

**207. PROFILE ON BAMBOO MAT, BOARDS
AND CORRUGATED SHEETS**

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I. SUMMARY

This profile envisages the establishment of a plant for the production of bamboo mat, boards and corrugated sheets with a capacity of 300,000 sq.mt per annum.

The present demand for the proposed product is estimated at 228,968 sq.mt per annum. The demand is expected to reach at 593,361 sq.mt by the year 2020.

The plant will create employment opportunities for 90 persons.

The total investment requirement is estimated at about Birr 8.31 million, out of which Birr 2 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 27 % and a net present value (NPV) of Birr 6.49 million discounted at 8.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

Bamboo, popularly known as 'poor man's wood' has been used for constructional purpose and other uses since time immemorial. Bamboo has been a potential source of raw material for handicraftsman. It also provides basic raw material for making various household articles. The unique strength properties of bamboo coupled with easy processing into useful products have enabled man to make many innovative products. Among these, bamboo mat, boards and corrugated sheets are popular and widely utilized products.

Bamboo Mats are woven from bamboo slivers. Dried resin coated mats are assembled in 2, 3 or 5 plies and hot pressed to produce bamboo mat boards of desired thickness. Bamboo mat coated with suitable resin binder are applied on platens having approximated sinusoidal wave patterns and designed to be fitted with hydraulic hot press to produce corrugated sheets.

Bamboo mat are used for making bamboo boards and corrugated sheets. In addition, bamboo mats are used for floor and wall decoration purposes, etc. Bamboo boards are applicable for Paneling, Partitions, Ceilings, Panel doors, Flush doors, Furniture, Packing, Storage, Transportation, Craft work, etc. Bamboo mat corrugated sheets are applicable for roofing of house and tukules, and fencing and shading applications.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Bamboo mat boards and corrugated sheets are products used for interior decoration and flooring of buildings. For estimating the present demand for the products the following assumptions are used;

- The main users of the product are the urban population
- Of the total urban house holds only 15% will utilize bamboo mat boards and corrugated sheets

Accordingly, considering the current urban household size of the region which is 381,600 the target household is 57,240. Assuming that each household will utilize two pieces of the product and one pieces two m², the current demand for bamboo mat boards and corrugated sheets is estimated at 228,960 m².

2. Projected Demand

The demand for bamboo mat boards and corrugated sheets is directly related with new housing units. Generally, housing units increases with the per capita growth rate. Thus, it is appropriate to forecast the demand for bamboo mat boards and corrugated sheets along with GDP growth rate. The 2000-2004 average real GDP growth rate achieved was 7.6 %.

Applying this annual growth rate, the demand for bamboo mat boards and corrugated sheets is presented in Table 3.1.

Table 3.1
PROJECTED DEMAND (M2)

Year	Projected Demand
2008	246,361
2009	265,084
2010	285,231
2011	306,908
2012	330,233
2013	355,331
2014	382,336
2015	411,394
2016	442,660
2017	476,302
2018	512,501
2019	551,451
2020	593,361

3. Pricing and Distribution

After considering the current retail price of various types of floor coverings, a factory-gate price of Birr 35 per set m² is recommended for the envisaged plant. The product can be distributed through establishment of own outlets at selected urban centers.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

According to the market study, the demand of bamboo mat, boards and corrugated sheet in the year 2008 will be 246,361 sq mt., whereas this demand will grow to 593,361 by the year 2020.

Based on the market study and the economic scale of production, the annual gross production capacity of the envisaged plant for bamboo mat, boards and corrugated sheets is 300,000 sq. mt per day based on 300 working days and two shifts of 8 hours per day. Increasing the number of working hours per day can increase this capacity.). Detailed annual production is as follows:

Table 3.1
BAMBOO MAT, BOARDS AND
CORRUGATED SHEET PRODUCTION CAPACITY

S/ N	TYPE OF BAMBOO PRODUCT	PRODUCTION CAPACITY (SQ. MT.)
1	Bamboo mat (assorted patterns and sizes)	75,000
2	Bamboo mat Board (assorted sizes and thickness)	150,000
3	Bamboo mat corrugated sheet (4-Layers) 1.05 mt x 1.8 mt x 3.7mm Thickness	75,000
	Total	300,000

2. Production Programme

Table 3.2 shows the production programme of the envisaged project. At the initial stage of the production period, the plant requires some years to penetrate into the market. Therefore, in the first and second year of production, the capacity utilization rate will be

70% and 85%, respectively. In third year and thereafter, full capacity production shall be attained.

Table 3.2
PRODUCTION PROGRAMME

Sr. No.	Product	Production Year		
		2008	2009	2010-2016
1.	Bamboo mat (Sizes 250cm x 125cm, 180 cm x 125cm, 180 cm x 150cm and patterns Herringbone type (450) and rectangular type (900).	56,250	63,750	75,000
2	Bamboo mat Board (Size and thickness depends on customers' choice)	112,500	127,500	150,000
3	Bamboo Mat Corrugated Sheet (4-Layers) 1.05 mt x 1.8 mt x 3.7mm Thickness	56,250	63,750	75,000

IV. RAW MATERIALS AND INPUTS

A. RAW MATERIALS

The raw material for manufacturing of bamboo mats, boards and corrugated sheet include raw bamboo, resins, preservatives and other chemical for treatment. The total annual cost of raw materials is estimated at Birr 6,704,000.00

Table 4.1 indicates the annual requirement of raw materials of the proposed project.

Table 4.1
RAW MATERIALS REQUIREMENT AND COST
(AT FULL CAPACITY)

Sr. No.	Raw Material	Unit of Measure	Qty.	Cost ('000 Birr)
1.	Raw bamboo	PCS	6,000,000	6,000
2.	Varnish & Black Oil	Gallons	90	13.5
3	Modified phenol formaldehyde resin	Kg	10000	100
4	Preservative	Lt.	3000	300
5	Resin (Assorted types)	Kg	15,000	150
6	Paints (Assorted colors)	Kg	500	50
7	Packing materials	Lump sum		70
8	Miscellaneous	Lump sum		20
	Total			6,704.000

B. UTILITIES

Electricity and water are the principal utilities of the project. The annual utilities requirement and cost are indicated in Table 4.2

Table 4.2
UTILITIES REQUIREMENT AND COST

Sr. No.	Utility	Unit of Measure	Qty.	Cost ('000 BIRR)
1	Electricity	KWh	250,000	118.4
2	Water	M ³	600	6
	Total			124.4

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

a) Bamboo Mat

Bamboo mat weaving is done manually, mostly by men and women, as part time vocation to supplement family income. From split bamboo epidermal layer is removed and slivers of thickness ranging from 0.6mm to 1.0 mm are made and dried in air to moisture content of around 15%. The dried slivers are manually woven into mats of different sizes and patterns. Herringbone weaving pattern is most common throughout the world.

b) Board Making

Bamboo mats are dipped in modified phenol formaldehyde resin mixed with a preservative to increase resistance to termite and decay. Resin coated mats are dried to a moisture content of around 10% either in drying chambers or industrial dryers. Dried resin coated mats are assembled in 2, 3 or 5 plies and hot pressed to produce bamboo mat boards of desired thickness of board and hot pressed. The boards are trimmed and cut to required

sizes. For thickness greater than 6mm, bamboo mats are interleaved with wood veneers to make bamboo mat veneer composites.

c) Bamboo Mat Corrugated Sheets (Bmcss)

Since corrugated sheets are more ideal for roofing application, attempts were made to develop Corrugated Bamboo Mat Sheet (BMCS). For this purpose platens having approximated sinusoidal wave patterns were designed to be fitted with hydraulic hot press to produce corrugated sheets by using bamboo mat coated with suitable resin binder.

2. Source of Technology

Building Materials and Technology Promotion Council

Core 5A,first Floor, India Habitat Centre, Lodhi Road

New Delhi 110 003

Tel: 91-11-2463 8097,2463 6747

Fax: 91-11-2464 2849

B. ENGINEERING

1. Machinery and Equipment

The list of machinery and equipment is indicated in Table 5.1. The total cost of machinery is estimated at Birr 2 million of which Birr 1.6 million is required in foreign currency. The plant needs vehicles (one pick-up) for transportation of finished product and for office activities. The total cost of the vehicles is estimated at Birr 320,000.

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

Sr. No.	DESCRIPTION	UNITS	Qty.
1.	Bamboo cross cutter	Pcs	3
2.	Tools for Splitting and preparation of bamboo slivers	Set	3
3.	Resin Kettle	Pcs	4
4.	Resin applicator	Pcs	4
5.	Hydraulic Hot press	Pcs	2
6.	Drying chamber	Pcs	1
7.	Fire tube Steam Boiler	Set	1
8	Scissor lift	Pcs	2
9	Aluminum cauls	Set	1
10	DD saw	Pcs	1
11	Measuring instruments	Lot	1
12	Conveyor	Set	1
13	Blower for cooling cauls	Pcs	1
14	Storage tank for formalin	Pcs	1
15	Weighing machine	Pcs	1
16	Stand-by generator with canopy and accessories	Pcs	1
17	Sprayer for prophylactic treatment	Pcs	2
18	Air compressor	Set	1
19	Band dryer (Alternate to drying chamber)	Pcs	1
20	Trolley	Pcs	3
21	Mould for Corrugated sheet	Pcs	2
	Total cost (Birr)		2,000,000.00

2. Land, Building and Civil works

The plant requires a total of 2500m² area of land out of which 1,600m² is built-up area which includes manufacturing area, raw material stock area, offices etc. Assuming construction rate of Birr 2500 per m², the total cost of construction is estimated to be Birr 4 million. The total cost, for a period of 80 years with cost of Birr 1 per m², is estimated at Birr 2,500. The total investment cost for land, building and civil works is estimated at Birr 4,002,500.

3. Proposed Location

According to the resource potential study of the region, the raw material, Bamboo, is identified in Bitta ,Yeki , Dita ,E/aner , Azernet woredas. Based on the availability of raw material infrastructure, utility and market out let Zada town of Dita woreda is selected and recommended to be the location of the envisaged plant.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The manpower requirement of the envisaged project is 90 persons. The list of manpower is indicated in Table 6.1. The total annual labour cost including fringe benefits is estimated at Birr 959,500.00.

Table 6.1**MANPOWER REQUIREMENT AND LABOUR COST**

Sr. No.	Description	Req. No.	Monthly Basic Salary (Birr)	Annual Salary (Birr)
1.	General Manager	1	2,000	24,000
2.	Snr Secretary	1	700	8,400
3.	Production & technical Head	1	1,200	14,400
	Shift super visor	3	3000	36,000
4.	Finance and Administration head	1	1200	14,400
5.	Secretary	1	550	6600
6.	Clerk	4	2200	26,400
	Bamboo Cross cutter operator	3	1350	16,200
7.	Bamboo splitter	10	5000	60,000
8	Sliver and Mat attendant	30	18,000	19,200
9	Chemical attendant	6	3000	57,600
10	Bamboo board attendant	8	5,600	216,000
11	Bamboo corrugated sheet attendant	8	5,600	216,000
12	Laborer	6	1800	21,600
13	Guard	6	2400	28,800
14	Driver	2	1000	2,000
	Sub-Total	90	52,600	767,600
	Benefits (25% BS)		13,150	191,900
	Grand Total		65,750.00	959,500.00

B. TRAINING REQUIREMENT

Training on manufacturing of Bamboo mat, boards and corrugated sheets will be given to workers for a period of one month. The training program can be executed either in a public or private enterprise. A total of Birr 50,000 is allotted to cover the expenses.

VII. FINANCIAL ANALYSIS

The financial analysis of the bamboo mat 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	8.5%
Accounts receivable	30 days
Raw material local	30days
Work in progress	5 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 Birr 8.31 million. 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	200
2	Building and Civil Work	4,000.00
3	Plant Machinery and Equipment	2,000.00
4	Office Furniture and Equipment	75
5	Vehicle	200
6	Pre-production Expenditure*	572.18
7	Working Capital	1270.97
	Total Investment cost	8,318.2

* *N.B Pre-production expenditure includes interest during construction (Birr 422.18 thousand) training (Birr 50 thousand) and Birr 100 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 8.73 million (see Table 7.2). The material and utility cost accounts for 78.19 per cent, while repair and maintenance take 0.86 per cent of the production cost.

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

Items	Cost	%
Raw Material and Inputs	6,704.00	76.76
Utilities	124.4	1.42
Maintenance and repair	75	0.86
Labour direct	460.56	5.27
Factory overheads	191.9	2.20
Administration Costs	307.04	3.52
Total Operating Costs	7,862.90	90.03
Depreciation	477.5	5.47
Cost of Finance	392.94	4.50
Total Production Cost	8,733.34	100

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.

$$\text{BE} = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 18\%$$

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 27 % and the net present value at 8.5% discount rate is Birr 6.49 million.

D. ECONOMIC BENEFITS

The project can create employment for 90 persons. In addition to supply of the domestic needs, the project will generate Birr 4.28 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.