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BACKGROUND

Sticks in different sizes and thickness lend themselves to different end products. Incense sticks find their way to most homes for religious or fragrance purposes. Decorative table mats, floor mats and blinds are applications that enjoy good market demand forming part of the soft furnishings industry as described in today's retail parlance. Other then these forms very many dormant utilisation options may exist considering the primary nature of the stick. Given its attribute of natural look, strength and convenience to work with, if such sticks are made available in standard measure, buyers would find applications and situations to utilise them.

These sticks have contributed to handicraft products with a good export market utilising traditional designs and patterns. However, a large domestic market that has been available seems to be on a decline with Indian homes adopting a more contemporary look, while these products still stay within the realm of traditional usage/looks. Obviously, this has led to such handicrafts suddenly looking out of place in a modern Indian home from an urban perspective. Inputs of designers with an understanding of consumer preferences backed by natural eco-friendly platform could turn things around to appeal to the new generation with new found purchasing power.

Consumers are looking for new colours, material combinations and different looking products. With increasing competition, the demand for better finishing and workmanship has also emerged. These are being demanded at no extra cost since consumers are not willing to pay more given the fact that the market is flooded with large variety of imported products available at affordable prices. Consumer tastes too have shifted to these new products easily available off retail shelves. This then constitutes the challenge the bamboo sector will have to face up to.

Traditional Indian handicrafts with limited designs and colours find it difficult to compete with such mass produced and different looking products of consistent quality that can be imported quickly in large quantities. Opening up of global borders is contributing to the choice available and with money coming into newer hands the basis of choice itself is undergoing a major change.

Mechanisation of processes while preserving basic sanctity of design is an option that the handicraft industry has begun to consider seriously. For one, mechanised looms for weaving table mats and window blinds out of bamboo have already made their appearance in some parts of the country, yet industry needs to transcend from its handicraft base to address needs of volume and quality.

Structure of Industry

Blind, incense and fine stick based mat making industries are currently in the unorganised sector. These are small cottage industries supplying to larger exporters and soft furnishing outlets through local agents or buying houses. Purbasha, the state managed handicraft marketing arm has played a major role in the past to be the vital link between producers and market.

With the Indian consumer becoming life style oriented, day by day demand for products that enhance interiors can be seen to be on the rise. The growth rate can be assumed to be equivalent to growth in the furniture industry that is nearly 12-20% per year. Bamboo Blinds (*chiks* as they are popularly known in Hindi) were earlier considered to be a middle class product available on road sides have now acquired an upper class status due to induction of weaving designs and state of the art mechanism fitted for rolling. This is evident from the shelf space being carved for such products in stores selling home furnishings and accessories.

Incense sticks on the other hand are also finding appeal as fragrance sticks and mosquito repellents in some cases.

Market Opportunities for Tripura

There are five opportunities for Tripura in the context of stick products. None of these are new products, rather the taking a new approach to meet needs of the market holds the key to growth. All these offer established market potential and optimisation with shift of value addition activity to Tripura will hold the key to their future success. As these get established, newer demands for products will be made on the system helping create new lines. The opportunity areas are:

1. Manufacturing hub for incense sticks and finished incense products
2. Supply of readymade bamboo sticks to mechanised looms making blinds
3. Supply of finished fine stick mats for homes
4. Supply of slats for flooring units established
5. As supplier of graded & quality certified intermediate material for applications

Details of these opportunities are covered in sections that follow.

OPPORTUNITY 1: INCENSE STICKS

1.0 Manufacturing hub for incense sticks and finished incense products

1.1 Background

The Agarbatti or Incense Stick as known otherwise is popularly called the fragrance ambassador of India. The Agarbatti industry depends heavily on forest products for its raw materials and India enjoys a natural advantage since nature has bestowed upon it a vast expanse of forest land. Also available is the traditional skill that has been contributing to manufacture of agarbattis for centuries. At the same time its wide utilisation for religious and fragrance purposes provides a ready market for the produce.

Agarbatti making is an art which made its appearance in the Southern region of India primarily because of easy availability of sandalwood and jasmine in the area. Traditionally, artisans in kingdoms of Mysore, Tiruchirapalli and nearby areas used to make aromatic and fragrance products that had therapeutic and cosmetic properties. The art soon spread among more families as demand for the product grew. Even today, agarbatti rolling is largely concentrated in the Karnataka, Tamil Nadu, and Andhra Pradesh. More specifically in locations such as Kolar, Chikmagalur, Murbagal, Salem, Walaja and Kuppam. While communities involved with rolling in these areas have imbibed the skills of rolling with the lower half of the hand, others have also taken up rolling agarbattis, Gaya in Bihar, and locations in Orissa, Maharashtra and MP being more prominent.

However, besides the art of rolling and perfuming, bamboo stick that forms the backbone of the product was also available in forests of Teknikota in Tamil Nadu. Sticks obtained from this source were smooth and sturdy to use. Bamboo's suitability other than aspects of availability and strength also stems from it being the only material that does not give out odour while burning, therefore making it ideal for making agarbatti. As demand for agarbatti grew and this source started getting depleted the agarbatti makers found bamboo sticks of good quality from other nearby areas such as Shimoga, Chikmagalur and Hassan districts in Karnataka. With demand further increasing, traders who were involved in procuring bamboo sticks from Karnataka focused their attention on the North Eastern Region of the country where bamboo was found in abundance. Thus was born the "Assam Stick" as it still called.

Traders from Assam started supplying sticks made from Muli bamboo available in Tripura and other parts of NER to traders in Karnataka. Due to the organised nature the trade evolved into, the agarbatti makers started to get their supply of bamboo sticks, through traders now just a phone call away. Most were oblivious of the fact where the sticks were coming from, at best they would say they that they were being sourced from some part of Assam. The ignorance still prevails, based on responses experienced by the research team while visiting agarbatti makers at Bangalore.

On the other hand while Tripura sticks meet up to 60% of the market needs the story behind this activity is not very pleasing. 1 in 5 households in North Tripura is involved in an activity that gets them low returns for doing work that is skilled and taxing on the body. An opportunity exists to correct this situation through intervention in production and marketing terms.

This in essence describes the neglect faced by bamboo stick makers in Tripura. While the agarbatti industry enjoys a handsome growth rate of 10-12% per annum the economic condition of the agarbatti bamboo stick maker in Tripura remains unchanged. However, it will not be correct to blame agarbatti manufacturers without assessing their constraints, as covered later in the report.

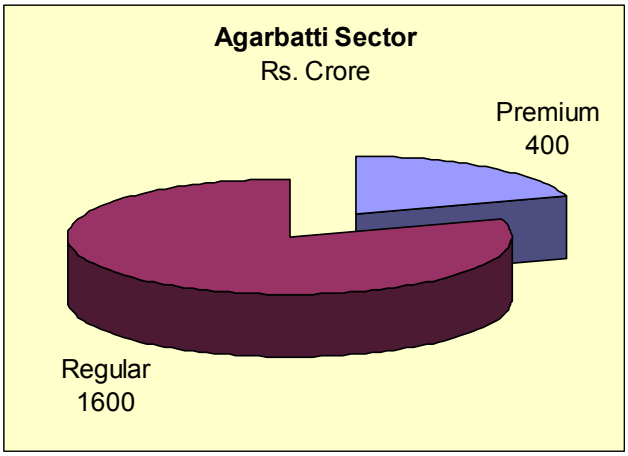
To commence the understanding process we need to begin by looking at the structure of the agarbatti industry in India.

1.2 Structure of Industry

The agarbatti industry is a fragmented one with numerous small players dominating the industrial landscape. The biggest brand in the agarbatti industry Cycle, has only 3% market share. FMCG companies like Hindustan Lever have tried to enter the industry to leverage their large distribution network through the machine made agarbatti route which appealed on aesthetics but did not rate highly on fragrance. The industry is still largely concentrated (almost 80%) in the Southern region. ITC has now entered the industry as a national player, buying from vendors who make handmade products.

1.2.1 Size of industry

The value of the industry at present is estimated at Rs. 2,000 Crore according to the All India Agarbatti Association. Out of this, 20% is the premium agarbatti segment while remaining 80% is the regular agarbatti.



It is important to understand this distinction because quality of sticks used in both segments is different. The premium agarbatti segment uses Shimoga bamboo (*Dendrocalamus giganteus*) sticks till date – these sticks are said to be smoother, thicker and not easy to bend On the other hand, the regular segment uses the "Assam Stick" which is of inferior quality as compared to Shimoga stick since it is thinner and tends to bend at the time of rolling. In Tripura sticks, the green part of the sticks is visible lowering its presentation value. Addressing such needs are exactly what will help add value to sticks sent from Tripura.

1.2.2 Growth of industry

The agarbatti industry is witnessing a healthy growth of 10-12% every year since the last 5 years or so and in a way is not able to cope with this growth. According to a leading manufacturer, the biggest constraint at present is the bottleneck created by rolling, putting tremendous pressure on their business. In order to meet growth needs of the industry it will have to look outwards and develop new rolling clusters. While some manufacturers have successfully developed newer clusters in Gaya, Orissa and Chattisgarh, given the myopic nature of the industry that is used to raw material and semi finished material landing at their door step through a phone call, most of them are still struggling to meet their needs through the current clustered arrangements. This presents itself as an opportunity to Tripura. The healthy growth of the industry coupled with constraints being faced in the industry makes a good case for Tripura to add rolling activity to its portfolio.

1.2.3 Organised vs. unorganised

25-30% of the industry is controlled by 20-25 large players with the turnover of each player being Rs. 25-30 Crore approximately. The largest player, Cycle has a turnover of Rs. 60 Crore with 75% of the industry being characterised by small players who undertake even perfume dipping and packaging through job workers supplying to Distributors. Market forces take the products through various

channels to where the demand is. The manufacturers are quite oblivious at times where their goods are being sold with one medium sized company owner in Bangalore commenting, "We have never seen our brand being sold through any shops, we don't know where it sells eventually". This also points to dependence of manufacturers on traders.

However, with distribution giants like ITC making a foray into the sector, larger players are seriously evaluating vulnerability in the supply chain as things stand.

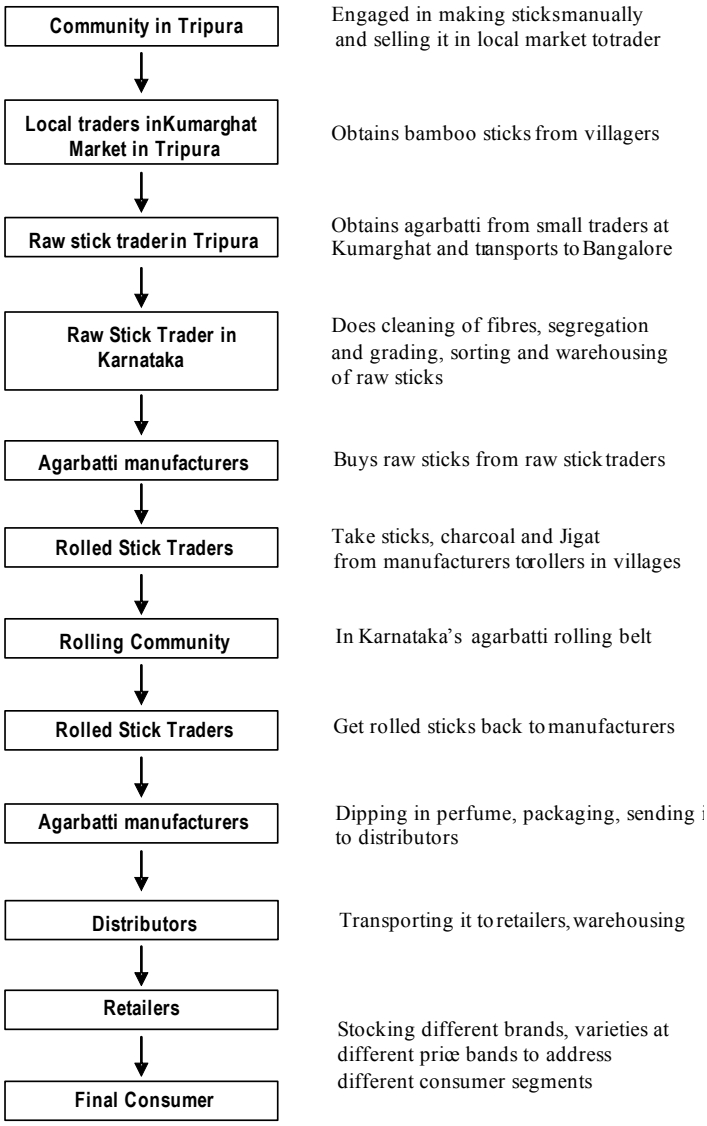
1.3 Supply Chain Mechanism

The agarbatti industry is characterised by a long supply chain from stick maker to final consumer. The industry prefers to outsource most activities firstly because the process is highly specialised, and secondly because aggregation of workers in an industrial environment may lead to formation of labour unions.

The industry consumes three types of raw material prior to fragrance dipping and packing stages – bamboo stick, jigat and charcoal. After rolling, the main ingredient required is the perfume which is the most expensive part of the agarbatti with industry sourcing these on its own. For other raw materials, it has another fixed set of traders with whom it deals on a regular basis.

To understand the context of the industry for the sake of Tripura stick manufacturers let us understand the supply chain from the bamboo stick to the final product.

1.3.1 Elements in supply chain



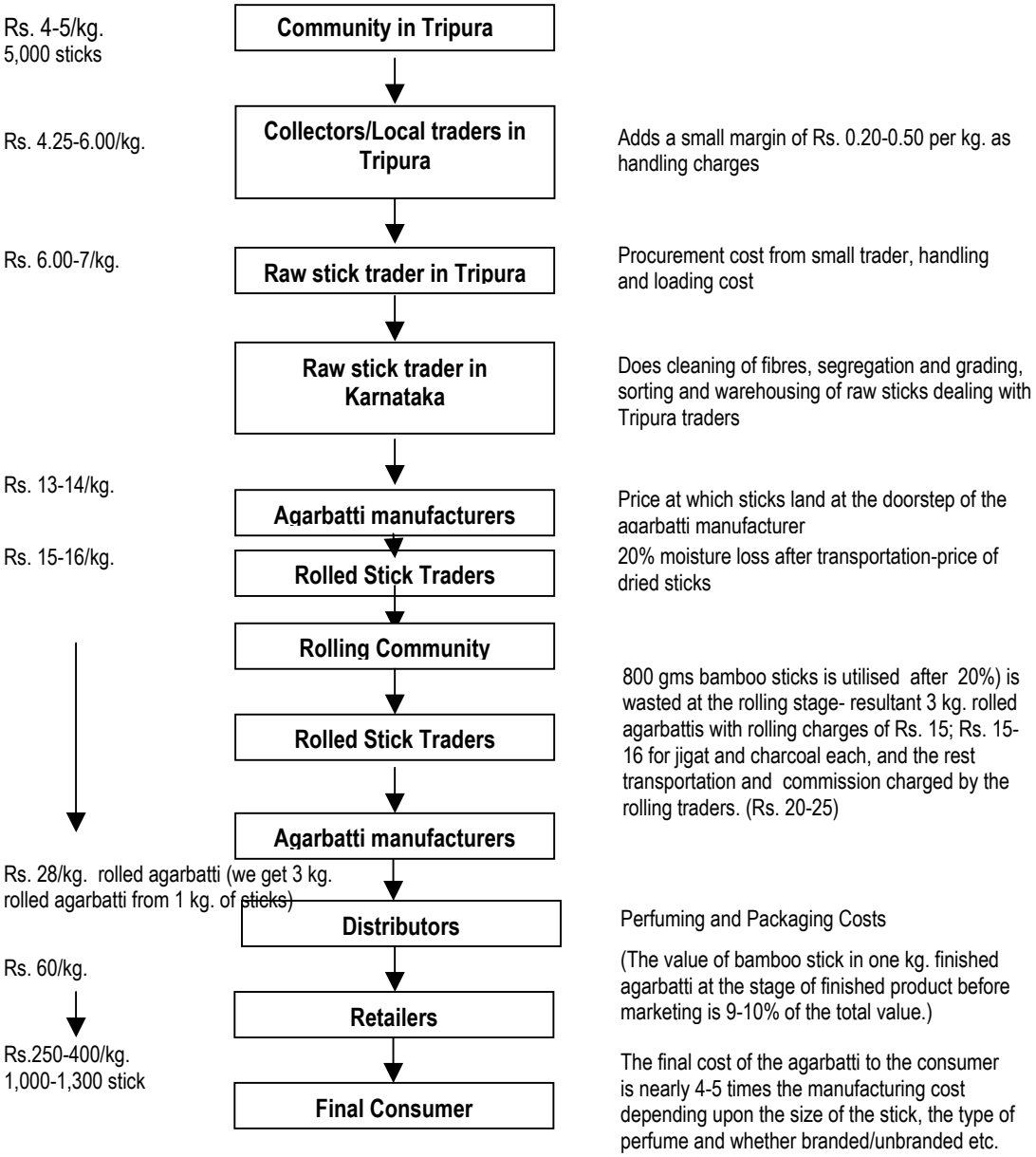
1.3.2 Vulnerability in Supply Chain

As is evident from chain above, different components in agarbatti making process take place in different geographical locations from North East to the Andhra-TN-Karnataka belt and finished products are distributed across the country.

As a result the chain has a large element of traders and transporters involved with it. On the other hand, the industry is fragmented hence competition is fierce. The final price to the consumer is constantly under pressure. Dependence on the marketing arm such as distributors and retailers is high. This reduces the margin for actual workers, which is the bamboo stick makers and the rolling community in the system. Wages for the rolling community have however been fixed through a work-motion study conducted in the past. The manufacturer also has to operate in a highly cost sensitive situation – any quality lapse in the stick or rolling results in higher consumption of perfume which proves detrimental to the overall cost.

The large chain therefore results in all the elements up to the stage of marketing to be constantly squeezed for margins and thus presenting an opportunity for alternate supply chain mechanisms to be put into place. However, in order to formulate the same we need to ascertain the value addition which takes place at each stage of the supply chain.

1.3.3 Value addition at each stage



1.4 Baseline assessment of agarbatti industry in Tripura - employment, volume & turnover

The size of the agarbatti industry in Tripura has been arrived through assessment of multiple sources of information. A field trip to the Northern region of Tripura where stick making is concentrated, meetings with agarbatti traders at Kumarghat market, meeting with transporters and validation of these with buyers, viz. agarbatti manufacturers in Bangalore covers the basis of effort.

1.4.1 Working pattern within agarbatti industry – hours of work, productivity, problems, seasonality, role of trader, transportation, vulnerabilities

Agarbatti Stick Maker (handmade) at Bagabasa Village

The village constitutes 15 families making agarbatti sticks. To manufacture agarbatti sticks they are using Mritinga (Bambusa tulda) & Bari (Bambusa polymorpha), largely Mritinga, as it is easily available.

The cost of Bamboo being procured is as below with the artisans depending on the local market for bamboo and bringing them either by cycles or on their shoulders thereby incurring no transportation cost:

Particulars	*Price in Rs. (per pc.)*
Bari (30-35ft, 12-13kg.)	15-25/-
Mritinga (25ft, 8.5-9kg.)	5-6/-

Generally, two types of agarbatti sticks having thickness 1.2mm & 2.2mm are made. The length varies from 8" to 10".

1kg. of 1.2mm bamboo sticks of 8'' length contains around 5,000 sticks.

1 person working 8 hrs a day can make 10 kgs. of sticks of 8'' having 1.2 mm dia. However considering the marginal nature of the activity very few are able to devote that kind of time to the activity. From each family on an average 3 members are involved with making sticks. However, women in the household do not work for more than 3-4 hours per day on an average making 5 kg. of sticks per day per person. At Killa CFC that has recently been started it was reported that 20 kg. of agarbatti sticks were being produced in 8 hours using Y Muli bamboo. The productivity varies with the size of the stick and from person to person, as also size and quality of bamboo. For purposes of calculations we have considered a productivity of 7 kg. bamboo sticks on an average per person per day (4 hours). This has been assumed based on various feedback including of Mr. M.R. Suresh (Manager-Product Development, Cycle Brand).

The villagers sell manufactured sticks to an agent at a price of Rs. 4-5/- per kg., who then finally sells them to the stick trader for onward shipment.

Mr. Anoop Devnath, Agarbatti Stick Trader in Nalchar, South Tripura

Mr. Anoop Devnath is the only trader of agarbatti sticks in the South. Around 20 trucks of agarbatti sticks go to different parts of the country from their godown every month. Each truck contains around 9-10 tons of sticks. There are around 45 agents who collect sticks from nearby villages on a daily basis and submit to his godown. The commission of agents is between 25-30 paise per kg. Sometimes smaller agents coming from interiors charge even 40-50 paise per kg. The trader then keeps a margin of 20 paise per kg. before selling onward.

The trade system is as below:

Stick Maker-->Collector of sticks-->Trader-->Final Buyer

Thickness	*Length (inch)*	*Margin/kg.*	*Demand*
1.1mm	8''		Low
1.2mm	8'' and 9''	20 paise	Very High
2.2mm	8''	20 paise	Very low

Transportation Cost from Nalchar:

Bangalore	Hyderabad	Ahmedabad	Raipur	Nagpur	Calcutta
Rs.50,000/-	Rs.37,000/-	Rs.60,000/-	Rs.35,000/-	Rs.38,000/-	Rs.33,000/-

Mr. Satyaraj Das, Mr. Tapas Kar, Kumarghat Agarbatti Traders

The Kumarghat market is a wholesale market. There are approximately 7-10 traders in the market engaged in selling bamboo sticks for agarbatti. Market operations start by 8 A.M. peak by Noon and close by 5 P.M. July to December is the peak season for this market.

Bamboo agarbatti sticks come from different parts within a 10 km radius surrounding Kumarghat. Some major villages are Nutan Bazar, Saidapar, Ganganagar, Dhumchera, Manughat. Traders of South Tripura also have their retail office at Kumarghat. The procurement rate is Rs. 4-7/- per kg. depending on quality and size of sticks that vary from 7.5'' to 9''. Local suppliers bring sticks by push carts or cycles with each stick bundle weighing around 25 kg. People also use jeeps to bring sticks to Kumarghat, each jeep carrying around 2,000-2,200 kgs. of sticks.

The bamboo sticks are then shipped to Bangalore, Mysore, Orissa, Calcutta, Chennai, Raipur, Ahmedabad, parts of Andhra Pradesh, Nagpur, Gaya among other towns. Transportation of sticks is done by trucks, each truck carrying an average of 9-10 tons. Indicative freight charges from Kumarghat are as below:

Bangalore	Hyderabad	Ahmedabad	Raipur	Nagpur	Calcutta
Rs. 42,000/-	Rs.37,000	Rs.60,000/-	Rs.35,000/-	Rs.38,000/-	Rs.33,000/-

Journey to Bangalore takes 12 days and that to Ahmedabad 25 days. Mostly trucks carrying fish to Tripura from Andhra are utilised to ship out bamboo sticks.

The trading system of agarbatti sticks from this stage onwards is as follows:

Stick maker-->Kumarghat trader-->Agent at buyer end-->Agarbatti industry.

Between the stick maker & Kumarghat traders there may be another agent who is involved with collection and delivery of sticks. This agent keeps a margin of 20-25 paise per kg. Of late, the Agarbatti manufacturers have even started contacting the Kumarghat traders directly with the Kumarghat trader keeping a margin of 10-15% per kg. According to traders, a total of 2,000 trucks of incense sticks move out of Tripura on an annual basis. The peak season lasts for 6 months when nearly 200 trucks per month are transported, with a total of 800 trucks moving in the balance 6 months.

1.4.2 Basis of current volume, turnover and employment numbers

Agarbatti traders in Tripura have estimated a movement of 20,000 tonnes of agarbatti sticks out of Tripura annually. Purbasha figures mention 12,000-13,000 tonnes annually. An average of 17,000-18,000 tonnes can be assumed to be the size of the agarbatti stick market from Tripura and this figure has been validated using industry estimates obtained from manufacturers in Bangalore.

- The value of the regular agarbatti industry that uses "Assam sticks" is Rs. 1,600 Crore
- Of these, 75% of sticks used are from Tripura pointing to a Rs. 1,200 Crore market value of sticks from Tripura.
- This is equivalent to 48,000 tonnes of finished sticks (taking price of finished product at Rs. 330/kg. approx. of 1,200 Crore market considering MRP of largest quantity sold)

- This translates into 12,000 tonnes of sticks used in raw material form.
- A wastage factor of 20% moisture and 20% due to non uniformity as indicated by agarbatti manufacturers indicates a total figure of 19,000 tonnes approximately.

Current volume of Tripura bamboo sticks	18,000 tonnes
Turnover @ Rs. 7/kg.	Rs. 12.6 Crore
Productivity	7 kg./person/day (4hrs)
Number of person days for 18,000 tonnes	25,71,428 person days
Number of days of employment in 6 months	150
Number of persons employed in stick making	17,142
Population of North Tripura	5,90,655
Female Population of North Tripura	2,88,001
Working age population (basis: 1/3rd)	96,000
% North Tripura women working population engaged in bamboo stick making	17,142/96,000 = 18%
One in every five households in North Tripura can be thus stated to be engaged in bamboo stick making 6 months every year.	
Current earnings for 7 kg. bamboo sticks/day	Rs. 4-5/kg. totalling Rs. 28-35/day
Includes cost of bamboo	Rs. 5 that yields 7 kg. sticks
Net earnings	Rs. 23-30/day. Say Rs. 26/day

1.5 Strengths and Weaknesses (SWOT)

Figures above show that though employment levels in the industry are high, turnover levels are low. It may be a better idea to focus on productivity to increase incomes rather than look to adding higher numbers of employability. An assessment of strengths and weaknesses of agarbatti stick industry in Tripura is presented on the following page:

STRENGTHS	WEAKNESSES
Availability of abundant raw material Availability of local skill for making bamboo sticks Trade relations already with end user industry No alternate source likely to be available for end user industry for a long time to come.	Industry in the clutches of 7 traders Bargaining Power of the lowest constituent – the bamboo stick maker is low. Lack of entrepreneurial talent to drive a local industry
OPPORTUNITIES	**THREATS**
Improvement in existing system through decreasing number of intermediaries Introduction of mechanization to increase the productivity per household Introduction of value addition in the industry through rolling	Difficult to penetrate/bypass the existing system of traders and create confidence in a new system Training on machine operation and stick rolling is a thankless job requiring patience on the side of the trainer – also training hours need to be compensated to encourage villagers to offer themselves for training in the first place – Work culture is rather demotivating in Tripura.

1.5.1 Opportunities

Thus, 3 types of opportunities are available for Tripura stick industry:

- o Sector optimisation
- o Mechanisation
- o Establishment of rolling facilities

1.5.1.1 Sector Optimisation Opportunity

In the existing supply chain, efficiencies can be introduced by elimination of the trader tier and introducing graded and sorted qualities that can then be used directly by industry. An interface between the agarbatti manufacturer and community would need to be introduced in the form of an institution or a body. The responsibility of the body would be to provide training for sorting and grading to the community and also to get into contracts on behalf of the community with the agarbatti manufacturer. It may have to fund procurement depending upon needs experienced. The body would be responsible for also setting the prices for different grades of sticks and negotiating supplies.

Assuming that one village of 15 households is organised into a single unit.

Current production of 15 households @ 7 kg./day for 150 days yields Rs. 26/day

15 x 7 x 150 = 15,750 kg. in volume terms, and

15 x 150 x 26 = Rs. 58,500 in value terms

Add to this the cost of bamboo and other costs at Rs. 5/kg. this component of cost totals: =15 x 150 x 7 x 5 = Rs. 78,750 (A)

This lands at the doorstep of the agarbatti manufacturer at Rs. 13-14/kg. totalling =150 x 7 x 15 x 13.5 which is Rs. 2,12,625 (for 150 days, 7 kg. per day, 15 households and Rs. 13.5/kg.)

Rs. 5/kg. is the transportation cost to Bangalore =15,750 x 5=78,750 (B)

Net available after transportation Rs. 2,12,625-78,750 (A) - 78,750 (B) = Approx Rs. 55,000

Currently margins of traders are as follows:

Trader	Margin	Turnover	Total Rs.
Local Trader/Collector (0.50-1.00/kg. incl. transportation	0.75/kg. from village)	15,750 kg.	Rs. 12,000
Loading and other handling Charges approximately	0.25/kg.	15,750 kg.	Rs. 4,000
Kumarghat trader	Rs. 1/kg.	15,750 kg.	Rs. 15,000
TOTAL AT TRIPURA			Rs. 31,000
Bangalore Trader (does grading, sorting etc)	Rs. 1.5-2/kg.	15,750 kg.	Rs. 23,625
TOTAL MARGIN OF TRADERS			Rs. 54,625

Proposed System for Sector Optimisation

Rs. 5/Kg. Current price available to community incl. price of bamboo

Rs. 2/Kg. Grading and Sorting at Village level

Re. 0.75/Kg. Collection through Collectors appointed by group (as present)

Re. 0.25/Kg. Transportation cost from village to the main transport location

Rs. 8/kg.

Rs. 0.25/kg. Loading charges/kg. (as present)

Rs. 8.25/kg.

Rs. 5/kg. Transportation Cost/kg.

Rs. 13.25/kg.

The earning of each family has potential to increase by Rs. 2/kg. which makes it Rs. 14/day for 7 kg. of sticks produced in a day that is a 60% increase over current earnings. To achieve this, the household may spend 1-2 hours/day more for grading, cleaning and sorting operations.

For a cluster of 15 households, earnings can increase from Rs. 58,500 to Rs. 90,000, a net difference of Rs. 31,500.

In a phase of 3 years if 25% of the households ie. 4,250 out of 17,000 households currently in this business are brought under this activity, earnings of these households can go up by 54%.

1.5.2 Stick Making Mechanisation Opportunity

Stick making equipment are being developed by ERG, Bangalore other than machineries being manufactured by other manufacturers. At present, the quality of sticks produced by these machines lack smoothness and brooming of fibres is noticeable. Polishing operations of sticks manufactured by these fixtures are under development. ERG is presently conducting trial runs with this equipment and we have made this a basis of working given its relative ease of operation, availability of support staff in NER and its functioning without need of electricity. These sticks are uniform, require no grading and sorting and can eliminate second stage loss of 20% that can be passed on to the community involved with stick making for their efforts of grading and sorting.

1.5.2.1 Workings through mechanisation using ERG equipment

Cost of a single set (2 sliver and 1 stick making machine)	Rs. 24,000
Production capacity of one fixture	35 kg./day
	4.375 kg./hour
A worker currently produces 7 kg. in 4 hours (manual basis)	
Production using machine in 4 hours would be	17.5 kg.
Price fetched by this graded variety is 20% higher (Rs. 16/kg.) than Rs. 13.25/kg. available in current conditions	

1.5.2.2 Project Cost and Jobbing charges

While it may be desirable, it may not be feasible for families to invest in machines themselves to begin with. As savings increase, they may be able to do so at a future date. In the interim, if an entrepreneur invests in this equipment it can serve the needs of 2 families who may use the machine at different time intervals of 4 hours during the day. Some entrepreneurs may also emerge from the 17,000 homes currently engaged in agarbatti stick making.

Cost of above machine incl. other equipment of Rs. 6,000	Rs. 30,000
Interest cost/month 12% annually	Rs. 3,600
Depreciation 15% annually	Rs. 4,500
Repair and maintenance 5-7% of machine cost/annum	Rs. 2,100
25% return per year @ 50% time usage	Rs. 7,500
(machine would work for 6 months only)	
TOTAL	**Rs. 17,700**
Assuming 25 working days p.m. for 6 months season (180 days total)	
Supposing efficiency of use is 60%	Rs. 118/day
Per hour rate	Rs. 15/hour
For 4 hours (normal working hours for a person)	Rs. 60/day
1.5.2.2 Earnings for the family through mechanisation	
Minimum price that agarbatti manufacturers are willing to pay for:	
Graded, uniform, machine made square sticks	Rs. 16/kg.
Less Transportation cost	Rs. 5/kg.
Less Handling and Collection Charges (Rs. 1.25 presently)	Rs. 1.5
BALANCE	Rs. 9.5/kg.
ILFS project direct cost (projected service charge)	Rs. 1/kg.
BALANCE	Rs. 8.5/kg.
Production 17.5kg. for 4 hours @ Rs. 8.5/kg.	Rs. 148.75
Bamboo cost for 3 poles (1 pole of Rs. 5 yields 5-7 kg. sticks)	Rs. 15
Accounting for higher wastage due to making by machine	
Cost of hiring machine for 4 hours	Rs. 60
BALANCE	Rs. 73/day
As against	Rs.26/day currently

1.5.2.3 Number of machines that can be absorbed in 3 years

Growth rate of agarbatti industry	10-12% p.a.
Equal to	1,800-2,000 MT
Which requires @ 150 days x 35 kg. per 6 months/machine	5,250 kg.
Less production loss due to discontinuation of the family earning livelihood from manual process	2,000 kg.
(Each family contributes 1,000 kgs. per year in the existing situation. On mechanisation, a family using a machine will produce 2,625 kgs. thus achieving an increase of 1625 kgs. per family)	
Net increase in production due to one machine (since 2 families use one machine)	3,250 kg./year
Number of machines needed in Year one	2,000/3.25 = 615
YEAR TWO (10% growth rate of industry)	615 x 1.1 = 675 app
YEAR THREE	675 x 1.1 = 750 app
Total number of machines which can be set up in 3 years =	2,000
Investment required for Machinery @ Rs. 30,000 per set up	Rs. 6 Crore

If this plan is implemented, 4,000 households would start earning Rs. 73/day as against Rs. 26/day in a period of 3 years.

1.5.3 Stick Rolling Opportunity

At present the agarbatti industry is growing at 10-12% per year. Given ground realities of raw material availability and labour, rolling capacity enhancement is being constrained. In the Bangalore region, communities involved in rolling are moving to better paying jobs in the garment industry creating tremendous pressure on the agarbatti manufacturers. Given this situation the agarbatti manufacturers in Bangalore are beginning to agree that time has come for Tripura to grow its ability to move towards producing finished products. When probed for volumes they agreed that the expansion of 10-12% was best met through efforts within Tripura. Should this be implemented through a project such as the Tripura Bamboo Mission they were willing to train the local community in skills and also invest their time and resources towards such a purpose. Making an independent assessment, this figure of 2,000 MT does seem achievable as can be seen below:

Rolling capacity suggested to be established	10% of industry size
YEAR ONE	2,000 MT
YEAR TWO	2,200 MT
YEAR THREE	2,420 MT
Rolling capacity/person day in Karnataka rolling cluster	12 kg. (1.5 kg./hr)
Rolling charges/day at Karnataka using manual sticks	Rs. 5/kg.
Saving of 20% moisture and 20% wastage on raw sticks on rolled sticks as being sent now	Rs. 2.50/kg. approx
Assuming working of 4 hours/day in Tripura rolling per day	6 kg.
Revenue @ Rs. 7.5/kg. as against Rs. 26/day presently from stick making work	Rs. 45/day

Production in 150 days@ 6 kg. per day	900 kg.
For one family	
Number of families needed for 2,000 tonnes in	
Year One	2,222
Year Two	2,444
Year Three	2,689
Total in 3 years	7,355
Thus 7,355 families trained in rolling of sticks can be productively employed in addition to 17,000 families already involved in current stick making activity.	
These families earning Rs. 45/day at the end of 3 years would yield a revenue of	Rs. 4.96 Crore
OVERALL YIELD FROM SUGGESTED IMPLEMENTATION STRATEGY	
<u>Option One – Sector Optimisation</u>	
Number of families involved (No new families considered)	4,250
Increase in revenue per family	Rs. 14/day
For 150 days	Rs. 2,100
Increase in revenue to Tripura households: 4,250 x 2,100	0.89 Crore
<u>Option Two – Sector Optimisation</u>	
Number of machines installed in 3 years	2,000
Number of families/machine	2
Number of families involved (No new families considered)	4,000
Increase in revenue per family	Rs. 73-26=47/day
For 150 days	Rs. 7,050
Increase in Revenue to Tripura households: 4,000 x 7,050	2.82 Crore
<u>Option Three – Rolling Value Addition</u>	
Number of new families involved	7,255
With earning capacity @ Rs. 45/day at end of 3 years would raise revenue of	Rs. 4.96 Crore
<u>Resultant Impact of Three Interventions Proposed</u>	
Current Employment (1 person/household)	17,000 HH
New Employment in Rolling (1 person/household)	7,255 HH extra
% increase in employment	42.7%
Current economy of Bamboo Sticks	Rs. 12.6 Crore
After 3 years (0.89+2.82+4.96)	Rs. 8.67 Crore
% increase in revenue	68.8%
Average revenue per family (17,000+7,255 family)	Rs. 42/day
% increase in revenue per family = (42-26)*100/26 =	61.5%

1.6 Implementation strategy through rural income generation approach

When looked at the production base from a cluster perspective, the total persons involved in Agarbatti stick making activity in Tripura is large. It is a rural non-farm economic activity adopted by households for extra income generation. Taking into account the figure of 5 kgs. per person for 4 hrs of work a day (6 month/year working) people involved with the activity comes to 24,000 persons.

We may compare this figure with the 4th Economic Census conducted by Department of Economics and Statistics in 1998 in which 2,68,257 persons are employed in different non agriculture sector economic activities in Tripura. Out of this 49,307 are involved in manufacturing whereas those involved with agriculture are only 4,751. Total women workers are 42,945.

Considering the 21.61% growth rate in non agriculture economic sector during previous 8 years (from 1990 to 1998), currently the persons employed in manufacturing activity would be 59,962. From this point of view the figure of 24,000 persons involved with Agarbatti stick manufacturing sector shows its vastness as well as unorganised spread, when compared to Tripura's total employment in the manufacturing sector.

Agarbatti Stick is manufactured in a number of villages in North Tripura, West Tripura, and South Tripura Districts. The above figure establishes the fact that this economic activity is without much of a cluster concept, but more as a small regular non farm activity pursued by a large number of households. From the above figures it is clear that the activity is largely pursued by marginal workers and as a part time activity by other workers.

Therefore two main strategies could emerge for income generation:

a. MECHANISATION FOR STICK PRODUCTION ACTIVITY: This need not be implemented as a cluster approach but as an agriculture extension approach. This will work through building awareness of mechanisation for better quality, productivity and improved price realisation amongst the largely dispersed stick making households. It could be taken up in more than 10 villages in the first phase in north Tripura around Kumarghat, and in 5 villages in West Tripura district around Agartala. The criteria will be to select areas where large quantity of sticks are produced. Each village around 5 households may be given machines on soft terms as long term credit. These machines could be shared by other families on a rental basis. Selection of first 5 beneficiaries in each village will be very crucial. They should be producers of regular large qty of stick and having the ability to take the lead in using machines setting a trend for improved productivity and gains.

The machine providers must have strong after sales support service for building confidence amongst users and to address initial teething problems. In fact in Tripura lack of such support could be a major bottleneck for usage of equipment and machines in rural areas.

b. STICK ROLLING ACTIVITY: Considering the nature of agarbatti manufacturing industry, this area will need to be developed to its full potential given its ability to increase income of households and also reduce transportation cost substantially. It will call for large scale training initially in North Tripura District and West Tripura district in more than 20 villages. In this process, the involvement of Gram Panchayat would be essential as it will help disperse knowledge of stick rolling faster by covering many households. Gram Panchayats can take this up as a rural household income generation program.

This activity will need initial support for purchase of rolls calling for involvement of enterprising manufacturers who will initially bear costs of sticks and towards training benefiting from a stable procurement (buy back) arrangement. Such an

effort will also help produce stable quality of Agarbatti instead of procuring from unorganised traders that leads to large scale rejections.

Effective involvement of the community – counselling, workshops, communication material, sustained involvement

This is not a fully developed economic sub-sector involving full time workers in it as yet. As a result the involvement of stakeholders will need to be carefully judged in terms of their availability, convenience and economic return.

The interest and involvement of the community in the process can be ensured through:

- Involvement of local institutions and bodies like panchayat, SHGs, banks. This will develop confidence in stakeholders involved with the process.
- Community mobilisation to be done through active SHG members.
- The training should be practical in nature but the theory must emphasise on economic benefits and must be delivered through interactive means so that stakeholders can present their problems to trainers.
- In a larger forum such as a workshop the involvement of other components of the supply chain is essential particularly traders and manufacturers. The face to face interaction between stick rolling households with buyers will instil confidence to the stick making and rolling community.
- For usage of machineries, involvement of local technical training institutions like NBIRT who have established credibility will be required.
- Identification of local mechanics and their training is necessary to deliver local support for supplied machines to ensure continuous quality.
- Local demonstration facilities of such machines are essential in Agartala and other district towns with availability from supply point of view.

1.6.1 Machines & Equipments for Agarbatti Making

In this industry a large number of households are involved and scattered across the country. Its nature is such that large corporates like HLL and ITC have not been very successful in converting it into a fully industrialised mechanised product. On the contrary, ITC is trying to take advantage of its prevalent unorganised nature as a low cost manufacturing process. The mechanisation must take place keeping this in mind as also its part time involvement nature. The machines should be easy to use, manual if possible with an option to run on electricity. It is unfortunate that such machines are few and far between although its requirement is very high not only in Tripura but the entire North East. It has also been noted in the field that many such machines that have been installed are not functioning properly and there is little support from the manufacturer's end. A simple intermediate technology with involvement of local mechanics is essential for faster dissemination of mechanisation in this sector. The best way to do this would be to induce direct involvement of a manufacturer in the process by inviting them to Tripura.

The smaller manual machine with lower price has a tremendous potential for this sector in Tripura. But these machines must ensure quality and increase productivity substantially. Many households can then buy these machines as they buy rice threshing machines.

By using such machines:

Cost of a setting up of a single unit stick making machine: Rs. 30,000

In one village for 5 machines the total cost will be: Rs. 30,000 x 5 Rs. 1,50,000

This effort will increase productivity by 4 times and will also help increase income by more than 20% on the unit price which will effectively translate to more than 5 times income from this activity. One month per household extra income generation will be Rs.50 x 15 days = Rs.750/- for two families sharing or renting it will be Rs. 1500/- per month. In this manner, less than 20 months will be required to pay back cost of machines.

OPPORTUNITY 2

2.0 Supply of Readymade Bamboo Sticks to Mechanised Looms for Blinds

A market seems to be developing for sticks to be utilised for manufacturing blinds of widths varying from 3' to 6' woven through mechanised looms. These looms are currently available in China and can produce roughly 1,200 sq. ft. of woven blinds a day. Other than aspect of higher production, the looms help meet market need for quality and consistency that a discerning buyer would expect while furnishing their tasteful living room.

2.1 Economics of Sticks as Raw Material

- Size of sticks used – 38" width of 2.2 mm and 2.5 mm diameter. The 38" sticks are cut into 36" to get 3' x 6' size blinds. 48" width is being planned to be introduced if market preference is established.
- 66 blinds of 3ft x 6ft size can be produced per loom per day that is the maximum capacity of the mechanised loom. The mechanised looms can also weave larger widths but since the demand is more for 3' x 6' products these are being produced currently.
- Each 18 sq ft blind requires 3 kg sticks and slivers.
- The rated production for one loom thus turns out to be 66 x 18 x 24 = 28,500 sq. ft. assuming 24 days production @ 100% capacity of machine
- This would result in approximately 4,750 kg of sticks and slivers needed as raw material per month. At Rs 40/kg, the rate at which it is being procured this works out to approx. Rs 1,90,000/- worth of sticks required as raw material in a month or Rs. 22.8 lakh worth of sticks annually or 57,000 kgs in weight terms.
- The price quoted for the finished product is 52-75/sq. ft. Assuming an average of Rs 60/sq. ft., the cost of sticks works out to 10% of price of finished product.

At present there are two industries with mechanised looms which are in the process of being set up in Guwahati and can source sticks from Tripura. The research team visited both these units.

(i) Vighnaraj Blinds

(ii) Rhino Industries

Considering the low investment going into such a unit and the abundant supply of sticks that can be generated within Tripura there is every reason that such units can be established in Tripura in the near future.

2.2 Vighnaraj Blinds

The unit is being established by Ms Dipshikha Deb Baruah with support from National Mission on Bamboo Applications (NMBA). She has been making such products using handlooms and had participated in a 10 day training programme on making of Venetian blinds conducted by Cane and Bamboo Technology Centre, Guwahati (CBTC). Although she had no prior experience of working with bamboo she set up her own blind making unit, Vighnaraj Bamboo Products with 3 workers and a small investment on 2 looms priced at Rs 5,000 each. This helped her make traditional blinds through a manual process that allowed her to experiment with design options. Not long after she began to participate in trade fairs and exhibitions and started to secure orders.

Vighnaraj products were appreciated for their design and skill with which they were made. Orders from Indian locations were executed in addition to those

received from Portugal, Spain and Brazil as well. Constrained by lack of production capacity and need to upgrade in terms of quality parameters to meet bulk and export requirements Ms. Deb Baruah approached NMBA.

NMBA provided the unit with guidance and offered technology support, financing and specialist advice on going about setting up two mechanised looms that were to be imported from Taiwan. It developed a configuration of equipment that would enable the unit to produce more blinds and improve quality. The Mission also supported the induction of equipment for carbonisation and bleaching as finishing processes and helped identify machinery, particularly mechanised looms, and process technology. The Mission also helped in training Vighnaraj workers in use of commercial natural dyes for added value and appeal to the final product.

Turnover at Vighnaraj increased from its small beginnings and the unit has expanded to meet added demand for its products. It is now readying itself to receive and install mechanised looms and processing equipment in the form of 2 weaving machines procured from Taiwan to make blinds. The overall project cost is Rs. 14.6 lakhs.

During a meeting with Ms. Baruah she mentioned that currently readymade sticks were being sourced for weaving from Shillong in Meghalaya at the rate of Rs. 39/kg but these supplies had to stabilise in delivery and quality terms. They were interested in exploring other sources for stick supply once capacity for weaving would increase after installation of mechanised looms. Another supplier in the meantime was being encouraged by Vighnaraj who was getting sticks converted at a CFC located near Guwahati.

Based on economics presented earlier, Vighnaraj's requirement at today's capacity for 2 machines on 100% rating basis would be 57,500 kgs. x 2 = 115 M.T. valued at Rs. 45.6 lakh.

2.3 Rhino Bamboo Blinds

Rhino industries, has recently entered the business of mechanised bamboo blinds manufacturing utilising 7 looms. The business group has earlier been involved with manufacturing galvanised corrugated sheets.

They are looking for suppliers of mechanised sticks to feed the loom and have indicated a preference to develop clusters to meet raw material needs of the unit. At Vighnaraj, the size of sticks used is 38" width of 2-3 mm thickness.

Based on earlier workings computed, these 7 looms will need approximately require 400 MT of sticks of value Rs. 160 lakh as per size and dimensional requirements indicated.

2.4 Current Activity of Stick and Blind Manufacturing in Tripura

All over the state various crafts persons can be seen involved with making of sticks for blinds, place mats , etc. The level of mechanisation is very low with most involved pursuing the manual route. Given the shift in consumer tastes and corresponding production processes the need for raw material also is undergoing shifts. There is an increasing preference for machine made sticks from their shape (round or square) perspective as also uniformity. The research team visited one such unit P.S. Green Gold Society run by Mr. Partha Chakraborty & his 2 brothers. P.S. has commenced operations recently in July 2005.

Their main output is stick for blinds, agarbatti manufacture, ice creams, and toothpick. Agarbatti stick is the main production line for them since being new to the market, they don't find much market for blinds given few manufacturers who need to be supplied sticks. Experience has not been good too with payment default in one case.

On the contrary, they are involved with fine sticks blind production themselves. After manufacturing sticks they distribute sticks & coloured thread to villagers trained by them who weave blinds on handlooms. They sell blinds at Rs. 5/- per sq. ft (Ex-Tripura price) that then are sold at around Rs. 10-12 per sq. ft. in New Delhi. The weaving capacity of each woman worker for a days work of 6 hrs is around 5 metres, but most villagers do not have looms that cost around Rs. 5000/- to Rs. 7000/-. These women use the KAMARTAT (see above) a traditional weaving machine that is utilised to produce 2-3 running metres per day. The output of the *Kamartat* varies from region to region and we have come across varying outputs of 2-5 metres per day being reported.

To increase productivity and improve upon finishing P.S. Green Gold started providing looms to villagers from their own investment and till date have provided 3 looms. To motivate those involved, they offer them better wages compared to others. They have also appointed a Manipuri lady with experience in handloom weaving to work as a mentor for villagers by providing training, better designs & supervising production.

To increase blinds sales, visits to cities and participation in different fairs is undertaken. Amongst other plans, they plan to work on long term supply arrangements to outlets in Bangalore & New Delhi. However, given the entry of mechanised looms they will largely be catering to the lower end of the market.

2.5 Production System

14 workers work 8 hrs a day on the following machinery forming part of the production system:

Machine	Nos.
Cross Cutting	1
Knot Removing	1
Sliver Maker	1
Slice Maker	1
Stick Maker	1
Size Maker	1
Polishing	1

The following bamboo species are used for production:

Species	Cost/bamboo (Rs.)	Length
Makhal (*Bambusa Pallida*)	10	25ft
Mritinga	10	25ft
Muli	3	25ft

Most bamboo is collected from interior villages by sourcing directly from villagers. Each Makhal & Mritinga bamboo costing around Rs. 10/- has a purchase price of Rs. 7/- and a transportation cost of Rs. 3/-.

Stick Production

Sticks of thickness 1.5 mm & 2.5 mm are produced. Mostly orders are for sticks of size 6'' to 16'' of both 1.5 mm & 2.5 mm, which are then used to make agarbatti for export. Around 80-90 Mritinga Bamboos are used every day.

Stick Making Process

Cross cutting bamboo into different sizes (2 Persons)

↓

Splitting each piece of bamboo (2 Persons doing manually or also outsourced, currently they do not have a splitting machine as they have limited space and the machine requires a large space)

↓

Knot Removing (1 Person)

↓

Sliver Making (1 Person)

↓

Slice Making (1 Person)

↓

Stick Making (1 Person)

↓

Size Making (1 Person)

↓

Polishing (1 Person)

During stick making the stick making machine discharges heavy dust affecting workers and production. It was also noticed that most of the time workers involved in cross cutting & polishing were idle and they could be utilised on other machines reducing overall staff involvement. It was suggested that another stick making machine be installed leading to an increase of 50-60% or more in productivity with same number of workers.

Production from one bamboo culm - unpolished

Dimension	Size	Stick Yield
20ft, 8kg	2.5 mm	1.5 kg
20ft, 8kg	1.5 mm	1 kg

Production per day - either size unpolished

Size	No. of Days	Stick Yield
2.5 mm	1	120 kg
1.5 mm	1	65-70 kg

Monthly production (Either Size)

Size	Quantity (Kg)	Form
2.5 mm	2,000	Polished
1.5 mm	1,000	Polished

Range of products and rate at which they are sold

Particulars	**Thickness in mm**	**Length**	**Price Rs./ Kg**
Tooth pick	1.5	1.5''	25
Stick	1.5	6''	45
		8''	45
		9''	45
		10''	45
		12''	48
		16''	50
	2.5	8''	45
		9''	45
		10''	45
		12''	40
		16''	40
		18''	40
		37''	50
		72''	60
Ice Cream	2.5	2.5''	25
Blinds	Either	5 Square Foot	25

- Price of Rs 50/kg was quoted for 37" sticks of 2.5 mm thickness used for blind manufacture. However units in Guwahati had indicated their price at Rs 39/kg.
- Production capacity of the unit is roughly 120 kg per day or 36 tonnes per year assuming 300 working days.
- The two blind making units at Guwahati described above together require nearly 515 M.T. of sticks annually
- There is scope to set up 10-12 units of similar size in Tripura for supplying sticks with an investment of Rs 10-12 lakh each.

A rough break up of such a unit is presented below as provided by P.S. Green Gold, Dharamnagar who has a similar setup:

Cross Cutting	36,000
Slicing	65,000
Splitting	2,00,000-2,50,000
Stick making	2,50,000
Knot removal machine	65,000
Sizing	45,000
Polishing	75,000
Cutter used in the stick making machine (3@15,000 each)	45,000
The other costs to be incurred are:	
Installation of machine	30,000
Carrying charges	35,000
Transformer	42,000
Shed	2,00,000
Other cost related to land	50,000

- At Rs 40,000 per tonne for 515 M.T. the turnover of such units could be Rs 2.06 crore with each unit employing nearly 15 workers each directly.
- The following then would be a summary of potential that would get addressed to meet needs of existing blinds industry:

- Number of units: 10
- Capital Invested: 1 crore (@Rs10 lakhs per unit)
- Turnover: Rs. 2.06 crore
- Employment Generated: 150 workers (@ 15 workers per unit)
- Volume produced: 515 MT

OPPORTUNITY 3

3.0 Supplier of finished table mats and floor mats

Fine stick mats are fast moving items in all types of furnishing stores catering to popular or premium category customers. Stores generally have a merchandising team that does the selection after 2-3 rounds of design approval and price negotiations. With the visibility and numbers of retail stores in the organised format on an increase they require variety in terms of products to fill their shelves with. This is the opportunity which Tripura can pursue offering contemporary designs using traditional or mechanised techniques.

The research team visited large format stores and furnishing chains in Mumbai and Bangalore to explore the possibility of fine stick mats. The stores visited were:

3.1.1 Home Stop - The Soft Furnishings Chain of Shoppers Stop

Shoppers' Stop recently launched its first home concept store HomeStop at Bangalore with a focus on soft furnishings. In addition, a slew of HomeStop stores separate from existing Shoppers' Stop will be launched by early 2006 in metros in cities like Pune, Hyderabad and Jaipur.

A meeting with the Head Merchandiser of HomeStop was done in Mumbai. According to them, Home Stop will be a one stop lifestyle solution store. In HomeStop the look and feel is contemporary and not at all ethnic. The bamboo fine stick mats in their present look therefore do not fit into the category of products seen at Home Stop. This had been made clear by the Head Merchandiser of the store at Mumbai. Inspite of this opinion, a wide range of similar products was found in a section of the HomeStop store in Bangalore.

A catalogue of products designed by Olom project artisans was also shown to the Head Merchandiser who did appreciate the work done but made it clear in the same breath that contemporary designs were required to meet consumer needs and find space on the shelf. The criterion for selection of vendors was purely design based and a minimum limit of Rs. 15 lakhs per vendor would be the minimum expectation to do business.

VISIT TO HOMESTOP, BANGALORE

The research team visited HomeStop at Bangalore and was pleasantly surprised to find a collection of handcrafted products including mats and table mats occupying a large section of nearly 2500 sq ft on the ground floor of the store. These were natural fibre products manufactured by Industree, a local group showing promise.

Considering the presence of these products at HomeStop opportunity for marketing products made out of bamboo sticks should find acceptance in the store. It is a matter of creating contemporary design and blending different colours, fabrics and styles together. To view the complete range of Industree products a visit was also undertaken to their exclusive showroom at Garuda mall in Bangalore.

3.1.2 Visit to Industree, Bangalore

Industree works with more than 100 producer groups. It has an annual turnover of Rs 10 crore out of which Rs 3 crore worth of products are exported. Industree sources from NGO's, trusts and co-operatives from all over South India and Orissa. Producer groups are small and mostly women home workers. They would provide a good platform to market products from Tripura price considerations being met.

PRODUCT RANGE

1. Natural fibre shopping bags and baskets.
2. Natural fibre place mats, runners and accessories such as bread baskets, cutlery tray, fruit basket, etc.
3. Natural fibre laundry and storage baskets, bins and boxes.
4. Natural fibre floor mats.

These products can be divided into collections for the dining table and kitchen, for living room, bathroom, desk, and so on. The following is a brief classification of products in each category:

- **Dining Table**: rectangular table mats, round table mats, table runners, food/ cheese covers, fruit trays, glass holders, vegetable baskets, cutlery trays, serving trays, appetizer trays, wine bottle holders and bread baskets
- **Desk**: file holders, pen stands, pen trays, file trays, CD boxes, waste baskets, storage boxes and pen pouches
- **Living room**: magazine racks, wood/ cat/ dog baskets, storage/dust bins, laundry bins, floor mats, foam cushions and door mats
- **Bathroom** (plastic woven): laundry bins, dust bins, bathroom mats, cosmetic boxes, lined pouches and bathing scrubs.

A model on the lines of product portfolio of Industree can be considered for development of fine stick category products from Tripura.

3.1.3 HyperCity Retail, Mumbai – Value Format Chain of Home Products

HyperCity is a big-box format of 85,000-100,000 sq. ft store in the value-retailing business floated by Shoppers Stop. The first store is slated to open by March 2006 in the capital. Food and grocery will not be as high on the selling agenda, instead the focus would be on value based home products.

A meeting with the chief merchandiser for HyperCity Retail again brought home the same feedback. The current designs of bamboo products are artistic, they need to be contemporary looking and mass produced to fill shelves. The current portfolio of products are addressing a niche market but need to have a mass appeal which is missing at present.

They were interested in business with a vendor only if large volumes can be supplied timely, and would not be involved with the aspect of design. However they do provide opinion on trends and styles. They were interested in fine stick mats and runners for their stores if they were available in vibrant colours. They advised using artificial dyes if natural dyes were expensive since they felt that mass market products were about price and not about making a statement.

3.1.4 LifeStyle, InOrbit Mall, Malad, Mumbai

This upmarket store at the BPO hub of Mumbai city, Malad was visited to get an insight into the current trends prevailing in terms of design and products for use at homes. Bamboo sliver based trays, table mats and floor mats occupied a limited shelf area. These had been imported from Thailand.

The opportunity of retailing through large format multi product departmental stores is not as promising as retailing through specific home product stores.

3.1.5 Pyramid, Tardeo, Mumbai

Another upmarket mall in Mumbai was visited for finding out more about trends in home products. However, Pyramid was largely into apparel and accessories

and the home section was also more focused towards bed spreads and towels. The focus on home furnishings was totally lacking.

As stated earlier, large mall formats in their present form are not suited to create enough excitement around new designs and styles of bamboo based mats. It is advisable to opt for furnishing stores and home accessories stores instead.

3.1.6 The Bombay Store, Mumbai

The Bombay Store has been in existence for around 95 years now with the first store opening in December 1906. The store houses an assortment of items including food products, ready-to-wear clothing, home furnishings, home accessories, cosmetics, health care, leisure and entertainment products. Currently, there are four Bombay Stores, operating in Mumbai (10,000 sq. ft.), Bangalore (30,000 sq. ft.), Pune (5,000 sq. ft.) and one smaller one located at the Mumbai airport to cater to travellers.

The Bombay Store is planning to increase its current number of outlets from existing three to twenty. With these plans in place the company is aiming to be present in all major metros including Delhi. The average size of the new stores will be approximately 15,000 square feet.

Nearly 50% of the current customer profile of The Bombay Store is foreigners and tourists. It has a loyal set of clientele that keeps coming back in search of new concepts and designs in home decor, apparel and accessories and is constantly on the look out for new vendors with innovative concept. A separate merchandising team for each product line is in place who have a discerning eye and are quick to recognise a good product.

When the research team visited the Head Merchandiser of the store with designs of fine stick mats and floor mats (Olom designs) they were immediately interested and appreciated the concept. They were willing to place orders during the meeting itself and desired to be sent designs and quotations at the earliest. They have suggested some more variety in designs shown to them by adding different colours and combinations.

One of the fast moving items in their store is the rug and different types of floor mats. The fine stick woven mat with designs appealed to them. Bombay Store is associated with ethnic products and fine stick mats and rugs match their current offering. They can be a good potential to market to but would like frequency of supply of new designs to be high.

3.1.6 @Home –Chain of Furniture Stores by Nilkamal Plastics

The Nilkamal Group, India's leading manufacturer of moulded furniture and material handling crates have a turnover in excess of US$ 100 million and is also the world's largest manufacturer of moulded furniture. The group has a wide array of moulded products in both the furniture as well as crates segment. The furniture product range comprises chairs, dining tables, coffee tables, trolleys, shoe racks, multipurpose racks, baby chairs stools, etc, to mention a few.

With the moulded furniture market having remained stagnant since the past couple of years, Nilkamal Plastics has made a foray into retailing after trying their hand at value adds. The company had launched moulded plastic sofa sets some time back and is now in the process of launching moulded plastic office furniture under the brand name, Novella, as well as storage cabinets and wrought iron look alike rocking chairs for the home segment.

The company also has its exclusive stores, Nilkamal Home Ideas, in as many as 20 SEC B&C towns, and is planning to set up 15 more stores in the next six months. Recently, Nilkamal also ventured into large format retail with the launch of its home solutions store @Home, which has been positioned as an aspirational

mid-market brand. The store offers furniture, home furnishings and accessories. They have positioned themselves as home-makers and not as a furniture store. The company has set up stores in Pune, Mumbai, and Ahmedabad, and is planning to set up 27 @Home stores in the next three years, for which it is planning an investment of Rs 40 crore.

Though most of the products available at these stores are currently imported, in coming months the company would be looking at tie-ups with international furniture and home furnishing brands which would be exclusively marketed through @Home stores.

The research team met up with the Merchandising Department of @Home in Mumbai. They considered the fine stick mats as well as floor mats (Olom designs) as good looking designs to be a perfect fit for the SEC B & C homes which they were targeting through their stores. The products would give them the variety that customers sought and at the same time fitted into their budget and looked appealing and new. However a visit to their recently opened store in Kandivili had the research team witness imported synthetic goods on display. This may be also due to non-availability of local goods at this point of time. However the Store Manager made it a point to emphasise that all goods stocked were imported.

Fine stick mats and rugs have a good opportunity to be sold through stores such as Home Stop, Hyper City Retail, Bombay Store and @Home.

3.2 Fine Stick Mat Making In Tripura

This is an area that offers opportunity to employ a large number of artisans given the fact that the products have a good acceptance in the market, are acknowledged as Tripura produce and can not be produced using machines. It will be important though to improve value on the product and raise the value realised for artisans involved. Many groups have been formed involved with such activity and one such group is covered below. However some other groups met at Jogendranagar though involved with large scale production still were not involved with centralised procurement or warehousing systems to meet group member's needs. Thus such groups can be immediately contributed to raise their level of management delivery.

3.2.1 Bijaya Bamboo & Cane Industry (Karamchara)-SHG

Bijaya Bamboo & Cane Industry is a SHG constituted of 13 members mainly manufacturing traditional handicrafts. They have got training in handicraft making from CBTC. There are four other similar kinds of SHGs around the village. Each member of the SHG is saving Rs. 50/- per month in the SHG account.

They buy bamboo from the local market and use Muli & Rupai bamboo for their handicraft needs. Each Rupai bamboo costs them around Rs. 25/- including transportation cost while Muli bamboo costs them Rs. 4/- + Re. 0.10/bamboo as transportation cost totalling Rs. 410/- for 100 bamboos.

They are also making fine mat blinds used for wall calendars with different designs. As they don't have any looms they are using KAMARTAT, a traditional weaving machine discussed earlier for mat weaving. Using the KAMARTAT a woman can weave maximum 5 m per day as against 2-3 metres reported earlier at another site (in a work span of 6 hrs). Though KAMARTAT is their traditional weaving tool, it is painful and hence continuous weaving can't be done for extended hours. If there is a demand of fine mats to be delivered in a short period of time, it will be quite difficult to meet such demand using this weaving arrangement.

For marketing of their products the SHG solely depended upon the local market, a nearby army camp that existed, and different fairs.

Till now, SHG members were producing all kinds of traditional handicrafts with traditional designs though they had got training from CBTC for handicraft manufacture. Though they have the potential of making all kinds of utility handicrafts, they have not yet found a market for it and hence are not involved with its manufacture. Also due to transportation difficulties between Agartala & North Tripura, traders had not approached them for ongoing orders.

Table mats (a set of 6 place mats and 1 centre piece) are priced at Rs 105. Calender/Wall Hanging made of fine mats are priced at Rs 40-60 per piece.

These SHGs can be trained to offer better designs and may also be provided machines for weaving as using Kamartat is a laborious process and productivity is also low.

3.3 Opportunity for Tripura

There are variety of mats being sold in organised retail chains visited. A single design is not likely to sell more than 2 pieces per store/day – this makes the annual potential to be in the region of 600 sets per store per year. Taking into account festive season and gifting sales we can assume per store sales to be 1000 sets per year.

Other than organised retail chains, there are standalone stores like Contemporary Arts and Crafts, Good Earth etc which can sell at least 30% of a large store. This can be assumed to be 300 - 350 sets per year per store.

If 3 organised retail chains and 50 such stand alone stores are targeted the sales potential we can expect is:

Organised Chain	**Stores currently**	**Next 3 years**
@Home	3	27
HyperCity	1	15-20
Home Stop	1	5-8
Bombay Stores	3	20
Big Bazaar	20	13)
Total	**28**	**70**

The 28 stores currently can account for 28,000 dining sets per year. 50 other stores with 300-350 sets per year would account for another 15,000-16,000 sets per year that would total to 40,000 sets approximately. This translates into around Rs 1.6 crore worth of dining table mat sets sold at a retail price at Rs 350-500 per set depending on the design taking an average of Rs. 400/set.

Order Potential	Rs 1.6 crore/annually
Retail Price of 6 mats + 1 centre piece	Rs 350-500

Each set of 7 mats (6 mats of size 18”x12” and 1 centre piece of size 30”x12”) will require:

Taking average selling price at Tripura of Rs. 150 per set and around 40,000 sets of mats required in a year, it translates to say 133 sets production per day.

Weaving

Taking size of each set of 6 table mats of 1.5 ft by 1 ft and 1 centre piece of 2.5 ft by 1 ft

1.5 x 1 x 6 + 2.5 x 1 = 11.5 sq. ft.

For 133 sets we would require 11.5 x 133	1530 sq. ft. woven daily

Stick Requirement

For 18 sq. ft. of mat 3 kg sticks are required implying approx. requirement of 2 kg of stick for the 7 piece set (11.5 sq. ft.) or 2 x 133 — 266 kgs. of sticks per day

No. of Looms required

Looms required on basis of production of 5 m per day (6 hrs) per loom using handloom

Since the loom would be 3 ft wide, in each width we get 2 mats requiring a weaving of 3 ft. for 6 mats and another 1 ft. for the centre mat i.e. in a total of 4 ft. one set of mat is produced.

4 ft = 1.22 metres

One woman weaves 5 metres a day on a loom

Total sets produced by one woman = 5/1.22 — 4.1 say 4 sets

One loom will produce 4 sets of mats per day.
To produce 112 sets per day 112/4 — 28 handlooms

Employment

Stick making	9 x 12=108 persons (based on 14 members required by SHG currently for different operations)
	Weaving 28 persons (Few more would be required for other operations)
	Total 150 (approx.) equivalent to 10 SHGs of 15 members

Investment

Looms (28 units) 28 x 7,000	Rs. 1,96,000
Stick making M/c (9 units) 9 x 30,000	Rs. 2,70,000
Total	Rs. 4,66,000

Cost

Cost of bamboo 10 x 32 x 300 — Rs. 96,000

From 1 bamboo 20-25 ft. about 7 kg of stick is produced

For 224 kgs, 224/7 = 32 bamboo would be required costing Rs. 10 a piece

Sale value at Tripura Rs. 250 per set (average price across different varieties ranging from Rs 350-500 per set in the market).

= 250 x 12,000 = Rs.30 lakh

From the above we see that 9 small units can be setup with each having 1 stick making and 3 looms at different locations in proximity of the raw material source or worker village.

This product will generate direct employment for 150 persons besides indirect employment.

OPPORTUNITY 4

4.0 Supply of slats for flooring units established

Bamboo Flooring represents the higher end of the strip based application. There are two flooring units that have been successfully established and are running at 20-40% capacity at present. These are large units with an investment upwards of Rs 2 crore in plant and machinery. Marketing of bamboo flooring tiles does not seem to be a problem as there is substantial demand which is coming from architects directly and feeding needs of the booming construction and interiors industry.

A typical flooring unit requires an investment in the range of Rs. 2-3 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 have entered the business. The units as mentioned below are located in the NER or in the state of West Bengal currently.

Name of Unit	**Products Manufactured**
Embee Forest Products, Siliguri	Flooring, door frames
Kosons Flooring, Guwahati	Flooring

The Bamboo Flooring units have a requirement of strips of a specific size and thickness. The viability of these units is based on receiving these strips from primary processing units serving as hubs. A very important factor is supply of consistent bamboo slats of uniform age and finish achievable only through a planned plantation route. As market matures there will be a demand for such higher grade material but currently the flooring manufacturers are relying on material available, though taking it through a process of sorting.

Encouraging entrepreneurs to set up such primary processing hubs have not yielded results as yet, since there is fear of dependence on the fate of these units that themselves need to stabilise. These units have therefore been compelled to manufacture their strips internally to build confidence. Some entrepreneurs are now showing interest in setting up primary processing clusters.

4.1 Embee Forest Products

The unit is situated at Siliguri in West Bengal. The products manufactured are bamboo flooring, shuttering board, sections and flush doors. The products require mats as well as slats 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.

For Flooring

They require dried and machined slats of 6-7 mm thickness and 2.5-3 inches length or 8 inches circumference. For this application bamboo a wall thickness of 13 mm would be needed (*Nutans, Tulda species are ideal*), which after two sided planing would reduce to 9-10 mm and would further reduce to 6-7 mm final thickness after drying and machining.

Market Price of Products

	Ex Factory Price (Rs)	*Market Price to Consumer (Rs)*
Bamboo Flooring	140/sqft	210/sqft

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 cost of production.

Quantity of Intermediate Products Required

They require dried and machined slats of 6-7 mm thickness and 2.5-3 inches length or 8 inches circumference. For this bamboo with a wall thickness of 13mm would be needed, which after two sided planing would reduce to 9-10 mm which would further reduce to 6-7 mm final thickness after drying and machining. 5 truckloads of flooring slats can be absorbed per month though there is no such limitation as the market is showing signs of picking up.

Since the requirement is 5 truckload per month number of slats can be derived as follows:

One truck load = 9,000 kgs

Daily requirement = 9,000x5/25 = 1,800 kgs

Taking density of dry bamboo as 0.7 the require volume is 1,800 x 1,000/0.7 = 25.72 lakh cm^3

Volume of one slat of 48"x1"x8mm = 247.75 cm^3

Number of slats of 48"x1"x8mm required = 25.72 lakh/247.75 = 10,379 slats, say 10,000 slats

The best way to address needs of raw material sustainably would be to establish intermediate units through SHGs.

Model Suggested for Intermediate Unit

Two levels have been suggested: Level One	Primary processing	
Level Two	Planing and Drying	

Level One

Number of stations in unit	2	
Number of bamboo poles needed/day	200 (20-24 pieces/pole from Tulda bamboo, price Rs 7-8 per pole)	
Machinery and Equipment Needed	**Nos**	**Cost/machine**
Splitting machine	2	Rs 1.5 lakhs
Cross cutting machines	2	Rs 50,000
Knot removal machine	1	Rs 75,000
Generator (15-20 hp)	1	
Tanks for storage of water for leeching	2	

The above machinery set up can be carried to the bamboo resource and slats can be made for a 7 day period. 1,50,000 slats of dimensions 1 metre x 25mm x 7-8 mm can be produced in 7 days.

Level Two

In the level Two unit, the slats can undergo the following process:

(i) Two sided planning, and (ii) Drying

The total investment in Level One and Two has been estimated at Rs 1 crore. The price per slat would be acceptable at Rs 1.50 per slat F.O.R. Siliguri.

3.4 Kosons Flooring

The bamboo flooring unit has been set up in Guwahati in Assam with a capacity of 60,000 sq. metres per annum which at 5,000 square meters per month works out to 50,000 square feet per month. They have a requirement of 20,000 slats per

day (at 100% capacity) and are willing to pay a landed cost of Rs 1.70 per slat of dimension 4ft length x 1" width x 8mm thickness.

Capacity = 5000 sq. metres per month or 5000/25 = 200 sq. mtrs. per day

12 slats of 4' x 1" are required to make 4' x 1' and three such layers are required for the required thickness of the flooring.

Total 12x3 =36 slats will give a flooring of 4' x 1' or 4 sq. ft.

In other words 36/4 = 9 slats are required per sq. ft. of flooring per day.

Production = 200 sq. metres per day = 200 x 10.76 = 2153 sq. ft.

Slats required per day = 2,153x9 = 19,375 slats of 4'x1" say, 19,000 slats per day

Internal capacity for slats =40% = 19,000x40/100 = 7,600 slats

Slats shortfall to be met = 19,000 – 7,600 = 11,400 slats of 4'x1"

Currently 20% of slat requirement is met internally through a captive arrangement while another unit at Bongaigaon has also been developed for supplying 20% of such requirement. The investment for the unit has to be made by a local entrepreneur. As a result of this, Kosons is working at only 40% capacity.

The viability if the unit is based on a hub and spoke model. There is a requirement of 3 feeder units which can come up for supplying remaining 60% of raw material requirement – this is equivalent to 11,000 slats per day.

A visit was undertaken to the unit at Guwahati and various flooring designs of good finish were noticed on the production line. Kosons has experimented with horizontal, vertical, natural, carbonised, and mix of these to produce a variety of flooring products.

Manufacturing Unit	Raw material slats (daily) for Flooring	
	Form	Slats/day
Embee	Slat (4'x1"x8mm)	10,000
Kosons	Slat (4'x1"x8mm)	11,400
Total		**21,400**

Total slats required daily (4'x1"x 8-9 mm) 21,400

5.3 The Slat Opportunity (Non planed, Non mechanised, Manual)

Number of slats/day	21400
Number of slats that can be made per day	75-100 slats
Employment generated 21400/87.5	244.6 say 250 persons.

The Slat Economy

Selling Price before transportation	Rs 1.70/slat
Annual Turnover 21400 slats/day 21400 x 300 days x 1.70/slat	Rs 1.09 crore

OPPORTUNITY 5

5.0 As supplier of graded & quality certified intermediate material

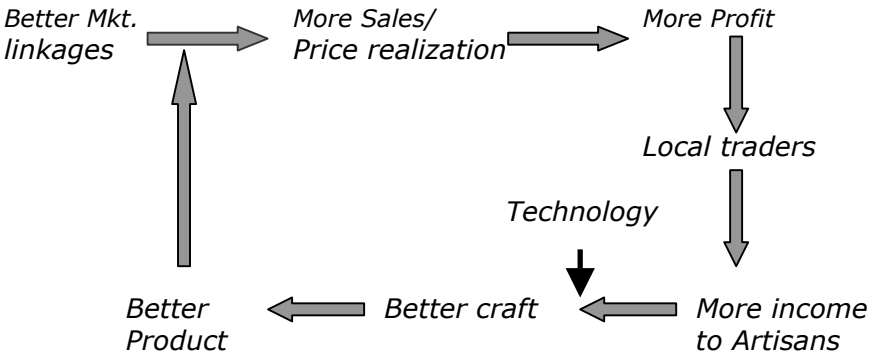
This will be a new approach planned based on the assumption that bamboo found in Tripura may find use in other regions if made available in standard size, graded and neatly packed. This could then meet needs of applications such as fencing, open partitioning, gates, wall cladding and even other such not identified. If the material is cut to standard length such as 2', 3' and 4', in fixed widths of ½" and ¾" and treated, it may find buyers in areas where bamboo is not readily available, cities for one. Sale could be done through the roadside system and once it starts to pick up value added lots could be sold through outlets such as hardware stores and the like.

While initially the material could be in its basic form, later they could be coloured by carbonising or using dyes, have holes punched to allow binding using fibres, and even have designs painted/burnt if preferences so indicate. In the past, various interior designers spoken to have indicated that such a material could come in handy if made readily available of a good quality on a consistent supply basis. This is important considering that the user may not be able to plan its use and would like to procure it as and when the need arises.

At the production end, it would not be worthwhile to dedicate efforts only to this effort. It would be more prudent to have those involved with stick making extend into offering this range on a trial basis to be scaled up as and when positive indications emerge from the market. Some bit of promotion may be required to be done to begin to let people know of such an option being available. For this reason, it may not be prudent to forecast any returns from it. It may be advised though that efforts be tapped to test the potential of this offering that if accepted by the market can turn into a large demand, addressing needs of export too. For this reason it is not proposed to be included to compute employment and turnover figures.

Implementation Strategy

As can be seen from the assessment of market potential sufficient demand for the quality products can be generated. At the same time higher value realisation too can be achieved in the manner indicated below:



Strategic clusters

The important clusters noticed for development of stick products are:

a) Agartala Sadar

b) Jogendranagar

c) Majlisjpur, and

d) Amarpur

Like all bamboo handicraft and furnishing products, quality of products do have a bearing from the livelihood status of artisans. In above clusters it has been noted that majority of artisans income from manufacturing these products are less than the daily wages as a labourer. As a result, mainly women are involved in this manufacturing process and that too on a casual/marginal basis with looms found inside the house where women weave products in their free time. While it may be difficult to break this routine it is important to realise that given the returns it is not surprising. To improve their involvement and consequent quality time and effort will have to be invested in improving their ability as also realising better values from the market.

Blind and stick making involves three important activities:

a) PRODUCTION OF STICKS: It is a less specialised, low skill job. The sticks are usually produced manually for various final products. The fineness of sticks and its sizes vary based on needs.

b) DESIGN OF PRODUCTS: This is a high skill activity usually involving a master craftsman with or without external intervention.

c) PRODUCTION OF END PRODUCTS: This requires reasonable skill and design sense. Usually different types of looms are used for making blinds, mats etc. and other processing activities may also be involved.

For fine stick *chick* making or furnishing material like curtain weaving the 'Gomti Women Hasta Karu Shilpa Samabay Samity Ltd.' of Amarpur Cluster of Amarpur Block , South Tripura will be the ideal location. This women's community has been noticed to have improved ability to produce products suitable to meet needs of modern houses.

For other types of products particularly table mats, coarse stick *chick,* etc. the Jogendranagar, Majlishpur and Agartala clusters can be involved. All these

clusters are near Agartala and are closely linked with both men and women being involved in these clusters for production process. Setting up units in Jogendranagar and Majlishpur during first phase will kick start the development of this industry at a faster pace. As these are close to each other the cascading effect on artisans and entrepreneurs involved in this industry will be far reaching.

Stick Making Mechanisation

Considering market information and requirements of furnishing industry mechanisation for production of sticks seems essential. This will improve the quality of sticks and in turn will enhance end product quality as well as increase productivity. In an earlier section the mechanisation process for stick production has been explained in detail.

Looms for Weaving

Weaving needs to be paid attention too. The semi mechanised or improved indigenous loom can help artisans produce quality products that can then involve large number of families presently associated with the trade. The existing skill and artisanship present in these clusters will fulfil needs of a sophisticated market keeping its ethnic feel or meeting contemporary design needs.

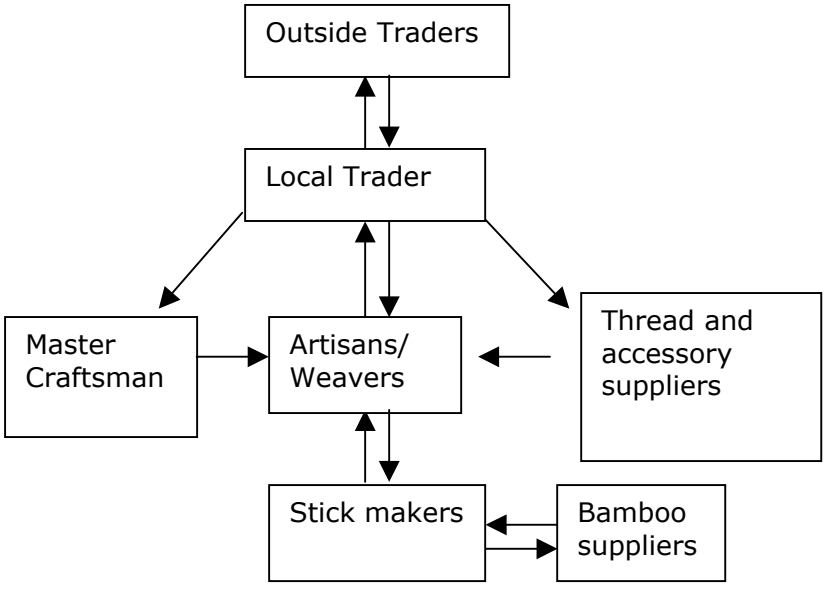
Market Exposure/Design training

Local master artisans require to be better exposed to markets and needed requirements. They need to be trained with modern design concepts that could be made to blend harmoniously with ethnic traditional design.

Strategy for development of units

The strategy for the development of units is a challenging issue in these clusters. The fundamental issue is refining existing norms to define the transactional relationships between cluster actors, starting from stick makers, weavers, master craftsman, local traders, cooperatives, outside traders, and banking institutions. At present these clusters are highly fragmented.

Private sector players, particularly local traders who can link artisans with outside markets must be encouraged in the initial stages. They need to function as a change maker for better profit. As can be seen, at the local level they are present at the highest tier of the local supply chain and have more control over the business and are intricately linked with the other actors of the cluster.



Linkages of Cluster Actors

As infusion of technology takes place at lower tiers, ownership of units will always cause a conflict within the cluster if ownership is lying at a lower tier at the beginning of such efforts. This can only be addressed by involving the most powerful actor that is a local trader in this case. Local traders in association with an outside institution can provide foundation for units to grow by involving local artisan SHGs in the production process. This will ensure harmonious production of better quality materials.

It is also important to set up multiple units within a cluster through other local traders. This will force local traders to network amongst each other and a larger artisan pool will be created within the cluster that will have a strong bearing on the overall productivity of the cluster.

Effective involvement of cluster actors

Establishing links between large merchandisers with local traders will provide the right kind of exposure to traders with a bearing on market potential and profitability. This link is the first essential step for development of this particular sector.

The artisan's spontaneous involvement in the process can be ensured through:

1. Organising design workshops at local artisan level within the cluster by involving merchandiser's representatives and local traders. The financial return on better quality material will motivate artisans further.
2. Mobilisation will be through active artisan's SHG members.
3. For induction of technology for mechanisation, involvement of machine manufacturers is necessary. Particularly ability of newer variety of looms, design changes possible, and its overall ability needs to be explained more effectively to users by manufacturers and existing users from outside.
4. Identification of local mechanics and their training is necessary to offer local support to machines, as also for regular tuning to ensure quality.
5. Local showrooms offering demonstration of such machines are essential in Agartala and other district towns. They also need to be made available easily with necessary finance linkages.

Machinery & Equipment for Agarbatti

This industry by nature is unorganised much like any other cottage industry forming part of a low cost manufacturing process. Mechanisation must be introduced keeping in mind its nature and involvement of women. Machines for stick making should be easy to use, preferably those that can be done manually as well as through electricity. It is unfortunate that such machines are few and far between although its requirement is very high not only in Tripura but the entire North East. It has been noted in the field that many of machines supplied in the past under one initiative or the other are not functioning properly and there is little support from the manufacturer's end. A simple intermediate technology with involvement of local mechanics is essential for faster dissemination of mechanisation in this sector. The best way to do this would be to have the direct involvement of a manufacturer. This could be done by inviting them to Tripura through various trade fairs and trade meets.

The intermediate looms (not fully mechanised) with more productivity and better design capability has a tremendous potential for this sector in Tripura. Such looms however must ensure quality and increase productivity substantially. NMBA could be approached for technical and financial support for upgradation and induction of such technology.