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# Bamboo Mat for Boards

<b>Location</b>	Chakmaghat, West Tripura district, Tripura State, India
<b>Suitability</b>	Households, self-help groups
<b>Benefits</b>	Poverty alleviation – Generates cash income – Gender neutral
<b>Level</b>	Household
<b>Capacity</b>	730 mats per year
<b>Keywords</b>	Bamboo – Mat

## Introduction

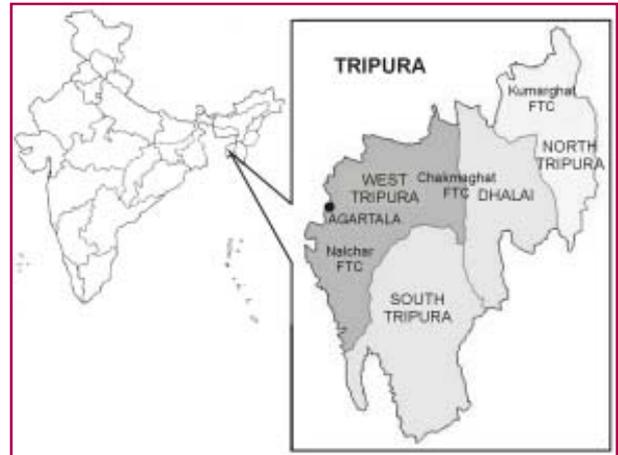
Tripura, one of the eight states of Northeast India, is the smallest state of the region and the second most populous state after Assam, with a total population of about 3.19 million, as per 2001 Census. The state is divided into four districts – North Tripura, South Tripura, West Tripura and Dhalai. Nearly two-thirds of the area is hilly, leaving very little cultivable land to meet the requirement of burgeoning population of the state.

States like Tripura have a sizeable number of artisans whose traditional working materials include bamboo. These bamboo articles often mean the difference between starvation and one square meal. In Tripura, bamboo handicrafts form a sizeable chunk of the rural economy. Ethnic communities in the state produce a wide range of articles from bamboo, both for household use as well as for selling for returns in cash or kind.

Bamboo mats are a traditional product of Tripura. However, the market for such products tends to be seasonal, which precludes a regular income. New opportunities are emerging with the development of novel products such as bamboo mat boards, which could be used for a variety of purposes such as roofing, walling, partitioning and furniture.

## The Enterprise

Production has the potential has the potential to develop into an auxiliary industry that caters to board manufacturers, particularly in the Northeast where a host of plywood manufacturers had to shut shop following the ban on felling of trees owing to ecological reasons. Tripura Bamboo and Cane Development Centre (TRIBAC), a non-profit organization set up by the Centre for Indian Bamboo Resource and Technology (CIBART), is therefore promoting bamboo mats. TRIBAC views such technologies as a means for ensuring sustainable alternative livelihood patterns in regions of Tripura.



The process documented is practiced by individual households. The household enterprise has a capacity to produce 730 bamboo mats per year, considering 300 workdays. Low capital investment, flexibility of work schedule and low level of technology make the enterprise ideal for rural income generation programs.

## The Process

The process of interlacing bamboo slivers to make mats is basically traditional. Poles of the bamboo species *Bambusa teres* (locally called Paora) are first cross-cut to the required lengths using a saw. These rods are then slivered and the slivers are interlaced in herringbone pattern.

## Beneficiaries

The main beneficiaries are households, which mostly operate in an informal set-up. Income earned from the activity could help alleviate poverty, particularly in lean months when agriculture is not an option. Most of the people engaged in such activities belong to socially backward classes.

## Key Financial data

Cost price per mat	: INR 69.21
Sale price per mat	: INR 70.00
NPV of the enterprise	: INR 3,772.00
IRR	: 75%
Benefit-cost ratio	: 1.02

It is assumed that the enterprise has the required work space available free of cost. Cost of raw material (bamboo) works out to INR 12.50 per mat. The rest of the production cost is mostly labour charges,

Exchange rate: US\$1 = INR 46



Cross-cutting the bamboo pole

which accrues to the household enterprise, as the labour is contributed by household members. The actual earning, therefore, is much more than the INR 0.79 per mat shown as net profit.

Costs for the enterprise include as fixed capital one-time cost of INR 500.00 towards tools, and annual operating cost of INR 50,424.00 towards costs of materials and labour.

### Key Benefits

- Livelihood creation and poverty alleviation
- Production can be carried out in households
- Very low capital investment
- Possibility of linking to board production industry

### Key Requirements

- Adequate availability of bamboo at a reasonable cost
- Rent-free premises to operate from
- Regular demand for the product
- Acceptability of the quality in the marketplace

### The Environment

Tripura, one of the seven sister states of Northeast India, is not only the smallest state of the region but also the third smallest state in the country with a geographical area of 10,491 sq. km. The state is situated in the south-western extremity of Northeast India. Nearly two-thirds of the area is hilly, leaving very little cultivable land to meet the requirement of burgeoning population of the state. Despite being geographically the smallest state in the Northeast region, Tripura is the second most populous state after Assam, with a total population of about 3.2 million and a population density of 305 per sq. km.

While Tripura's population density is lower than the all-India level (324), its per capita net sown area of 0.214 acre is 1.5 times lower than the all-India level (0.343 acre). This points to the growing population pressure on the cultivable land resource of the state.

The aerial extent of the state ranges from 22° 56' to 24° 32' North latitude and 91° 09' to 92° 20' East longitude with the Tropic of Cancer passing through it. While Assam and Mizoram share its eastern boundary, Bangladesh surrounds it on three sides through a boundary of 856 km (almost 85 percent of its perimeter). For this reason, Bangladesh plays a large role in the development of Tripura, as a consumptive market and even influencing the social fabric of the state. Geographically, Tripura is in relative isolation from the rest of India owing to: (a) Physical distance from rest of India; (b) Post-Independence closure of relatively short routes through Bangladesh; and (c) Inadequate development of rail and road transport facilities.

The population of the state is 3.199 million as per 2001 Census, with a decadal variation of 15.74 percent during 1991-2001 as against the all-India variation of 21.34 percent. Much of the growth is attributed to migration factors. Urban population is less than 18 percent of the total, reflecting the rural and agrarian dominance on the state economy. There are 19 tribes, the major among them are *Tripuri, Chakma, Reang, Halam, Jamatia, Mog, Noatia, Kuki, Garo* and *Lushai*.

At present, there are four administrative districts in the state – West Tripura, South Tripura, North Tripura and Dhalai. Agartala is the capital of Tripura. There are 15 sub-divisions in the state. Besides, there are 38 blocks, 874 revenue mauzas – out of which 856 are revenue villages – 12 town panchayats and six census towns. This apart, Agartala Municipal Council area consists of 17 municipal wards. Moreover, there are 962 village panchayats

Agartala is connected by road with Guwahati via Shillong by National Highway No. 44, known as Assam-Agartala Road, which is the only road link with the rest of India and is the lifeline for Tripura. The National Highway is now being extended up to Sabroom, which is the southern-most point of Tripura. All districts and sub-divisions are well connected by all-weather roads.

The state capital Agartala is well connected by air with Calcutta and Guwahati. The flights from Guwahati and Calcutta take hardly 45 minutes to reach Agartala. The state has three more small airports at Khowai, Kamalpur and Kailashahar.

Tripura is also connected by rail via Guwahati and the railway station nearest to the capital city is at Kumarghat (in the North District of the state), which is



Slivering of bamboo slats

140 km away from Agartala. The total length of railway track from Dharmanaga))facturing sector (6.41 percent of workforce engaged) lagging far behind. About 66.8 percent of the rural people are under the poverty line.

The per capita State Domestic Product (SDP) is very low (Rs. 10,231 compared with the National Domestic Product of Rs. 15,541 in 1999-2000).

Rice is the major crop, as it is well suited to the marshy conditions of the northern basin. Sugar cane, mustard and potatoes are also grown. Main cash crops are jute, cotton, tea and fruits. The agricultural production is not sufficient to meet the needs and the state imports large quantities of rice, wheat, maize, pulses and sugar to cover the shortfall. Main export items from the state include plywood pulp, bamboo and rattan articles, timber and canned fruits. Shifting cultivation by slashing and burning of forests (locally called *jhum*). About 35,000 to 40,000 ha of forestland is annually cleared for this. As per the Task Force on Shifting Cultivation, about 17.7 percent of the forest area is affected by shifting cultivation by 40 percent of the tribal population.

According to the Forest Survey of India, the forest cover in Tripura constitutes 54.76 percent of the total geographical area, up from the 52 percent in 1997. The types of forests are: evergreen forests, moist deciduous forests, swamp vegetation, bamboo forests, rattan brakes, dipterocarpus forests, savannah and grassland vegetation.

According to Tripura's State Forestry Action Plan, the bamboo resources cover an area of about 2,397 sq. km, which includes areas under shifting cultivation. Another 109 sq. km outside the forest areas is estimated to have smallholdings of cultivated bamboo. Apart from this, almost each rural house has at least one homestead bamboo clump. Tripura has about

26 species/varieties of bamboos belonging to the genera *Bambusa*, *Dendrocalamus*, *Gigantochloa*, *Melocanna*, *Melocalamus*, *Neohouzeaua*, *Oxytenanthera*, *Schizostachyum*, etc. The main species found in the state include: *Bambusa affinis*, *B. balcooa*, *B. nutans*, *B. pallida*, *B. polymorpha*, *B. teres*, *B. tulda*, *Dendrocalamus hamiltonii*, *D. longispathus*, *D. strictus*, *Melocanna baccifera*, *Melocalamus compactiflorus*, *Neohouzeaua dulloa* and *Oxytenanthera nigrociliata*. Although most of these species grow naturally and are found in abundance in the forests, *Melocanna baccifera* (Muli) and *Bambusa tulda* (Mritinga) are the most widespread and *M. baccifera* is the most used. There are plantations both in the public and the private sectors, and there have been several planting initiatives recently to raise *D. strictus* and *B. bambos* plantations using tissue-cultured plantlets.

Bamboo has been, and continues to be, an integral part of Tripura's ecology and economy. It is an essential housing material for over a million of the rural poor in the state, and also serves as a widely used material for furniture making. A large number of houses, warehouses, granaries, shops and workspaces have been built using bamboo as the main construction material. Besides bamboo posts and structural members, bamboo culm is also used – split and flattened – as flooring material, walling material, as well as for doors. It is not uncommon to see even thatching made of bamboo leaves. Bamboo culms are used also to construct field and house fences, and also form an important component in the religious and cultural practices of the tribal people.

Bamboo handicrafts from Tripura are immensely popular throughout India and form a sizeable chunk of the rural economy. Tripura is famous for its bamboo screens made from split bamboo, so finely woven that they look almost like ivory. Bamboo matting is another thriving industry in the state. The bamboo sector also supports industries that produce paper and incense sticks (*agarbatti*).



Close-up of the woven mat

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## The Enterprise

The process documented is practiced at household level. The enterprise has a capacity to produce 730 bamboo mats per year, considering 300 workdays of one 8-hour shift each.

Markets mostly local, located within reasonable distance from the production site; hence, no transportation or marketing costs are involved.

The enterprise documented here uses *Bambusa teres*, locally known as Paora bamboo, an indigenous species that grows to a height of about 20 m and attains a diameter of about 8 cm. It has internodes that are about 40-50 cm long. This bamboo is mainly used for making mats, baskets and agarbatti sticks.

## Inputs

- Bamboo poles

- Hacksaw
- Knife

## Process Details

1. The bamboo culm is cross-cut into 4 cylindrical pieces (1 top piece of 9 ft length, 1 bottom piece of 9 ft length, and 2 middle pieces each of 5 ft length).
2. The cross-cut pieces are split into halves using a heavy knife.
3. Each split is re-split into 5 slats each.
4. Using knife, each slat is reduced to 1-mm thick slivers (15 mm width, and 9 ft or 5 ft long).
5. Weaving is done in herringbone pattern, using 102 slivers (9 ft long) vertically and 173 slivers (5 ft long) horizontally.
6. The mat is trimmed to a size of 8½ ft × 4½ ft, which is the standard size for boards.



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## BAMBOO MAT : ON-FARM MODEL

### A. PARAMETERS

Local currency unit:

INR (US\$1 = INR 46)

Interest rate

- working capital (without project) 6% per year
- working capital (with project) 15% per year
- fixed capital (without project) 6% per year
- fixed capital (with project) 15% per year

Loan period (months)

- working capital (without project) 12 months
- working capital (with project) 60 months
- fixed capital (without project) 12 months
- fixed capital (with project) 60 months

### B. FIXED CAPITAL

Item	Without project				With project								
	Y1-Y5				Y2		Y3		Y4		Y5		
	Unit	Quantity	Rate	Total	Quantity	Rate	Quantity	Rate	Quantity	Rate	Total		
Tools & Equipment (Saw, Knife)	Lump sum	1 Set	0	0	1 Set	Lump sum	500	0	0	0	0		
<b>Total</b>				<b>500</b>									
<b>Raw Materials</b>													
Bamboo (B. teres)	per mat		12.50	-	730	12.50	9125	730	12.50	9125	730	12.50	9125
<b>Labour</b>													
Permat	workday	0.0943	60.00	688	688	60.00	41299	688	60.00	41299	688	60.00	41299
<b>Total</b>				<b>50424</b>			<b>50424</b>			<b>50424</b>			<b>50424</b>
<b>D. REVENUE</b>													
Sales/year	No	730	0	0	730	70	51100	730	70	51100	730	70	51100
<b>Total</b>							<b>51100</b>			<b>51100</b>			<b>51100</b>

## E. CASH FLOW PROJECTIONS

Item	Y1	Y2	Y3	Y4	Y5
<b>INFLOW</b>					
Sale revenues	51100	51100	51100	51100	51100
Enterprise contribution					
- Fixed capital	500	0	0	0	0
- Working capital (7 days operating cost)	980	0	0	0	0
Total inflow	52580	51100	51100	51100	51100
<b>OUTFLOW</b>					
Fixed capital	500	0	0	0	0
Operating costs	50424	50424	50424	50424	50424
Total outflow	50924	50424	50424	50424	50424
Cash Flow	1656	676	676	676	676
<b>F. FINANCIAL ANALYSIS</b>					
Return on total capital employed					
- Income from sales	51100	51100	51100	51100	51100
- Cash outflow	50924	50424	50424	50424	50424
- Net cash flow	-804	676	676	676	676
Internal rate of return – IRR (%)	75.08%				
Discounted cash inflow	216648				
Discounted cash outflow	212876				
Net present value – NPV	3772				
Benefit/Cost ratio	1.02				
Contribution (Sales - variable cost)	676	676	676	676	676
Profit before interest, tax & depreciation	676	676	676	676	676
Fixed Cost	Nil				
Depreciation	100	100	100	100	100
Profit before Tax – PBT	676	676	676	676	676
Present value ratio – PVR	1	1	1	1	1
Tax (tax exempted)	Nil				
Profit after tax – PAT	676	676	676	676	676
Break even point ( in value)	7559				
Break even point ( in unit)	108				