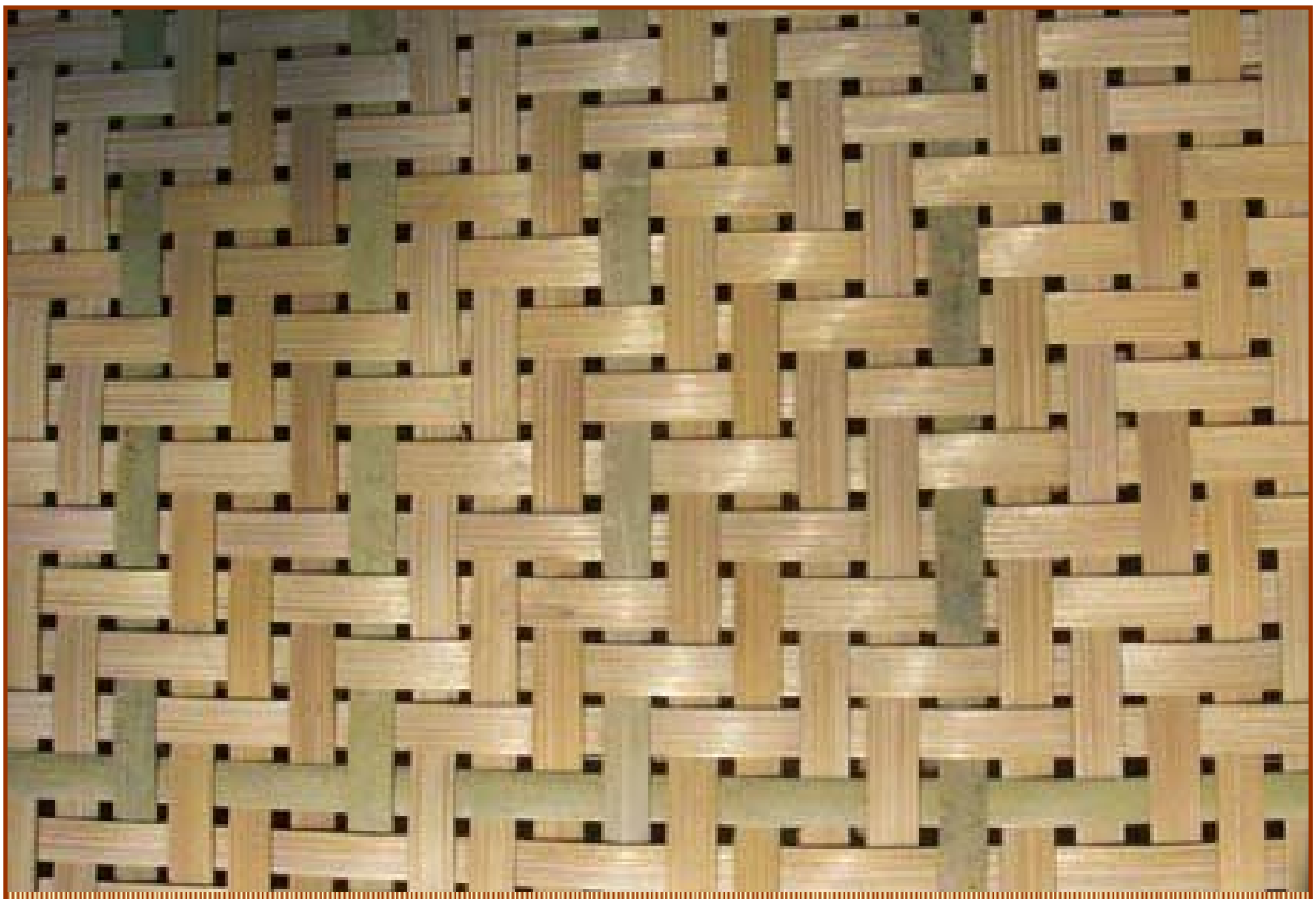

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Background

Mats are a useful intermediate product made at the primary processing stage and finds large scale utilisation for production of mat board, shuttering board and roofing sheets.

Innovative products like pre-fab houses and pallets to package and export tea have also been designed using mat boards. The market has responded well to these industrial products and there is a good demand for these products emerging from the disaster struck areas like tsunami and earthquake. Bamboo Mat Board has been awarded an ISI code now which has increased its market acceptability particularly in disaster rehabilitation applications. Industries are waking up to these opportunities with newer units planned to be set up in the Eastern region and Southern region of the country. Kitply a one time market leader is increasingly looking to utilisation of bamboo by introducing new product ranges.

Other than being an intermediary product for board manufacture as indicated above, mats can be used as a floor covering or wall cladding for partitions or to meet aesthetic needs. The ever growing furniture market is always in need of new designs and new materials. Being a decorative item however, variance in design will be required to get over consumer boredom or fatigue factor. Many a times in the past, interior designers interviewed have indicated that they can't use the material extensively given consumer needs for something new. This end of the market whether as a stand alone mat or through the form of boards will thus be constrained by its variety of look in years to come.

Units involved with manufacturing bamboo mat board, bamboo mat corrugated sheets, and prefab houses have been set up in the last 3 years in different states of NER and West Bengal.

Structure of Industry

A typical board manufacturing unit, roofing sheet unit or prefab house making unit requires an investment in the range of Rs. 1-3 crore on plant and machinery. Entrepreneurs who have traditionally been in the ply board industry or manufacturers of items which lend themselves to usage of bamboo board like prefab houses or railway cabins or even home grown entrepreneurs in NER who know the region and the resource well have entered the business. The units as mentioned above are concentrated geographically in the NER or in the state of West Bengal currently. Another unit is coming up in the state of Karnataka.

Name of Unit	**Products Manufactured**
AB Composites*	Bamboo mat corrugated sheets
Embee Forest Products	Shuttering board
Kitply Industries	Bamboo decorative mat board, shuttering board
APIL	Prefab houses, boards, pallets
Timpack	Bamboo mat corrugated sheets
Meghalaya Boards	Mat board
Zonun Matply Pvt. Ltd.	Mat board

** AB Composites utilises jute as a composite material with bamboo*
^ Embee Forest Products uses wood with bamboo in its products

Different sources have been used for procurement of technology for manufacture of boards. The ply board making units like Kitply and APIL have developed their own processes by modifying their existing units in Margherita and Namsai respectively. Others like Embee products and Timpack have procured the technology from NMBA while some of them have procured the technology from China.

2.0 Opportunities for Tripura

The industries are being run by technocrats who know their product and technology and who are equally strong in their marketing acumen.

Units have overcome process teething problems and are prepared to go in for full fledged production. Mat weaving however seems to be the ruling constraint at this point of time. At present they are making do with in house production by either making own mats and strips housing mat weavers or sourcing through traders. However, this is not sufficient – shortage of woven mats is the biggest barrier to the growth of the industry and presents itself as an opportunity should cost and quality needs be met.

Industry owners have indicated that on many an occasion suppliers have failed to deliver on their promises to the market and if they do not soon get a steady supply of mats, it could threaten operations. This will obviously reflect poorly on the so called huge potential identified for bamboo sector with capitalised investment seen.

Although these units had evaluated the availability of mats and developed supply sources yet experience with vendors developed has been far from satisfactory. There have been issues with both, quantity as well as quality of supplies. Past efforts with local communities have not resulted in delivery of required quantities on time. Many of them have spent extensive time even in Tripura to develop stable mechanisms of supply, but to no avail.

It is more important to understand the apprehensions expressed by many large buyers on Tripura being able to deliver on promises made. The units met with were also keen to collaborate in the effort if a new institutional mechanism could be put on the ground that could take a single point onus on discussion and delivery. When probed, some even indicated keenness to collaborate by establishing units in Tripura if a package can be offered to neutralise the cost disadvantage in operation and/or transportation terms. Any new supply based arrangement will have to take into account past failures and suggest a commitment mechanism executed through contracts with non-performance penalties put down as an important clause.

3.0 End User Industries for Mat

3.1 Timpack Industries

The BMTPC and the IPIRTI, have jointly developed a technology for manufacturing of Bamboo Mat Corrugated Sheets (BMCS). The Council has transferred this technology to a private entrepreneur M/s Timpack Pvt. Ltd. for commercial production and marketing. Timpack Industries is presently producing Bamboo corrugated sheets at Byrnihat , Meghalaya about 30 kms from Guwahati. The product BMCS has a ready market with orders from Government as well as private parties.

The unit cannot meet with demand of order due to erratic supply of mats which are an intermediate product in the production of the BMCS. Each BMCS requires 4 mats of size 8ft x 4ft. The product is superior to the GI sheet in many ways and is likely to enjoy a good market growth provided there is continuous supply in the market. Moreover mat would continue to remain the critical component in the product because it is part of the ISI and building code specification for the BMCS. Mats cannot be replaced by strips or by flattened bamboo if ISI specifications have to be met. This in turn opens up the government and relief supply market particularly for disaster mitigation needs.

Quantity of Mats Required

The production capacity of Timpack is 10,000 mats per day. At 30% utilisation as is the case presently the unit requires 3000 mats per day of 8ft x 4ft size for its production facility. There are certain specifications with respect to quality of weaving required, width of strips, green skin removal, no gaps in weaving, etc. that need to

be complied with. They are willing to pay Rs 41 per mat and will be willing buyers for a truckload of mats daily at the price indicated, landed at their factory inclusive of any local taxes levied.

Sourcing of Mats

They have indicated that in the past they had approached the Tripura Forest Department for arranging supply of 3000 mats per day. They had visited areas around Agartala and had entered into an agreement with the Forest Department to supply 3,000 mats per day but at the end of one year they could receive only 6,000-9,000 mats.

One of the reasons cited for failure of delivery was the incidence of food subsidy given by the state in Tripura coupled with low mat weaving capacity of one mat per day - the community is happier living off subsidised food than weaving a mat and earning Rs 30-33 per day.

Unless mat productivity increases to 4 mats per day and per mat labour cost is in the region of Rs 25 per mat sourcing mats from the community may not be viable.

Apart from the low production capacity, another reason attributed to the failure was the non familiarity of community to weave mats of sizes 8ft x 4ft as they were used to weaving 6ft x 3ft sizes without the degree of quality as would be acceptable to a Board manufacturer. Poor quality woven mats not only work against the quality of finish but also end up using much more epoxy, a key bonding agent that adds to costs substantially.

They have developed some mat supply sources around Nagaon in Assam but these are not adequate to fulfil their demand. Currently they are working on part time shift basis and are unable to schedule their production since supplies are not reliable.

Solution Suggested for Sourcing

Timpack Industries is willing to participate in training the community in Tripura in terms of the quality and specifications of the mats they need. However they suggest that a local entrepreneur in the form of a consolidator should be developed in Tripura who can mobilise the community, do quality control and load the required quantity every day. The fish trucks coming back from Tripura can be used to transport the mats. Transportation rates for a 9 MT trucks containing 3000 mats would be in the region of Rs 25,000-30,000 per truck working out to be Rs 8-9 per mat. If the labour cost inclusive of the bamboo is Rs 25/mat it makes the cost Rs 34/mat. Out of this taking care of local taxes at Tripura and other costs like commissions etc. they should still find it viable to sell at Rs 41 per mat which Timpack is willing to pay.

3.2 Embee Forest Products

The unit is situated at Jalpaiguri in West Bengal. The products manufactured are bamboo flooring, shuttering board, sections and flush doors. The products require mats as well as strips as intermediate products for their shuttering board and flooring products respectively. The company is able to sell its products in the open market and also has orders from architects and interior designers for bamboo flooring.

Specification of Products Required

For Shuttering Board

It is made from five layers – two outer layers are woven mats of 1.2 mm thickness and 8ft x 4ft dimensions whereas the inner layer is of 4mm thickness which is of the same dimension but can either be flattened bamboo or a woven mat. Since sourcing of mats is a problem, using flattened bamboo provides a good option. Mats can be coarsely woven also. Five layers totalling 14.4 mm thickness are compressed into 12mm thickness.

If the inner layer is a flattened bamboo it can be made with Muli bamboo flattened, rolled, chemically treated and passed through a drier. The green portion should be removed. The required width of 4 ft. can be obtained by stringing the slats together using thread.

The viable landed rate for mats required for shuttering board is Rs 48/sq. ft. inclusive of transportation by road for outer layers and Rs 32/sqft for inner layers.

Market Price of Products

	Ex Factory Price (Rs)	*Market Price to Consumer (Rs)*
Shuttering Board	20/sqft	36-37/sqft (12 mm thickness)

The products are subject to Excise, VAT and CST which account for nearly 20% mark up above ex-factory prices. They are distributed through distributors and retailers which accounts for another 50% mark-up (20% distributors and 30% retailers).

Raw material prices comprise 50% of the cost of production.

Quantity of Intermediate Products Required

For Shuttering Board

2000 mats are required per day in sets of 5, 2 for outer layers and 3 for inner layers as per dimensions described above and at rates enumerated above. This is equivalent to a truckload. A rejection rate of more than 3% would not be acceptable with payment terms of 30-45 days after delivery is the norm. They are currently sourcing these from Gram Vikas, Orissa.

Problems of Sourcing from Tripura

According to Mr. Mazumdar, the cost of transportation is very high from Tripura. Another factor which adds to the difficulty in sourcing intermediate products from Tripura is the duration of monsoon which is as much as 6-7 months. In peak monsoon season deliveries may take even a month. This is the practical difficulty in sourcing from Tripura. The rail head at Karimganj and Dharamnagar can offer solution towards this problem once operational fully.

Another problem cited by Mr. Mazumder was the quality of mats supplied. Artisans are not tuned into needs of an industrial production; hence they fail to maintain the uniformity in weaving and also do not treat bamboo before converting it into strips for mats. Mats cannot be treated after weaving; these mats can then not be used for the shuttering boards. However looking to the problems mentioned they can be addressed with training and awareness building.

3.3 Kitply Industries

Kitply Industries has modified its machines at its Margherita unit to produce bamboo ply board. They are manufacturing shuttering boards and decorative plyboards which have a face of bamboo. They are developing designs to entice the market in 4mm and 6mm thickness and plan to soon launch it in the market and are buoyant about the market accepting the product.

Requirement of Mats

They need 2,500-3,000 mats per day which they are currently sourcing from Nagaon at Rs 32 per piece which is of 2.5 mm thickness. The dimensions required are 8ft x 4ft with 2.5 mm, 1 mm and 1.5 mm thickness. However, these supplies are erratic and there are also quality issues. They are looking for suppliers who can meet their quality as well as quantity needs. They are also aware of flattened bamboo to be used as a design or structural element and are working on its utilisation.

Other specifications for mat indicated by them are availability of at least 10-15 weave designs with minimal thickness variation.

3.4 AB Composites

AB COMPOSITES, has diversified into composite related activity in 1986 and engaged in designing and manufacturing Fibre Glass Pressure Moulded Precision Components for Indian Railways.

Usage of bamboo for prefab shelters and to manufacture BMCS sheets and prefab huts are their areas of focus. They supply primarily to Govt. agencies, school buildings in Kargil for one. They have a requirement of 3,000 mats daily and are willing to pay a price of Rs 40 per mat FOR Jalpaiguri factory. They are currently sourcing mats from West Bengal itself which works out cheaper as has been indicated by them. Transportation cost from Tripura would increase the cost of the mat by Rs 17/mat as the rate for one truckload of 3,000 mats works out to Rs 50,000.

Their expectations from mat suppliers were that (i) there should be no green skin layer, (ii) there should not be a pronounced gap while weaving and the thickness should be >0.6 mm but not more than 1 mm

3.5 Arunachal Products India Ltd.

APIL is in the production of pre-fab houses using bamboo boards. These houses have a durability of 25 years, are fire and earthquake resistant. The roof, walls as well as flooring is made from bamboo. The pre-fab house is priced at Rs 300/sq. ft. for a constructed house of 12ft x 12ft. 125 boards of 16 mm thickness are needed to manufacture 8 houses. The production capacity can be rated at 5 houses per day. This translates into a requirement of 300-400 mats or equivalent flattened bamboo of 4 mm each per day.

Apart from pre-fab houses the unit also manufactures decorative ply, mat ply, columns and trusses made from bamboo. The decorative ply of 4mm thickness and 8ft x 4ft length and width is priced at Rs 400/sq. metre. Bamboo Plyboard of 16 mm thickness is priced at Rs 460/sq. mtr. while matply of 4mm thickness is priced at Rs 250/sq metre.

Taking all products into account, an estimate of 2000 mats/flattened bamboo per day can be derived for APIL.

Source of raw material supply

Bamboo is procured from Arunachal Pradesh itself. The unit uses flattened bamboo and not mats for manufacture of boards. 3 layers of flattened bamboo of dimensions 52 inches width x 8 ft length is used. *Kakoo* bamboo is being used presently.

These are currently being sourced from Nagaland. These are feeder units which are working in an entrepreneurial mode with no subsidies being applied in any form. 3 units have been set up as ancillary units with an investment of Rs 10 lakh per unit.

The configuration of a unit is:

Cutting machine	1
Cross cutting machine	1
Knot removal	1
Flattening machine	1

Mats are also procured from Nagaland @ Rs 45 per mat.

Role of APIL in setting up subsidiary

APIL assists the units in machinery selection, training and quality of raw material selection.

3.6 Meghalaya Plyboard

The unit is located in Shillong and into manufacturing of particle board and bamboo matply. They are sourcing the mats from Tripura, Mizoram, Assam and Meghalaya

currently. They have appointed agents who procure the mats from the village level. These agents make arrangements to store the mats and when they have a substantial lot they supply it to the factory. According to Mr. Bawri of Meghalaya Plyboard the quality of mats has fairly stabilised in terms of the evenness of the width and the weaving.

The plyboard uses five layers of mats all of which have to be in the same width for proper bonding. A second grade plyboard with different width of the mat strips in different layers is not acceptable in the market. Also, a plain face with laminated paper does not stick evenly. The result is a mat face for the board for which there is a marketing problem. Bamboo ply is priced higher than commercial ply.

According to Mr. Bawri a truck can accommodate 2,500 mats and not 3,000 mats which is the figure generally used for calculation of transportation cost per mat. He is presently procuring mats at the rate of Rs 60-62 per mat landed at his factory. The mats procured locally from Shillong are costing him Rs 43-44 per mat.

He maintains that it is not possible for bamboo products like boards and flooring to gain a substantial market since there are cheaper substitute products available in the market.

3.7 Mansaram Architects, Bangalore

They are involved in building and construction activities using bamboo as a raw material. They are planning to set up a plyboard manufacturing unit in Karnataka which would require 3,000 mats per day of following specifications:

- Sliver thickness = 0.6mm +/- 10%
- Width of sliver = 2cm
- No gap between sliver and woven mat
- No epidermal and endodermal layer in sliver
- Moisture content < 10%
- Weaving should be herringbone type
- Smooth sliver is better
- Size of bamboo mat – 9ft x 4.5ft and 7ft x 4.5ft

They are willing to pay a price of Rs 45/mat landed at Bangalore which would mean that they will need to procure mats from a regional location. However given the feedback got from workers in the agarbatti industry who are moving to the garment industry such an eventuality does not seem feasible. Costs therefore will need to be raised for mat costs.

4 Current Activity of Mat Making In Tripura

Mat making in industrial form has not yet taken shape in Tripura. It is currently a home usage product sold through local markets. We found mat making in the Matabari cluster in South Tripura making vegetable baskets and coarse mats. A visit was also made to the CFC at Killa.

4.1 Matabari Cluster

Matabari is a handicraft cluster in South Tripura near Udaipur. The cluster has 3 SHGs having 15 members each. Other than these SHGs there are approximately 182 families within the 5 km of radius who can also be trained in mat making skills. Bamboo is sourced from Udaipur & Maharanipur. Y Muli bamboo costing Rs 10-12 per pole is used for mat making. The supply chain of bamboo is from Kalshi market to the Matabari cluster through 3 traders.

4.2 Kalshi--Maharani Pur Trader--Udaipur Trader--Agent for Matabari Cluster (weekly)--Matabari

The products are:

Products	Price in Rs.
Chatai (4ft x 3ft)	15
Kula	15
Dala(Mulberry Cultivation)	22
Jhali	20
Turi	8
Sabji Tokri	(5 - 7)

In winter *Sabzi Tokri* is the best selling product. Depending upon size its price varies from Rs.5-7 per piece which is then available in the market at a price of Rs.7-9/piece. The artisans sell *Tokris* locally and through agents in Udaipur & Maharanipur market. Each person can make 15-20 tokris working 7-8hrs a day generating an income of Rs 75-100/day subject to market demand.

As per the villagers a 20ft Y-Muli bamboo pole yields 1 bamboo mat of size 8ft x 4fts and each costs around Rs.35/- (Bamboo cost: Rs.10/- + labour charge: 25/-). Each person can make 3 mats per day.

Monthly Estimate of Mat production of size 8ft x 4ft	
No of families:	35
Average working member/family	3
No of mats produced per family per day	10
No of working days	25
Monthly production/family	250
For 35 families (250 x 35)	8750

4.3 Killa CFC

Killa is a CFC in South Tripura near Udaipur established for training of prospective artisans on mechanised approaches as well as serve as a production centre. The CFC has 20 members. Work starts at 8 AM and carries on till 4 PM. Most workers are women and they make *Chatais* (1.9m x 0.9m), Basket for storing rice, *Kulla* & agarbatti sticks. Agarbatti stick is one of the main produce at the CFC. Y-Muli & Mritinga bamboo is used for products mentioned. Details of *Chatai* production are:

Chatai* Production 1.25m x 0.9m (12 square feet)	
1Person per Day of 8hr can produce	10-12 *Chatai*
Labour cost/*Chatai*	Rs. 4-5
Selling Price of 1 *Chatai*	Rs. 10/-

* These crude forms of mats cannot be used for making boards or BMCS and are not acceptable to board manufacturers.

5.0 Opportunity for Tripura

The requirement for mats has been estimated from information obtained from units visited during the study. Mats and derived products like strips find usage in making BMCS, and Shuttering Board/Plyboard.

The requirement of Mat for industry is as under:

Manufacturing Unit	Raw material Required (Daily) Number of mats		
		BMCS	Shuttering
Timpack	Mats Reqd (8'x4')	3,000	
Embee	Mats Reqd (8'x4') 1.2mm		800
	Mats Reqd (8'x4') 4mm		1,200
Kitply	Mats Reqd (8'x4') 1-2.5mm		2,500
AB Composites	Mats Reqd (8'x4') 1.2mm		3,000
APIL	Mats Reqd (8'x4') 4mm		2,000
Meghalaya Plyboard	Mats Reqd (8'x4') 1.2mm		800
	Mats Reqd (8'x4') 4mm		1,200
Total		**3,000**	**11,500**

Total Mat required daily (8'x4') 14,500

5.1 Employment Opportunity

Mat based board manufacturers have indicated a demand for mats far beyond what Tripura can address at the current point of time. Since Tripura is best suited to produce these mats this can be a great opportunity.

The case for mat making as a sustainable livelihood proposition is possible only if community is able to weave at least 4 mats per day for which they can earn Rs 25/- per mat. To meet this end an aspect considered was that of supply of slivers through a CFC based arrangement taking care of two important aspects at the same time, consistency of quality and availability of raw material. However such a plan will call for an investment of Rs. 25 lakhs+ for equipment alone to establish such a CFC making it unviable to pursue when aspects of cost recovery and capital investment recovery are taken into consideration. Also to be considered is the fact that unless 150-200 workers can get together to work from a location to utilise capacities installed it may not be viable to justify this investment towards operations of Cross Cutting, Splitting and Slivering. Mat weaving of course would need to be done manually.

It may be better to run a collection based mechanism encouraging a manual production basis as prevalent though focusing on improving quality from a process perspective. To this end some level of addressing needs of tools and techniques must be investigated for viability. One consideration that came to the mind of the team was whether thicker slivers could be used for mat weaving cutting down on number of slivers made and also on number of operations taken to weave a mat. While the manufacturers do not anticipate any issue, study must be done to see the technical feasibility of such a move.

Considering the number of poles to be worked on at a given point of time it is quite feasible to use a hacksaw and *Dhao* for carrying out all operations. Quality of tools used including tips and sharpening mechanisms could be focused on. The first step to mechanisation could be the installation of a ERG type manual slicer or the electrically run Slicing Machine costing Rs. 45,000 that can deliver 10-12 slices a minute. An overall viable cost set for this would be Rs. 1.5 lakh given the need for 1 Slicing and 2 Slivering machines to first reduce thickness to desired level and then produce slivers. Such smaller feeder units could be established closer to points of weaving clusters allowing improved chances of viability and usage.

5.2 The Mat Opportunity (Manual)

The community has to step up its productivity from 2 mats to 4 mats/day in order to make the collection process less time consuming and viable. At the same time such a production level will allow the weavers to earn Rs. 90/100 per day for a day's work utilising 8 hours.

Number of mats woven/day	4
Number of mats needed per day	14500
Number of persons which can be employed 14,500/4	3625
The Mat Economy	
Labour charges	Rs 25/mat
Bamboo	Rs 8-9 per mat
Selling Price before transportation	Rs 35/mat
Annual Turnover due to involvement of 3,625 people/day	14500 x 300 days x 35/mat = Rs. 15 crore

There exists immense potential in the mat supply industry which Tripura can tap to create a sustainable supply source. The activity can be stepped up phase wise from year one to year three of the project.

Year	**Number of mats/day**
One	4,000
Two	9,000
Three	15,000