular, is used.

As for the secondary materials required, they include chemical reagents for pickling – mainly hydrochloric acid. The annual requirement of raw materials for barbed wire manufacturing is indicated in the Table 4.1.

**Table 4.1**  
**RAW MATERIAL REQUIREMENT AND COST**

Sr. No.	Description	Qty	Cost '000 Birr		
			F.C	L.C	Total
1	Wire rod Ø 5.5mm-ASA 1010	400 tonnes	1,748.00	349.60	2,097.60
2	Saw dust	1.5 tonnes	-	0.087	0.087
3	Zinc	3.0 tonnes	20.83	4.17	25.00
4	HCL	250 Lt.	1.60	0.32	1.92
5	Ammonium Chloride	34 tones	7.50	1.50	9.00
6	Packing Material	L.S	-	10.00	10.00
	<b>Grand Total</b>		<b>1,777.93</b>	<b>365.68</b>	<b>2,143.61</b>

## B. UTILITIES

The major utilities required by the plant are electricity and water. The estimated annual requirement of utilities of the plant at 100% capacity utilization rate and their estimated costs are given in Table 4.2

**Table 4.2**  
**UTILITIES REQUIREMENT AND COST**

Description	Qty	Cost '000 Birr
Electricity , kWh	960,000	454.656
Water, m <sup>3</sup>	1,500	15.00
<b>Total</b>		<b>355.45</b>

## **V. TECHNOLOGY AND ENGINEERING**

### **A. TECHNOLOGY**

#### **1. Process Description**

A surface coating of iron oxide which forms on steel when it is heated, must be removed from the wire rod and this oxidation layer will be removed by cleaning machine.

The clean wire rod is coated with lime, borax, or phosphate. This coating prevents rusting, neutralizes any remaining traces of acid, and helps lubricants adhere to the wire rod when it is made into wire.

One end of the coated wire rod is shaped to a point. This end is inserted like a thread going through the eye of a needle into a die consisting of a very hard central nib made of tungsten carbide surrounded by a steel holder. The wire rod is lubricated with oil or soap and is pulled through the die to reduce the diameter. This process is known as drawing. A series of dies are used to reduce the wire rod from its original size to the desired size of the wire. For barbed wire, the diameter is typically 2.5 mm.

Drawing the wire causes it to become hard and stiff. To make it pliable, it is heated, a process known as annealing.

Wire to be made into barbed wire is usually galvanized (coated with zinc) in order to prevent weathering. The wire must be perfectly clean and dry to be properly galvanized. First it is cleaned in a bath of hot, dilute hydrochloric acid, and then rinsed with hot water. It then passes through a solution of hot zinc chloride or ammonium chloride to prevent rust from forming as it is dried. After drying, the wire passes through bath molten zinc. Excess zinc is wiped off and the coated wire is allowed to cool.

A single automated machine performs all the steps needed to transform galvanized wire into barbed wire. Two wires are fed into the machine and twisted together to form the cable. Another wire is fed into the machine from the side and twisted around one or both of the cable wires. This wire is cut at an angle on both sides to form a two-point barb. Two wires are twisted and cut together if four- point barbs are needed. The barbed wire is pulled along a set distance usually 10 or 13 cm, and the process is repeated to space the barbs evenly. The barbed wire is wound onto spools and cut into 402 m lengths. These spools are then loaded onto trucks for dispatch to the customer.

## **2. Source of Technology**

The address of machinery supplier is given below:-

Shandong Weichai Imp. & Exp. Corp.

Address: No.6A, Siping Rd., Kuiwen District,

Weifang, Shandong, P.R of China

Tel:+8269988

Fax:+86-536-8232079

Email: swiec@public.wfptt.sd.cn

## **B. ENGINEERING**

### **1. Machinery and Equipment**

Plant machinery and equipment required for barbed wire plant is presented in table 5.1. The total investment cost of plant machinery and equipment is estimated at Birr 19.9 million.

**Table 5.1**  
**MACHINERY AND EQUIPMENT REQUIREMENT AND COST FOR**  
**BARBED WIRE PLANT**

Sr. No.	Description	Qty. (No.)	Cost '000 Birr		
			LC	FC	Total
1	Wire drawing machine (for drawing the wire from Ø6.5mm-2.5mm)	2 Set		80.96	80.96
2	Cleaning machine for oxidation layer	1 Set		4.74	4.74
3	Wire tip sharpening machine	1 Set		12.15	12.15
4	High speed barbed wire machine	2 Set		85.00	85.00
5	Work shop equipment	L.S.		150.00	150.00
6	Dies for drawing machine-for one year	100pcs		6.07	6.07
7.	Galvanizing machine	1 set		45.00	45.00
8	Furnace	1Set		250.00	250.00
<b>Total</b>			-	<b>633.92</b>	<b>633.92</b>
Insurance, Customs Duty, Inland Transport, Bank Charge, Etc.			190.18	-	190.18
<b>Grand Total</b>			<b>190.18</b>	<b>633.92</b>	<b>824.10</b>

## 2. Land, Building and Civil Works

Total land space required is about 1,000 m<sup>2</sup>. The total land lease value for 80 years at the lease rate of Birr 0.625 per m<sup>2</sup>, will be Birr 50,000.00. A built-up area of about 350 square meters will be utilized for production, storage of space parts and office rooms. The construction cost of the built-up area, at a rate of Birr 2,300.00 per m<sup>2</sup>, is estimated to be Birr 805,000.

### 3. Proposed Location

The main factors of selecting the location for barbed wire manufacturing plant are: availability of access road to transport the raw materials and finished products and easy to get utilities. Hence, it is proposed to locate the plant in Jinka town which can fulfilled the above requirement.

## VI. MANPOWER AND TRAINING REQUIREMENT

### A. MANPOWER REQUIREMENT

The plant requires a total of 51 persons and the details of their position along with the annual labor cost are indicated in the Table 6.1.

**Table 6.1**

#### **MANPOWER REQUIREMENT AND ESTIMATED LABOUR COST**

Sr. No.	Job Title	No. of Persons	Salary (Birr)	
			Monthly	Annual
1	General Manager	1	2,000	24,000
2	Secretary	1	800	9,600
3	Production & Technical Head	1	1,700	20,400
4	Commercial Head	1	1,600	19,200
5	Finance & Administration Head	1	1,600	19,200
6	Personnel	1	800	9,600
7	Accountant	1	750	9,000
8	Accounts Clerk	1	400	4,800
9	Cashier	1	500	6,000
10	Sales person	1	500	6,000
11	Purchaser	1	500	6,000
12	Store Keeper	1	500	6,000
13	Quality Controller	1	800	9,600
14	Shift Leader	3	750x3	27,000
15	Operator	9	400x9	43,200
16	Assistant Operation	9	250x9	27,000
17	Laborer	10	150x10	18,000
18	Mechanic	1	700	8,400
19	Electrician	1	700	8,400
20	Driver	2	400x2	9,600
21	Guard	3	200x3	7,200
	<b>Sub – Total</b>	<b>51</b>		<b>289,800.00</b>
	Employee's Benefit 25% basic salary			72,450.00
	<b>Grand Total</b>			<b>362,250.00</b>

## B. TRAINING REQUIREMENT

Training of production worker is required. Therefore, the production supervisors, operators and technicians need to be given three weeks training on production, repairing and maintenance activities.

The training cost is estimated at Birr 25,000.-

## VII. FINANCIAL ANALYSIS

The financial analysis of the barbed wire 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	8%
Discount cash flow	10.5%
Accounts receivable	30 days
Raw material local	30days
Raw material, import	90days
Work in progress	2 days
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days

## A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at 2.71 million, of which 23 per cent will be required in foreign currency. The major breakdown of the total initial investment cost is shown in Table 7.1.

**Table 7.1**  
**INITIAL INVESTMENT COST**

Sr. No.	Cost Items	Total Cost (‘000 Birr)
1	Land lease value	50
2	Building and Civil Work	805
3	Plant Machinery and Equipment	824.1
4	Office Furniture and Equipment	125
5	Vehicle	200
6	Pre-production Expenditure*	280.73
7	Working Capital	426.98
	<b>Total Investment cost</b>	<b>2711.81</b>
	Foreign Share	23

\* *N.B Pre-production expenditure includes interest during construction ( Birr 130.73 thousand ) training (Birr 25 thousand ) and Birr 125 thousand costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

## B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 3.40 million (see Table 7.2). The material and utility cost accounts for 76.89 per cent, while repair and maintenance take 1.21 per cent of the production cost.

**Table 7.2****ANNUAL PRODUCTION COST AT FULL CAPACITY ('000 BIRR)**

<b>Items</b>	<b>Cost</b>	<b>%</b>
Raw Material and Inputs	2,143.61	63.07
Utilities	469.65	13.82
Maintenance and repair	41.2	1.21
Labour direct	217.35	6.40
Factory overheads *	72.45	2.13
Administration Costs **	144.9	4.26
Total Operating Costs	3,089.16	90.89
Depreciation	205.16	6.04
Cost of Finance	104.3	3.07
<b>Total Production Cost</b>	<b>3,398.62</b>	<b>100</b>

\* *Factory overhead cost includes salaries and wages of supervisors, insurance of factory workers social costs on salaries of direct labour etc.*

\*\* *Administrative cost includes salaries and wages, insurance, social costs, materials and services used by administrative staff etc.*

## **C. FINANCIAL EVALUATION**

### **1. Profitability**

According to the projected income statement, the project will start generating profit in the first year of operation. Important ratios such as profit to total sales, net profit to equity (Return on equity) and net profit plus interest on total investment (return on total investment) show an increasing trend during the life-time of the project.

The income statement and the other indicators of profitability show that the project is viable.

## 2. Break-even Analysis

The break-even point of the project including cost of finance when it starts to operate at full capacity (year 3) is estimated by using income statement projection.

$$\text{BE} = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 20 \%$$

## 3. Pay Back Period

The investment cost and income statement projection are used to project the pay-back period. The project's initial investment will be fully recovered within 4 years.

## 4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 24.65 % and the net present value at 10.5% discount rate is Birr 1.8 million.

## D. ECONOMIC BENEFITS

The project can create employment for 51 persons. In addition to supply of the domestic needs, the project will generate Birr 1.27 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.