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RESEARCH ARTICLE

Possibilities of standardizing the solid bamboo furniture making in India

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Abstract: Design is a key component for bamboo sector development in India. Last two decades various designers had explored the potential possibilities of using solid bamboo species from India for making furniture. *Dendrocalamus stocksii, Thyrsostachys oliveri* and *Dendrocalamus strictus* are some of the commonly used bamboo species found in India, which are solid in most of the cases. These three are growing in various regions in India, cultivated by farmers and is available in good quantities. Looking at the market potential, we have explored the design application of these species, especially for making furniture. In the process of designing and experimenting, we have developed possibilities of material standardization, various standard formats of joints, standard process of making, finishing combination with other material etc. which can create wide range of furniture. This approach can help in bringing the quality of standard and sustainability aspect looking at the market potentially. This process can be followed by both industrial and semi-industrial furniture manufacturing sectors in the country. Also this can build an identity for the Indian bamboo furniture compared to other industrial process using bamboo composites by other countries. This approach can change the bamboo furniture making scenario in India and can establish a good economic model 'from plantation to the consumer'.

Keywords: bamboo, design, furniture, standardization, species

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Introduction

Bamboo is one of the best natural materials available for various uses from small products to furniture and the construction of houses. It is truly a sustainable – eco-friendly renewable natural resource and one of the fastest growing plants. Various species of bamboos are found at different parts of Indian sub-continent and used locally for various purposes. Most of these uses are in the form of baskets, houses, bridges, and various products for local needs. In the contemporary context, the last two decades bamboo-based activities have been showing tremendous growth, in terms of its availability and the usages. The utility of bamboo by the consumers has also increased with innovation of new applications which is introduced by various institutions, designers, entrepreneurs etc. Various efforts, such as plantation, design training, technological intervention etc., are introduced to uplift the bamboo clusters in India, looking at the market potential of this material.

The bamboo furniture making sector in India, we can observe there are various approaches followed. It is based on various kinds of bamboo material, like hollow type, solid type, or using various composites. Traditionally for many years artisans are following the method of making hollow bamboo furniture which are very strong, heavy, and non-dismantlable type. These are difficult to transport and in handling. Another approach which is using solid bamboo which

which is established around two decades back. Even though it is fixed type, comparatively this is lighter in weight and easy to handle. However, the packaging and transportation issues are still there. In both the above cases the scalability is an issue, and this cannot meet the market demand. Some of the industries in India have been trying to establish making furniture using bamboo composites. However, this method is still needed to establish the demand and supply. The Indian furniture market is very huge, and the bamboo furniture can find a good place in it if we address the potential areas in a strategic manner. We need to look at the species, design approach and the technology aspect to scale up the production.

As a furniture designer I have been investigating and experimenting many approaches in making solid bamboo furniture for about last two decades. Some of these has been introduced to the artisans in the filed through various training programs. These experiences and feedbacks from industrial sectors have encouraged me to think about a new system that can help in scaling up the bamboo furniture production with a standardized method to address larger potential of the market.

The raw material

There are various solid or partially solid bamboo species found in India. The partially solid portion of the bamboo has a very thick wall and is also suitable for utilizing in the making of furniture. After experimenting by making furniture products, the raw material that is used is *Dendrocalamus stocksii* (Fig. 1a & b) which is naturally distributed in Central Western Ghats of India. It has medium sized, and strong culms. Though the natural distribution of this species is in humid tropics with lateritic soil type, this species has a wide adaptability and comes up well in tropical humid, sub humid and semi-arid conditions under black and red soils as well.

Fig. 1. *Dendrocalamus stocksii* from Pune (A); Western ghats Region (B)

It is the most preferred species by the farmers in Peninsular India. *D. stocksii* is considered as an important agroforestry species, ideal for plantations in watershed and coastal regions. It is planted as a component in home gardens or as pure block plantations. This is an extremely manageable species with great economic and ecological importance as well as large scale utilization potential. This species is a preferred one among bamboo users because of its non-thorny nature, loosely spaced culms which facilitates easy management. Because of its inherent properties as a solid bamboo, it can be bent to form a curve/arc by applying heat and pressure on the poles. This is one of the important properties when we consider it for making furniture products. Similarly, since it is solid in nature joining it with various joints like timber is also an added advantage. Sometimes the above portion of the culms will be hollow which can be utilized for various applications. The raw material from various region appears in change in the diameter which also helps in using various components of furniture. This can be one of the species that can be used in larger scale as an industrial raw material for furniture making.

The design approach

The approach is derived from observing the market needs and the potential of solid bamboo species which is not yet explored at its best possible ways. The Indian bamboo furniture sector is lacking the approach of component-based production system and knockdown joints that define the scalability in an industrial scenario. The current systems of bamboo furniture manufacturing is by using hand tools and semi-mechanized method does not support scalability in terms of numbers. This is due to the current approach in design and construction method that has been practiced so far. We require the knock-down and flat pack systems, which are the market trends, that helps in easy production, transport, and

Fig 2. Raw material, *D. stocksii, o*f various diameter from 60 to 20 mm (approx.) in natural form

handling for both retailers and customers. So, the challenge challenge here is establishing a proper standardized method of raw material processing, joinery systems that can be adaptable for both small scale and large-scale furniture making sector. This approach can be partially adapted by hand made sector, semi-mechanized sector, and the industrial sector.

Standardization of poles

Currently large-scale furniture manufacturers are utilizing only standardized raw materials for their production of furniture. However, solid bamboo comes in various sizes, diameter etc. in its natural form. So, creating standardized raw material of solid bamboo in its natural form is the key challenge.

Standardizing certain length, diameter etc., according to the availability can create a system in utilizing this raw material for a methodical production. This study is done on the bamboo from various locations where it has been cultivated, which established the dimension of this species and can be standardized for furniture making.

Based on the experiments, several *D. stocksii* samples are collected to check the available diameter and finalize the standardized rods (Fig. 2). It is found that the maximum diameter at the bottom of the pole available is 60mm (+/-) approx. which are mostly solid. Then the variation in up to around 20 mm. Fig. 3 presents the different diameter class of *D. stocksii* available. Based on these, following dimensions are finalized as the standard diameter rods that are suitable for making various furniture, in combinations. The diameter can be standardized to 20mm, 25 mm, 30mm, 35mm and 40 mm in its diameter (Fig.3 & 4). This can be achieved through

Fig 3. Various standard diameter achievable from *D. stocksii*

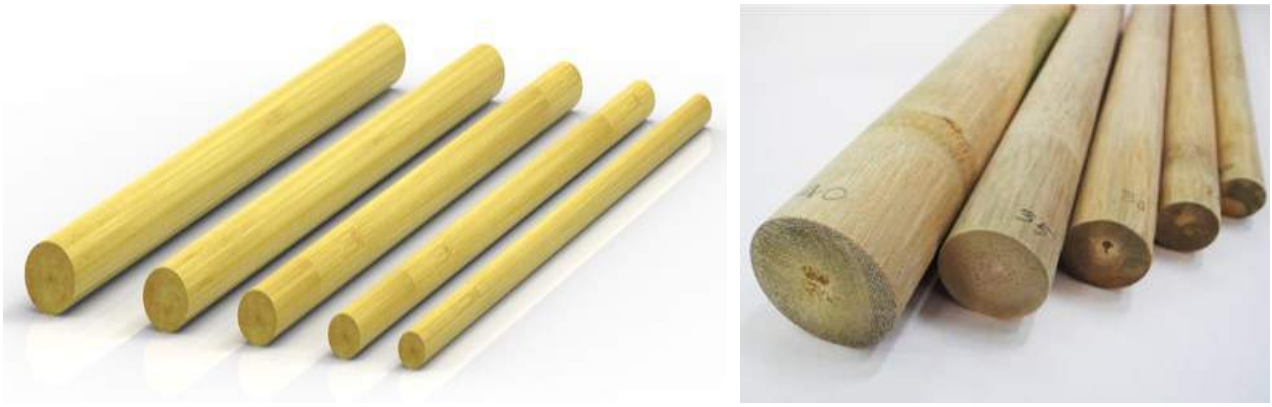

Fig.4. Samples of standardized poles prepared as part of experiment

mechanical processes with currently available technologies.

Standardization of joints

The second part of the challenge is the development of standardized joints for fixed and knockdown furniture making. After doing the research of existing joints and testing I have established several bamboos to bamboo joining methods for the previously mentioned standardized solid bamboo poles using currently available equipment. This can be refined, and a new set of machines could be introduced for an appropriate production method. Along with connectors it will be helpful for creating any types of furniture structure using the standardized poles of solid bamboo. This can be achieved with simple mechanized process existing in the furniture manufacturing sector with necessary modifications. Based on this, number of test joints were created to understand the viability of it with fitting to each other with various diameter of poles (Fig.5). Based on this a size versus joinery proportions was created as a reference point for designers and manufacturers (Fig.6).

Fig 5. Sample joints made as part of the experiments with various sizes of poles

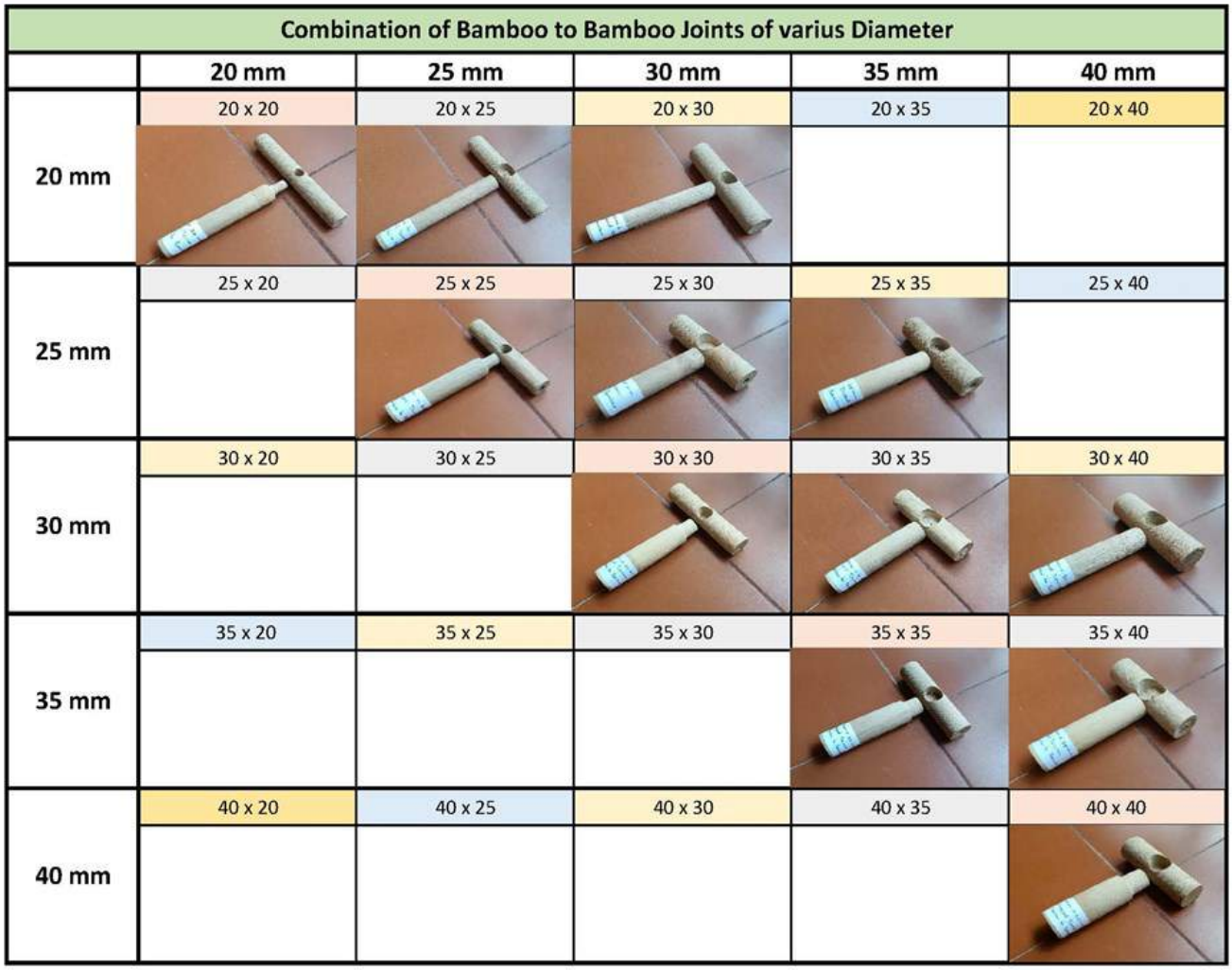

Fig 6. Size Reference Chart describing the various possible combinations of standardized solid bamboo rods

Metal connectors

Along with these I was also looking into developing a few standardized steel connectors (Fig.7) to enable the production and assembly faster as well as strength. We can create many furniture using only bamboo to bamboo joints; however, this limits the further possible in design direction to expand the collections. The combination of these joints and connectors will be helpful for creating any types of furniture structure using the standardized poles of solid bamboo. Altogether this will enhance the capacity of production, flat pack, transportation, the assembly and dismantling.

With this basic construction method was derived to experiment the viability. The construction of a simple frame structure is described with the 3D images below here (Fig.8) to understand the basic method. This defines a particular way of processing raw material to components and the assembly method. This can be a scalable method to be used in a larger bamboo-based unit and will also bring the cost of production more affordable to the customers.

Examples of furniture

I have been associated with the Centre for Bamboo Initiatives of National Institute of Design since the past 20 years. During this period, I designed many solid bamboo furniture as part of various projects and development. Initially most of the furniture were fixed type rather than knockdown type. Gradually the concepts of knockdown joints were tried out using various bamboos to bamboo joints and metal connectors along with hardware. Now

Fig 7. The exploration of metal connectors in various forms and junctions

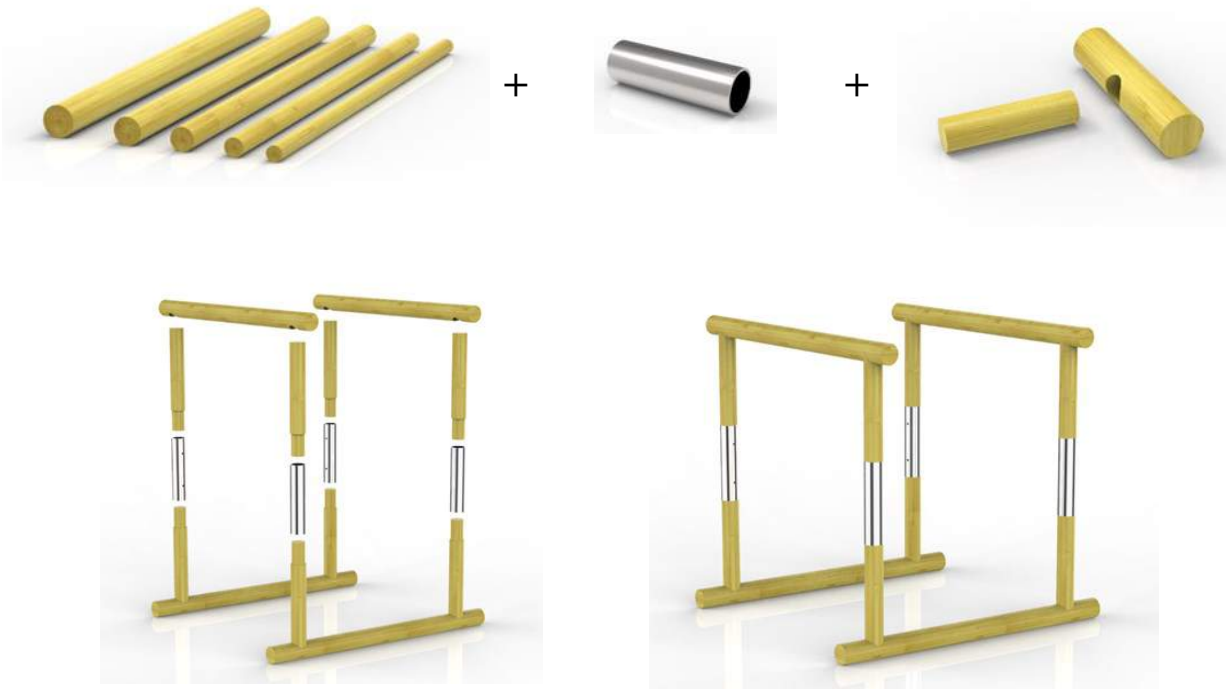

Fig 8. Basic frame construction using the joint & connector with solid bamboo pole

with the new approach of standardized solid bamboo poles and joints I have tried making various combinations for prototyping furniture (Fig.9). This demonstrates the potential direction for generating more designs for all categories of residential, office, partition, school furniture etc.

This approach is mostly to create the furniture structure. However, various other materials like bamboo boards, glass, canvas, upholsteries, etc. (Fig.10a & 10b), can be used appropriately along with this for the surfaces.

Standardization of production process

Based on the above experiments and findings a system of production method can be created to understand it well to maintain the quality aspects of the furniture (Fig.11). In the system these existing methods and new methods are suggested with available and modified technologies. Some of the process can be completed near the harvesting place itself to make sure the material is transported without much insect attack on it. This will reduce the risk in long term storing and using the material

Fig 9. A test prototype of center table, created using the standardized method of construction

Fig 10a. Prototype of a office table using the bamboo structure with steel connector and bamboo laminated board ad the top surface

Fig 10b. Various prefabricated components of the office table constructed as per the standardized systems created as part of the research.

in an industry or warehouse. Most of the other process are using the basic machines and tooling that is required to standardize the pole dimension and joints like round tenon and fastener bits etc. Bamboo being a harder and fibrous material it required good hard and sharp tools compare to timber. Even though we are using similar machines which is used in woodwork it requires some modification of tools and fixture that helps working with bamboo. The work process flow chart is given below for the ready reference to understand the standardized methods in various stages.

Market Potential

Connecting this development to market is also very important. Currently domestic and international market is looking for bamboo furniture for various segments which could be scalable to an industrial level production. The furniture should be affordable to the larger section of the consumers, simple, strong as well as help in easy production and transport. This will open the potential of bamboo furniture market supporting large scale farming of similar species, processing and will create more job opportunities. Several technology developments are

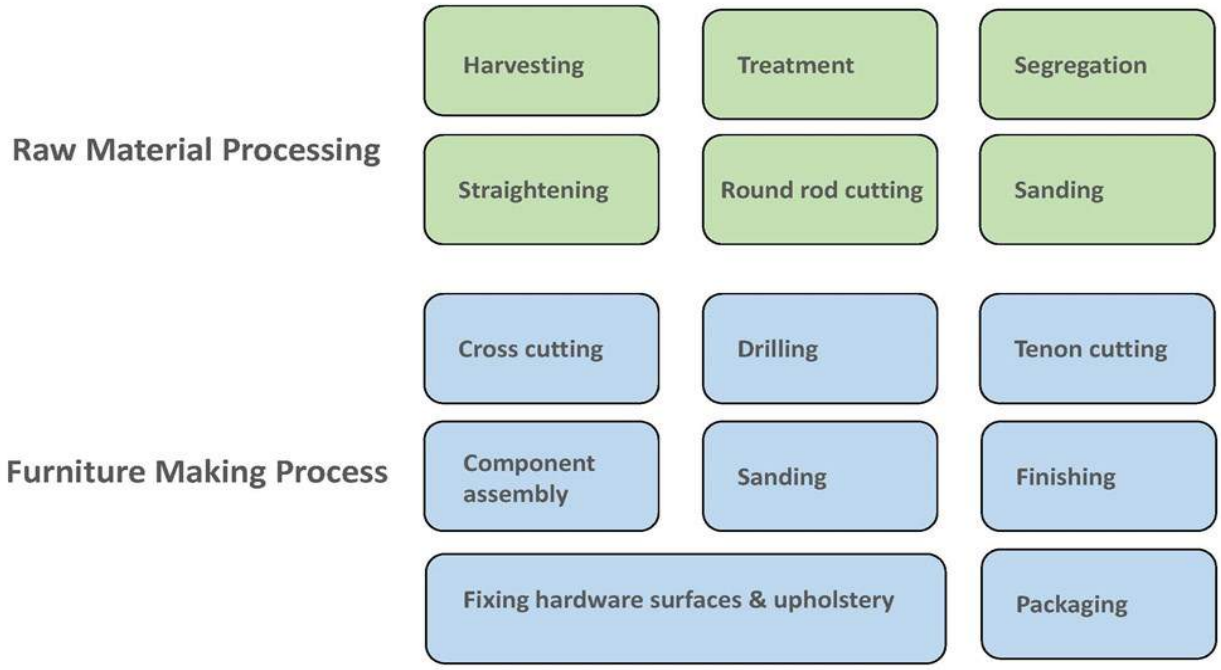

Fig 11. Standard process flow chart for making the solid bamboo furniture from raw material to the product packaging

required apart from the current technologies to create a smooth production line. However, this will be one of the way Indian furniture sectors can shape up with using local bamboo species. The current manufacturers and entrepreneurs can adapt this method with their current set up adding few more processes. Large furniture retailers in domestic and international market can look at this as an opportunity to look at India in producing bamboo furniture in large scale.

Conclusion

The above development shows an opportunity for Indian market to scale up for bamboo furniture manufacturing, which is achievable in near future. However, the efforts need to be put in creating an ecosystem from farming to processing to production. This needs to be established in specific to the requirement of above methodologies and can ease the entire process. I am still in the process of validating my development with a greater number of products and furniture for various uses. Simultaneously my students are also using this method in developing their new furniture systems in various projects. A proper bamboo furniture manufacturing standard can be established through this development which will guide students, entrepreneurs and manufacturers for development of furniture.

This system also has an opening to combine the traditional woven baskets and trays for making sustainable furniture for retail space. This will help in reducing the non-eco-friendly material used in a retail environment. I have developed few models for such applications which is also scalable and at the same time provides rural employment in villages. Through these we can drive the market to use more sustainable material and replace the other materials.

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