Livelihood potential of Bamboo-Based Technologies

Sujatha.D [*] & Mohanty B.N[**]
IPIRTI, P.B.No2273, Tumkur Road, Bangalore, India
Pin: 560 022.
E-mail: dsujatha@ipirti.gov.in

Abstract

A brief account of potential of bamboo as alternate to wood panel products is discussed which is primarily due to their superior physical & mechanical properties coupled with faster growth and quick maturity and the R & D efforts recently made to evolve a number of innovative engineered products. Estimation of employment opportunities for unskilled rural/tribal especially for backward communities and traditionally skilled artisans by establishing units for the production of Bamboo composites like Bamboo Mat Board [BMB], Bamboo Mat Veneer Composites [BMVC], Bamboo Mat Corrugated Sheet [BMCS], Bamboo Mat High Density Panel, Bamboo Mat Trays (BMT) Bamboo Mat Moulded Skin Board (BMMSB), Bamboo Mat Ridge Cap (BMRCS) and bamboo wood has been made. All the products developed requires bamboo mat as a raw material. The bamboo mats weaving is a social activity found in the rural areas. Most of the women folk have generated the habit of weaving from their ancestoral origin which is their livelihood day to day. The technologies developed successfully by IPIRTI and the employment that can be generated while these technologies are adopted is highlighted in this paper . The paper describes broader aspects of employment generation on industrial processing of bamboo based composites The data generated during a survey of people involved in the production of processed raw material, namely, bamboo mats, their socio-economic conditions, the problems faced by the artisans are also dealt with.

Other related issues to run the bamboo based industry successfully based on the technologies developed by IPIRTI with peoples participation in selecting right types of bamboos and growing of such species, scope for widening uses of bamboo resources available in the country through mechanical intervention, need for development of indigenous machineries for successful adoption of technologies, and the awareness programme required for promoting this technologies are also briefly described.

Key words: Bamboo, employment, composites, economic

Full addresses of authors:

1) [*]*Ms. Sujatha. D*
Scientist 'E' – HOD (Adhesive Technology)
Indian Plywood Industries Research & Training Institute (IPIRTI),
Post Bag No.2273, Tumkur Road, Bangalore 560 0022
Tel. No.91-80-30534005 , Mobile: +919880005284, Fax No.91-80-28396361,
E-mail: dsujatha@ipirti.gov.in

2) [**]*Dr. B.N.Mohanty*
Director,
Indian Plywood Industries Research & Training Institute (IPIRTI),
Post Bag No.2273, Tumkur Road, Bangalore 560 0022
Tel. No.91-80-30534002, Fax No.91-80-28396361, E-mail: director@ipirti.gov.in

Theme: Community and Economic Development

Introduction

Bamboo cultivation and utilization have gone in parallel with the growth of human civilization. However, as newer utility materials were available, bamboo remained as a potential material for rural people especially with the poorer section of the society. Even during clear felling of forest, bamboo has been treated as unwanted weeds. However, scarcity of wood and search for wood alternative had rediscovered bamboo as a potential raw material for manufacture of all sorts of alternative wood based products. The preference for bamboo is due to its fast growth, short period of maturity, easy propagation, processing by simple hand tools into useful products, higher weight verses strength ratio and its availability all over India.

The multiple uses of bamboo integrate various socio-economic sectors of the society who are traditionally and currently associated with bamboo activity. Important sectors are Forest Department, farmers/growers/people associated with harvesting, artisans or preliminary processors, traders, industry, etc.

Traditional use pattern and employment opportunities

Bamboo is the most important non-timber renewable lignocellulosic product having wide range of applications such as fibre, food and woody material representing many commodities numbering over 1500 documented uses. Bamboo is particularly important to over 2 billion poor disadvantaged people living in Asia, Africa and Latin America. In Asia, it forms the backbone of every rural life, and will continue to do so due to increase in population. Recent findings conducted in India are reported to generate 15 jobs per hectare of bamboo grown, with virtually no capital investment. Among the traditional uses, following may be considered as most popular and important uses for bamboo.

Construction: Bamboo is widely used for housing, bridges, temporary shelters, scaffolding, and several similar applications as bamboo is very user-friendly material, it is naturally pre-finished and ready-to-use form. Bamboo can be directly utilized in most applications without pre-processing steps like debarking, sawing, planning, etc. required as in case of wood. Many houses in the developing bamboo rich countries are made entirely of bamboo, or use bamboo as the principal structural element. The concept of "growing one's own house" is common especially in Asia, where families typically grow and maintain adequate bamboo stocks, to meet the needs of maintaining housing requiring peoples' involvement and thereby generating employment opportunities for needy people. Use in housing involves engineering applications, but the potential extends to other structures due to the excellent tensile strength properties of bamboo.

Innovative Products from Bamboo as Wood Substitutes and Employment Opportunities:

In view of declining wood supplies, interest is growing in search of alternates for wood from renewable materials which are energy efficient and environment friendly and are biodegradable in nature. It is in this context that bamboo, which perhaps is the fastest growing plant (grass) species, emerges as a material of immense potential. Research and development activities carried out so far and the positive results obtained, it is clear that bamboo could provide a partial solution to a number of problems faced by the World at present day context. One of such problems being the near certainty of wood shortage in the near future due to conservation oriented management practices aimed at harvesting environmental services of natural forests. Thus, to have answer to the problem of wood shortage, a solution is needed comprising of following characteristics for its success.

- A product that can substitute wood in the widest range of uses and the production of those products should have positive environmental impact
- The product should be made in rural environment to assist in reducing the pressure on urbanization
- The pattern of production should be such that rural people/artisans/traditional bamboo weavers are not displaced by it and can participate meaningfully in the overall activity, particularly in respect of growing of bamboo and intermediate processing to meet the requirement of the industry.
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The first bamboo-based panel was developed in China in the 1940s. Since then, over 30 varieties of panel products have been developed. Among the technologies developed, only a few like composites based on bamboo mats and bamboo strips are produced on a commercial scale, where others are mostly based on limited laboratory experimentation and industrial scale testing. Bamboo based panels may be broadly classified into four groups:

- Bamboo culms converted into slivers, strips or lathes by cutting or flattening and further processed
- Culms peeled into veneers and further processed
- Culms converted into particles, fibres, wafers or strands and reconstituted

Combination of one or more of the above products among themselves or with other materials like wood, other lignocellulosic materials inorganic substances, etc and further processed.

Of the above types of boards, boards based on bamboo mats and bamboo strips have shown great promise in Indian context and in China as well. The bamboo mats technology developed at IPIRTI, India has been found to be an exemplary demonstration of Agenda 21 by an International Selection Commission and consequently registered as World Project at the Expo-2000, Hannover, Germany. Since then IPIRTI is pursuing R & D activities intensively and has developed following technologies by using bamboo as substitute for wood/building materials based on traditionally skilled tribal/rural people or artisans. Technologies which have already been commercialized or ready for commercialization are:

A. Bamboo Mat Based Products

1. Bamboo Mat Board [BMB]
2. Bamboo Mat Veneer Composites [BMVC]
3. Bamboo Mat Corrugated Sheet [BMCS]
4. Bamboo Mat High Density Panel
5. Bamboo Mat Moulded Skin Board (BMMSB)
6. Bamboo Mat Ridge Cap (BMRCS)

B Bamboo Strip Based Products

1. Bamboo Wood [Laminates]
2. Bamboo Flooring Tiles
3. High Density Transport Flooring

C. Bamboo in round/split/composite form

1. Bamboo Based Housing System
2. Bamboo Match Splint

Considering vast potential of the innovative industrial products having developed, preliminary survey was made to assess Socio-economic conditions as well as the problems encountered by the people involved in the preparation of basic raw material, mostly mats, availability of bamboo and other constraints faced by these people.

The technology developed based on bamboo mats are labour intensive and estimated employment opportunities based on production of various bamboo based composites developed as alternate to wood/panel products or building materials by IPIRTI estimated employment opportunities for various bamboo technologies developed and commercialized are given in Table-1.

Mat weaving is being traditionally done by bamboo artisans and so far this activity was limited to them. In case mats are consumed by industry, requirements of mats will be in thousands and hence is the employment generation.

For example, a bamboo mat board processing unit using a 10 daylight hot press can manufacture 1300 – 1400 board per day. Each board requires 3 mats. If both slivering and mat weaving is manual, one person can make one or at maximum one and a half a mat per day. Employment generation can consequently be evaluated.

Slivering by hand is a very slow process and productivity is very less and overhead comes to be high because the process is solely manual. Productivity can be changed if the slivering is done by machine. Both imported and indigenous slivering machines are available. Addition of slivering machine helps to increase the availability of the number of slivers for mat weaving which inturn would increase the mat production per day. It is to be highlighted here that although slivering machine is used for making the bamboo slivers, all the other activities like mat weaving and treatments if any are by manual process.

Table – 1

EMPLOYMENT OPPORTUNITIES FOR NEEDY PEOPLE IN MAT WEAVING FOR INDUSTRIAL PANEL PRODUCTS FROM BAMBOO, NAMELY BMB, BMVC & BMCS

No. of units proposed	50 Units for the production of BMB, BMVC & BMCS
No. of hot presses proposed for each unit	1 each for BMB & BMVC with 10 day-lights and 1 for BMCS with 6 day-lights
Production capacity per annum 3-shift basis	5,50,000 cum (1,75,000 BMB, 3,75,000 BMVC and 30 m.sq.m. BMCS eqlt.to 2% roofing sheets
Employment opportunities i) Mat weaving activity @ 2 mats/person/day ii) Skilled factory workers iii) Supervisor/managerial	 2,50,000 persons throughout year (75 million person days) 32,500 persons throughout year 4,500 persons throughout year
Quantity of wood replaced Reduction in use of roofing sheets based on hazardous/energy intensive materials	9,00,000 cum 1,12,500 tonnes

To have impact of technologies developed, a number of production units should be established in order to derive benefits. Keeping in view the raw material position in the country, skilled bamboo related works including mat weaving/handicrafts products, at least 50 units can be established in different parts of bamboo rich States.

Bamboo mat is the raw material for production of BMB, BMVC, BMCS, and BMMT. Survey (R Venkatasubaiah and Y.Narayana Chetty 1998) has revealed that one artisan can make one to two mat of 2.5 M x 1.25 M size per day. The artisans have also informed that if ready slivers are given, one artisan can produce five mats of same size per day. However, all mats produced, so far, in India is hand made in respect of sliver making as well as mat weaving. Based on the present production capacity of the mat weavers, the probable employment generation, bamboo requirement and factory product output. By establishing 50 such units in the country with full production, it is expected to produce huge quantity of panel products as alternate to wood panel products and other building materials such as bamboo mat corrugated sheets for roofing purpose by replacing traditional roofing sheets such as Asbestos Cement Corrugated Sheets (ACCS), Corrugated Galvanised Iron Sheets (CGIS), Corrugated Aluminium Sheets (CAC), Fibre Reinforced Plastic Sheets (FRPS) etc. which are based on scarce, energy intensive/hazardous materials of limited availability and non-renewable resources, with environment-friendly and people friendly material, the bamboo. The innovative products through value addition are also expected to generate huge employment opportunities for rural poor and in particular women involved in mat weaving activity. Details such as expected production of panels/roofing sheets, potential employment opportunities for skilled and unskilled people, estimated quantity of wood and traditional roofing sheets replaced, requirement of bamboo and finally returns to the entrepreneurs are given in **Table-2.**

Table – 2

ESTIMATED EMPLOYMENT OPPORTUNITIES FOR VARIOUS BAMBOO TECHNOLOGIES DEVELOPED AND COMMERCIALIZED BY IPIRTI

Sl. No.	Product	Employment In Person Days (Three Shift Basis) With One Hot Press, 10 Day Lights			
		Unskilled	Semiskilled	Skilled	Total
	Bamboo Mat Board(BMB)/Bamboo Mat Moulded skin board	6,00,000	180	20	6,00,200
	Bamboo Mat Veneer Composite(BMVC)	4,00,000	350	50	4,00,400
	Bamboo Mat Corrugated Sheet(BMCS)	3,00,000	120	20	3,00,140
	Bamboo Wood(Laminates)	-	400	30	430
	Bamboo Match Sticks	5,000	50	10	5,060

Status of Bamboo Artisans and Bamboo Related People

Survey made by Agriculture Finance Corporation, Mumbai in three states viz., Kerala, Maharastra, and Assam, reveals the present status of the community engaged in bamboo activity. **Table 3** gives data on the status of the community in three states.

Table 3

Case-Study on Socio-Economic conditions of Mat Weaving Communities under IDRC funded project at IPIRTI by 'AFC' – 1997 in Three States

(1:Kerala, II: Assam and III: Maharastra)

Sl.No.	Particulars	State Wise Inferences		
		I KERALA	II ASSAM	III MAHARASTRA
1	Household Category (%)			
	i) Landless	10	85	45
	ii) Marginal Farmer	0	05	55
	iii) Small Farmer	-	10	-
		-		
2.	Social Classification (%)			
	i) Scheduled Castes	20	50	75
	ii) Scheduled Tribes	-	-	25
	iii) Backward	20	50	-
	iv) Religion Minorities	60	-	-
3.	Family size	4	6	5
4.	Literacy (%)	67	32	44
5.	Employment Status (%) (Fully or Partially)	84	79	100
6.	Nature of Employment (%)			
	i) Mat Weaving	44	88	44
	ii) Cultivation	19	02	22
	iii) Agri.labour	-	06	20
	iv) Petty Business	12	02	01
	v) Others	25	02	13
7.	Types of houses owned (%)			
	i) Mud walled Thatch Roof	-	100	15
		-	-	85
	ii) Mud walled Tiled Roof	10	-	-
		0		
	iii) Pucca walls –tiled			
8.	Electricity connection (%)	10	-	35
		0		
9.	Sources of Drinking Water (%)			
	i) Community wells, rivers	10	70	100
		0	30	-
	ii) Wells in backyard	-		
10	Sources of Bamboo (%)			
	i) Cultivator	-	40	-
	ii) Agency	-	10	30
	iii) Market	10	50	30
	iv) Others [Pilferage]	0	-	40
		[KSBC]		
11	Frequency of procurement (%)			
.	i) Daily	10	-	-
	ii) Weekly	0	100	100

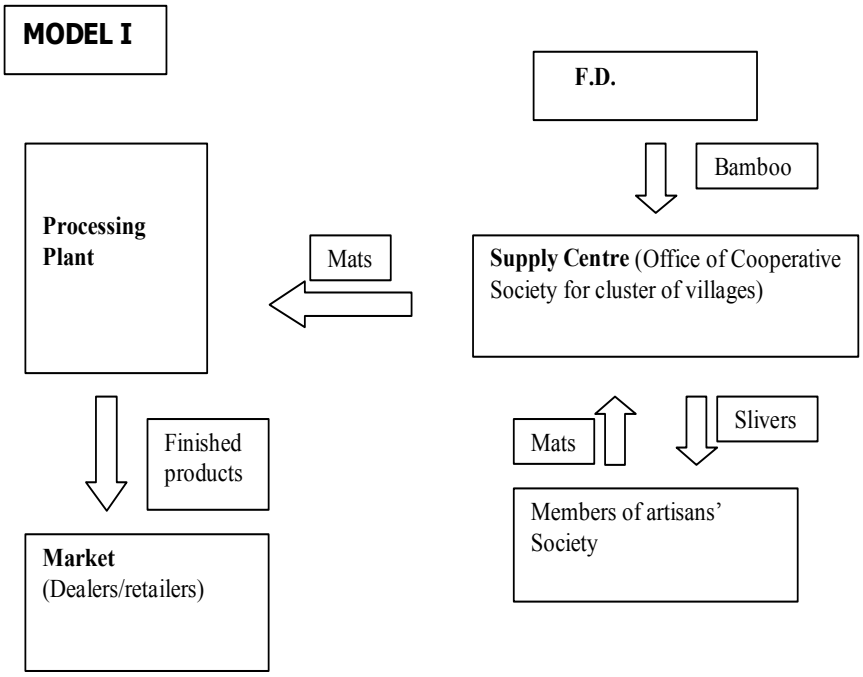
12	Price per Culm/Reed			
	i) Free	10	-	-
	ii) Rs.10-15	0[Loan]	05	100
	iii) Rs.20-25	-	95	-
		-		
13.	Weaving activity (%)			
	i) Throughout the year	10	100	50
	ii) 9 months/year	0	-	50
		-		
14.	Place weaving	Own Houses	Own Houses	Own Houses
15.	Weekly production of Mats/per household unit			
	i) Commercial Mats	40	40	20-30
	ii) Special Mats	20 -30	-	-
16.	Selling price of Mats [Rs./Sqm]	05	06	04
	i) Commercial Mats	10	10	14
	ii) Special Mats			
17.	Fund Borrowing and its source (%)	10	15	50
	i) Credit Basis	0	85	50
	ii) Money lenders/Traders	-		
18.	Adequacy of Returns (%)			
	i) Adequate	25	25	25
	ii) Inadequate	75	75	75
19.	Training in Mat Weaving (%)	25	-	-
	i) Traditional skills & Training	75	100	100
	ii) Only Traditional skills			
20.	Problems of Weavers			
	i) Non-availability of Bamboo	NA	True	True
	ii) Non-availability of cheap working capital	NA	True	True
	iii) Poor returns	NA	True	True

The study clearly established that bamboo related work of artisans is not remunerative and the family has to search alternative source of income for livelihood. What is more important is that the young generation are not interested in the old generation activities and are in a mode to switchover to other profession unless they are bounded to involve in bamboo related activity for livelihood.

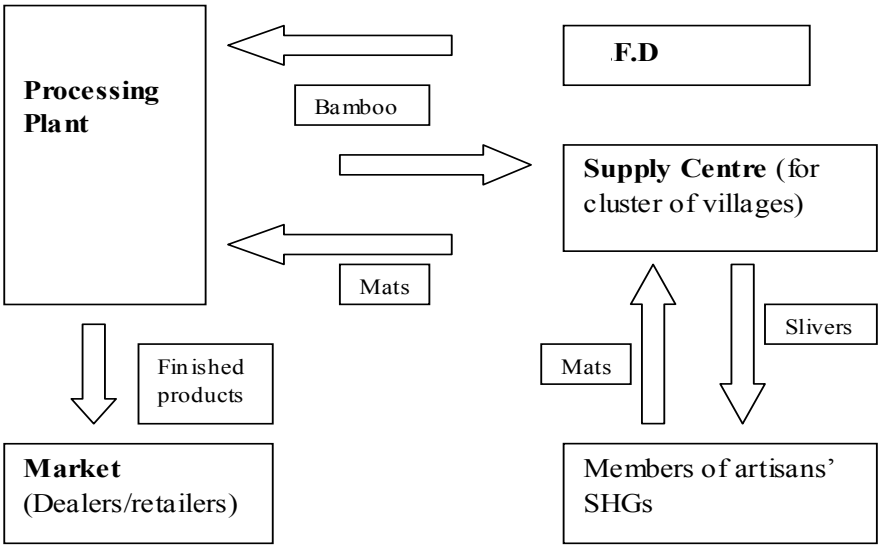
Artisans Involvement in Industrial Processing of Bamboo

Artisans, who are at present involved in bamboo related activities, may well be engaged in mat-weaving and strip-making for industry. IPIRTI has evolved two models to involve the artisans in such activities.

Models for Project Implementation



MODEL II



Value Addition Through Industrial Processing

The major interest on the part of the nation is to produce wood alternative from bamboo to meet the need of the society to save natural forest, preserve balanced ecosystem and protect environment. But the production of wood substitute from bamboo is purely a commercial activity and if

the cost/benefit ratio is not positive, no industrialist or entrepreneur will involve into it. Commercial production of the bamboo based technology developed at IPIRTI has been initiated and based on cost of production and market value of the product, the cost/benefit ratio of these products have been calculated. **Table 4** gives the cost/ benefit ratio of the product.

Table 4

B/C Ratio for various Bamboo Based Products

Assuming the industry achieve 100% production in 5 years the B/C ratio is as given below:

Sl. No.	**Product**	**Production per annum**	**Production cost Rs. In million**	**Sale price Rs. In million**	**B/C Ratio**
1.	BMB	378000 Nos. 2.44M x 1.22M x 4mm @ Rs.420/- per board	158.76	175.13	1.10
2.	BMVC	216000 Nos 2.44M x1.22M X 12mm @ Rs.640/- per board	138.24	193.53	1.45
3.	BMCS	216000 Nos. @850- per Board	1213	1365	1.15
4.	BMT	30000 per annum	1. 05	1.50	1.4
5.	BMS	29.1 m boxes	8.73	13.1	1.5
6.	BMMSB	120000 skin @2150 per board	1934	2511	1.30

Poverty Alleviation through Bamboo Activity

It is well established that mat weaving by the artisans is not remunerative. Poverty alleviation through mat weaving is possible if it is remunerative which would otherwise make the activity attractive. It will be necessary to make the work process more technically challenging through mechanization of the process. This would enhance productivity per worker and enhance wage rate. It is also necessary to educate the bamboo worker about the Bamboo Mission in the country and make them a part of the whole process through workers – NGO, Workers-Industry-Corporative. The young generation who are gradually going away from traditional bamboo activity, can be made to involve in mat weaving activity, only if their activity can be regarded as a prestigious occupation at per with other industrial activity and simultaneously becomes remunerative.

Govt. Policy for Development of Bamboo Sector

The bamboo sector in most other countries is still a part of the informal and backward rural economy. There has been an inability to grab the large potential, which has been successfully demonstrated by the Chinese bamboo industry. This raises the question of the bottlenecks facing bamboo development. Many of these inhibiting factors are at the policy level and are additional to a lack of knowledge among the important stakeholders and a widespread stigma of bamboo as a poor man's timber.

Bamboo is not a priority item of the Forest Department and no special care/policy is being evolved for growing and harvesting of bamboo in the forest. Major revenue earning from bamboo by Forest Department is by supplying to paper and rayon industry which consumes at least 45%

of the total bamboo produced in the country (About 4.5 million tones per annum). Although bamboo crafts generate about 240 million workdays and income about Rs.13 billion per year, Government revenue earning is poor from this sector. Providing bamboo to artisans directly by Forest Dept has not become feasible due to (i) Cost of extraction of each bamboo by Forest Dept. is about Rs.15/- to Rs.17/- , a price not acceptable to artisans, (ii) Total consumption of bamboo in a locality by artisans are very low, (iii) In many states, 4 years or more aged bamboo is only permitted to be felled; but the artisans require tender bamboo of 2-3 years old for many products produced by them. Even during clear felling of forest, bamboo was treated as unwanted weeds .

As on today, all institution/organization, Government departments related directly or indirectly with forest, have to focus their attention towards bamboo as wood alternative.

Conclusion:

This natural resource has played a major role in the livelihood of rural people and in rural industry, especially in tropical regions. Over 2.2 billion people the world over are dependent on bamboo and its related industries for income, food, and housing. Although the rural communities have traditionally been using bamboo, the utilization has been highly localized as bamboo has often been viewed as an inferior substitute of timber. For example, although over 1 billion people in the world live in bamboo houses, yet there has been little effort to build such houses commercially. Consumption or utilization has therefore been direct and restricted to poorer people with low income and low purchasing power. Market linkage has as a consequence been weak or non-existent in most countries.

Country like India confronted with rural poverty and depleting forest resources, offers a sustainable option with considerable potential. However it will require joint effort by the international donor community , research institute, national government and pioneer investors to attract entrepreneur in the bamboo related activities and turn the belief that the bamboo may become the eco-friendly wood alternative of the 21st century in to a reality, besides its contribution to broaden environmental goal i.e. control of erosion of soil, reforestation and watershed management. It also provokes the acceptance of new generation ecofriendly materials world wide. Value added products can be produced as well as consumed - both in domestic and export markets. The setting up of bamboo based industry will save forest and create huge employment generation.

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