Theme 3: Economy /

3.3 Business & Innovation - Product Development – Design

Name of the Author: *Susanth C S*

Name of the Institute: *National Institute of Design, Bangalore, India*

Position: *Senior Faculty, Head – Centre for Bamboo Initiatives*

Email: *cssusanth@nid.edu*, Mobile No: *+91 9449831450*

Address: *National Institute of Design, HMT Link Road, off Tumkur Road, Bangalore, India*

An Approach for Designing Solid Bamboo Furniture

Abstract:

Bamboo is the most sustainable – ecofriendly - renewable natural resource used for various purposes. It is used to make small products, furniture and to construct houses and structures. This material has been used by human beings from everywhere in the world in various forms. In India many species of bamboos have been used by various communities for different purposes. During the last two decades' bamboo based activities has shown tremendous growth in India. The consumer utilization of bamboo has also been increased due to innovation of new applications introduced by designers and various institutions. Explorations and experiment done at NID Centre for Bamboo Initiative using different bamboo species have contributed much to the Indian bamboo sector. Being part of this Centre at NID for many years I have been exploring the utilization of solid bamboo species for application in furniture products. Solid bamboo species like *T. olivery and D. stocksii* are some of the bamboo materials used by me in these explorations. In the process of developing new furniture I have developed many joints and fixtures to be used with solid bamboo for making knockdown furniture. Even though many other entrepreneurs and designers where involved in making of solid bamboo furniture, the system developed at NID stood very different and prominent among them. Initial designs developed at NID were either fixed or interlocking type, which had many limitations in terms of production and transportation. Later various hardware was used in making knock down type of furniture. However, the large scale production was difficult in such type of designs. This lead me to develop many metal based fixtures which made production and assembly of bamboo furniture faster and easier. This paper describes the approach and system I had created in making solid bamboo furniture in India

Key Words:

Solid bamboo, furniture, design, innovation, joints, knockdown, system, economy, sustainable, eco-friendly, renewable, production and transportation

Introduction:

Bamboo is one of the fastest growing plant, whether it is called as green gold, giant grass or woody grass it is one of the amazing raw materials to explore in various ways and means for all kinds of applications. Conversion of bamboo to various sizes of splits and its pliability to weave and construct structure etc. makes this material very special among other natural materials. Similarly, many of the special properties of bamboo helps to create various products for day to day life. Worldwide designers and artists are using this material creatively in various applications and installations. Even though different bamboo species are growing in every part of India, the North-Eastern part of the country houses the maximum number of species. The traditional communities in those areas utilized the bamboo at its best. The book published by National Institute of Design (NID) named Bamboo and Cane Crafts of North East India describes the best innovation and uses of bamboo documented by *M P Ranjan, Neelam Iyer and Ganshyam Pandya.* Traditionally bamboo has been utilized in India for making houses, products, tools, equipment and also as weapons. It has been used as one of the best construction material for making houses and other structures like bridges etc. In the north eastern India one of most advance tribes called *Apa-Tani* Tribe had practiced systematic plantation and use of bamboo since many centuries. That shows the potential possibilities of this wonderful material which also can be easily adapted in this modern time.

Bamboo is the best material to substitute many applications of wood, steel, plastic etc. The continuous decline of forest resource in India, which is effecting the wood based furniture industry can certainly look into bamboo as one of the best substitute. There are many successful examples found from various parts of the world to support the above statement, especially from China. However, this has to be looked in to the Indian context with available Indian bamboo species. Any such development in the bamboo sector is deeply connected to the available species. Any application of bamboo should be developed based on the properties of selected species. This is one of the important factor that National Institute of Design has been following since many years. This method has been evolved from the traditional way of looking at various bamboo species for different uses. For example, some species are good for construction of houses, some are good for weaving baskets and some are good for weapons etc. This same methodology can be followed in today's scenario also.

After doing many experiments and exploration to make furniture using various bamboo species, the designers have observed that the solid bamboos found in the country are very much suitable for making furniture. Many designers and entrepreneurs in India who had tried making furniture using

solid bamboo had developed their own methods and systems. At NID many furniture have been designed by faculty members and designers and worked out many methods including joinery systems and tooling etc. At the later stage some of the explorations done by me using steel connectors and fixtures created a new direction in making furniture. This system can be adopted for making furniture using any of the solid bamboo species in the world. The solid bamboo species taken at NID by me for product development especially for making furniture has been explained in this paper along with examples at the later chapters

NID Centre for Bamboo Initiatives

NID's Centre for Bamboo Initiatives (CFBI) has been set up for various activities related to Bamboo based research, design and technical development and training. The Centre acts as a platform for institute's faculty members, students and designers to experiment and innovate new product application to build new resources for the bamboo sector in India and abroad. Product development, new joineries, finishes, introduction of new tools and equipment, curriculum and institution building are some of the major activities undertaken at this Centre. The Centre had initially established at NID Ahmedabad with various projects and activities and contributed to the bamboo sector at various levels. The activities included innovation for traditional bamboo sector as well as for industrial sector. Later in 2010 the bamboo Centre have established its activities in NID Bangalore campus (figure – 01) and started many activities to promote bamboo as material for day to day life under my leadership. The Centre is also a good place to learn about bamboo and its various processes to make products and furniture.

Figure – 01 – a view of NID Centre for Bamboo Initiative at Bangalore, India

The Selected Solid Bamboo Species - *Dendrocalamus stocksii*

D. stocksii is naturally distributed in Central Western Ghats. It has medium sized, stout solid (Figure – 02) 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. 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 of 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 preferred most among bamboo users because of its non-thorny nature, loosely spaced culms which facilitates easy management (S.Viswanath, Geeta Joshi, P.V.Somashekar, Ajay D. Rane, Sowmya. C and S.C.Joshi 2012)

Figure – 02 – cross section of D. stocksii

Figure – 03 – heat bending of solid bamboo

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 (Figure – 03). This is one of the important property when we consider it for making furniture. Similarly, since it is solid in nature joining it with various joints like timber is also an added advantage. Sometimes the top portion of the culms will be hollow which also can be utilized for various applications. Since this species is easy to cultivate and manage to produce quality raw material, it can be one of the species can be used in mass scale as an industrial raw material for furniture making. Because of these reasons, I have selected this as one of the species for exploration and innovation of bamboo furniture. *Thyrsostachys oliveri* and *Dendrocalamus* strictus are the other solid bamboo species found in India and used by many other designers and at NID. These three bamboo species are cultivated in farm lands and available for commercial purposes including furniture making.

Approach in Design of Bamboo Furniture

At NID I have used various design approaches for developing bamboo based products and furniture, such as species specific, market specific, user specific, regional specific and sector specific. Out of these in this paper I am explaining about species specific product development carried out at NID by me which may be more appropriate to be done in India for bamboo based furniture sector.

As a solid bamboo *D. stocksii* is one of the best bamboo material for making furniture products in India. Because of its solid nature it is easy to construct a structure using simple joints similar to a timber. Looking at this possibility NID has explored various joints and examined the potential application of these in making furniture. Along with bamboo we have also explored other materials as combination to create joints for making it folding or knockdown. These experiments had increased the potential usage of this bamboo to make it knockdown furniture which are the core share holder of furniture market. The Indian furniture market is very huge which currently import a huge quantity of furniture from other countries which are more in knockdown nature. Thus the experiments done at NID are very relevant to the current market scenario not only in India but also in other countries looking at the modern lifestyle.

Figure – 04 – bamboo table design with using metal connectors designed during 2012-13

In India bamboo being a traditional material and currently used mostly for handicrafts making, the perception about the material is very different. The consumer in India has not been much aware of the potential of furniture application of bamboo. The modern material like steel, plastic and various forms of wood have already created a good impression in the furniture market with various styles according

the taste of customers. Thus it is important that the bamboo also has to be explored at its best to create furniture for modern life to compete with the current market scenario.

I have identified some of the other market potentials like, furniture for education sector, retail sector, hospitality sector, public furniture etc. are some of the important area where the requirements are in huge quantity. These will also bring good awareness about the use of bamboo and will increase the confidence among the users about its strength and other various aspects. This will also help to align the thinking of customer along with bamboo as a raw material for day to day life.

The Design Process Followed at NID

The process of designing a bamboo furniture starts with some of the key considerations mentioned below:

- The design could be for making in an Industrial / semi industrial / handmade set-up
- The design should be suitable for available / selected species
- The design should have a utility / lifestyle value as per the focused market segment
- It should be considered for easy adaptation by manufacturer for production
- It should be considered about available tools / technology with the manufacturer
- It should be considered for easy transport / knockdown type / foldable

The designer also has to know about the raw material, how to use it, tools and technology available which actually shape up the ideas and detailing of furniture designed (figure – 05)

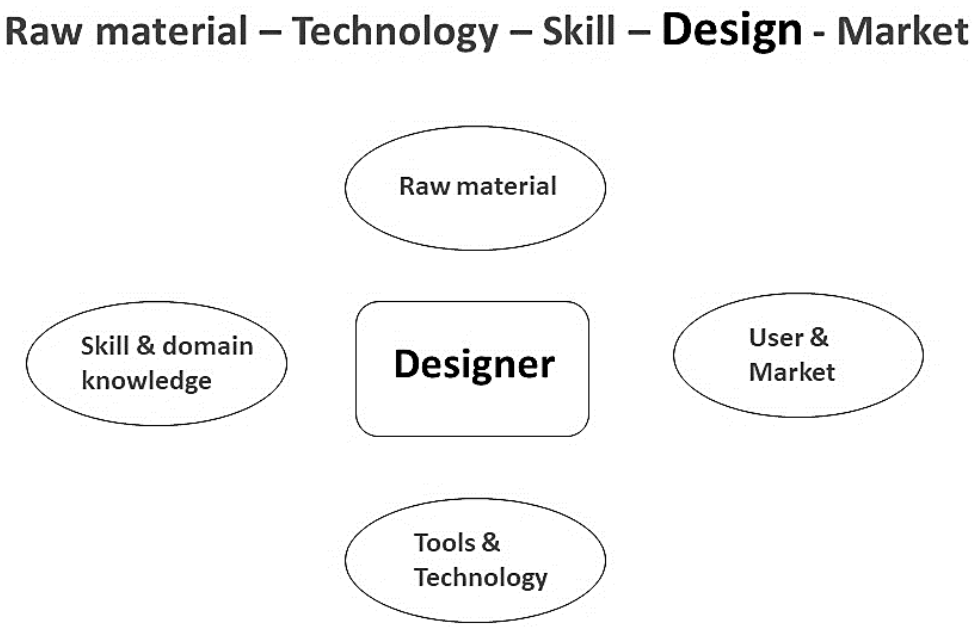

Figure – 05 – diagram of the knowledge base needed by a designer do develop bamboo furniture

Once the above knowledge is gained a lot many experiments and explorations need to be done while development of concept to perfect the structural and aesthetics of new furniture. Since there are no proper technical guidelines and many of the details and structural exploration has to be developed through trial and error methods, which eventually helps to develop a proper guideline for a particular species for product development. By doing such kind of practical material research, NID has developed a good knowledge base on this part which is usually imparted to other designers, manufacturers and artisans through various training programmes and workshops. Some of these knowledge also has been documented in a form of booklets and manuals for a particular user group.

The following given chart (figure – 06) is a typical design process followed by a designer or a design team at NID in bamboo product development, which is quiet common in the design community

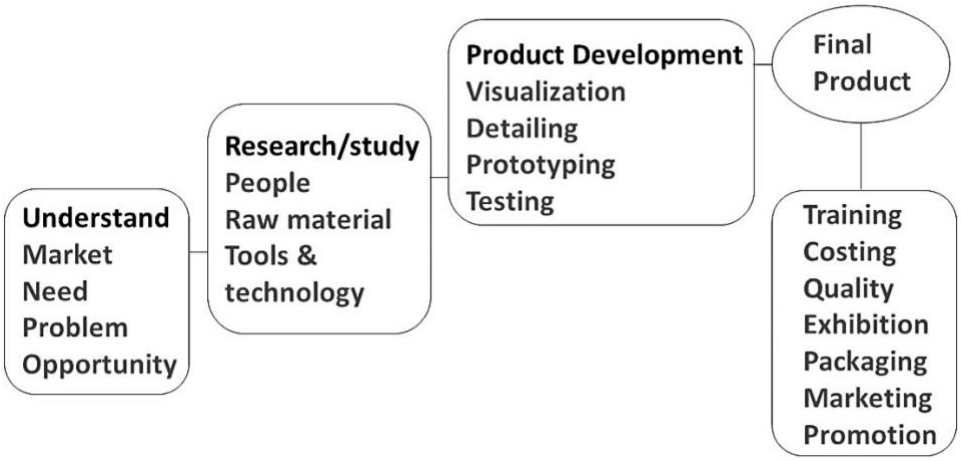

Figure – 06 – diagram shows a typical process followed for designing a bamboo furniture

Sometimes many new techniques, process, joints or details are developed in the process of new product design. For example, most of the knockdown joints are developed during the critical stages of product development while the designer is stuck in a particular situation. Which may be due to the limitation of material or technology or may be a user need. For example, the steel joints used in some of the bamboo furniture and rocking horse came as a solution for a problem appeared in the process of its development (figure – 07)

Figure – 07 – 3 stages of product improvement in terms of design and technical aspects

In the above example (figure – 07) of rocker one can notice the changes occurred in the process of product development. The first one is not knockdown type. In the second it is knockdown but metal pipe bent was an issue for some of the craftsmen to produce it. In the third stage it is knockdown type and there is no metal bent used.

The Design System, Metal Connectors and Joints

The final design has been prepared after many experiments and exploration done which satisfy the property of material, techniques, technology, production requirements, market, user etc. Here each of the joints and connectors have played a big role. If we take the example of children rocker the following are the system level approach in producing components and its assembly (figure – 08, 09).

Figure – 08 – the components and the assembly of the rocker

Figure – 09 – the components with metal pipe bent and without bent

This is one of the direction I have taken at NID Bamboo Centre as potential way of making knockdown bamboo furniture which can be produced easily, easy assembly, knockdown and transportation etc. embedded in the system. There are few more examples (figure – 10) also shown here with this article. The entire range of residential, educational, commercial and office furniture systems can be developed using such methods. It has been also tested in the field (figure – 09) with artisans for their consent and comfort in production with minimum infrastructure at various locations

in India. This can be one of the indigenous method of making furniture in India with solid types bamboo is available in huge quantity through a proper farming, harvesting, processing, production techniques etc. The field test (figure – 10) also shows the viability and acceptability of these furniture production method can be adapted well in all places. It also does not require heavy technology and equipment. The skill also can be learnt easily through small trainings modules with proper guidelines to achieve quality.

Figure – 10 – the images of field training with new metal connector system

Figure – 11 – the Design of table and seat in solid bamboo with metal connectors

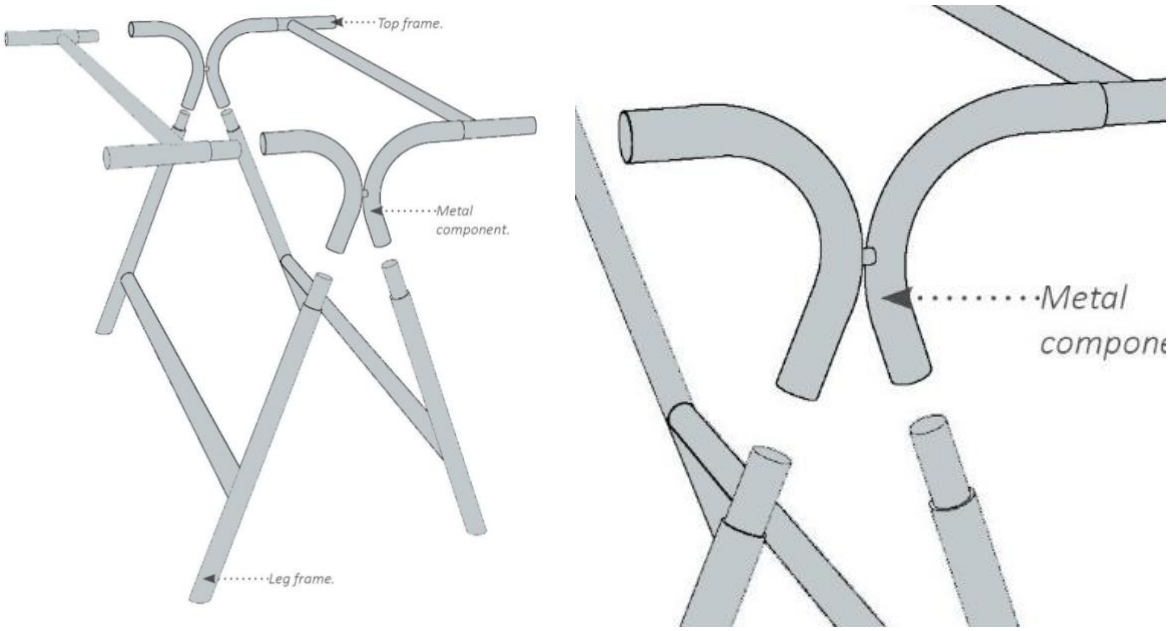

Figure – 12 – the diagram shows the joinery and connector system

Figure – 13 – the design of table in solid bamboo with metal connectors

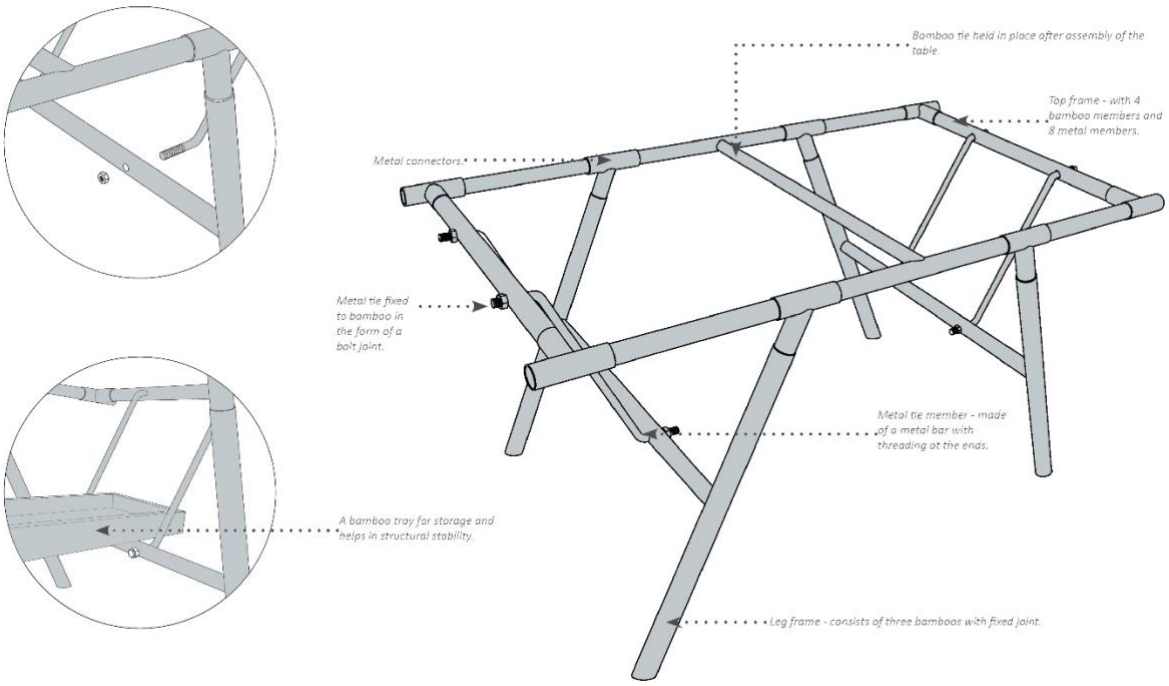

Figure – 14 – the diagram shows the joinery and connector system of table

Figure – 15 – the Design of Sofa in solid bamboo with metal connectors

Other Methods of Joints

Apart from using metal pipe joints NID designers and me had developed various systems of joints and construction methods for making furniture using hardware. These methods also are very much adaptable and helpful to make knockdown furniture in small scale or large scale production. These have also been tested and evaluated with artisans in the field workshops at various locations in India. The tools and technology, jigs and proper specification drawings and guidelines will allow them to follow the proper process to maintain quality.

Figure – 16 – The design of various bamboo furniture

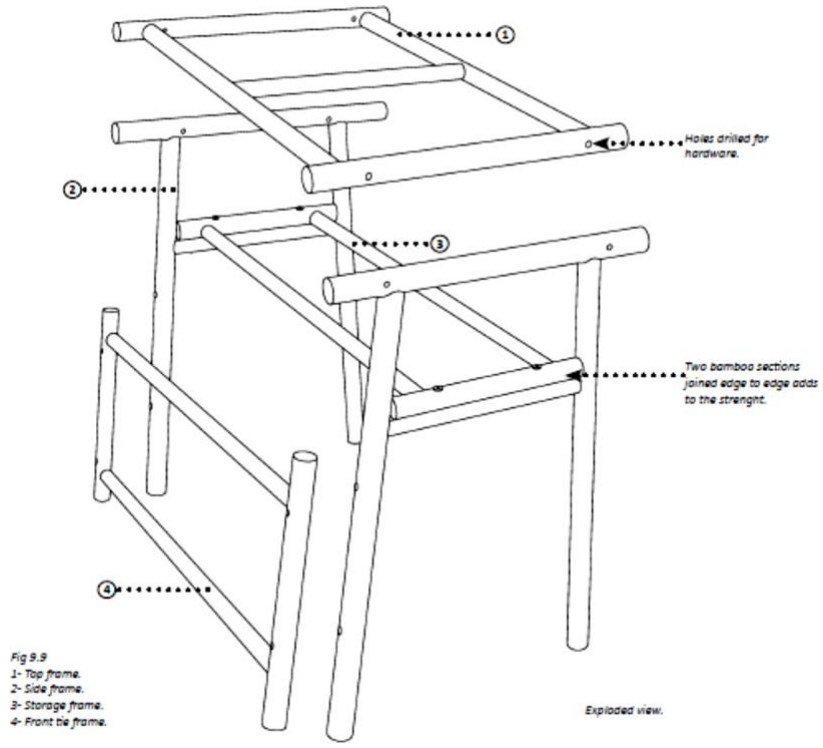

Figure – 17 – the diagram shows the joinery system of table

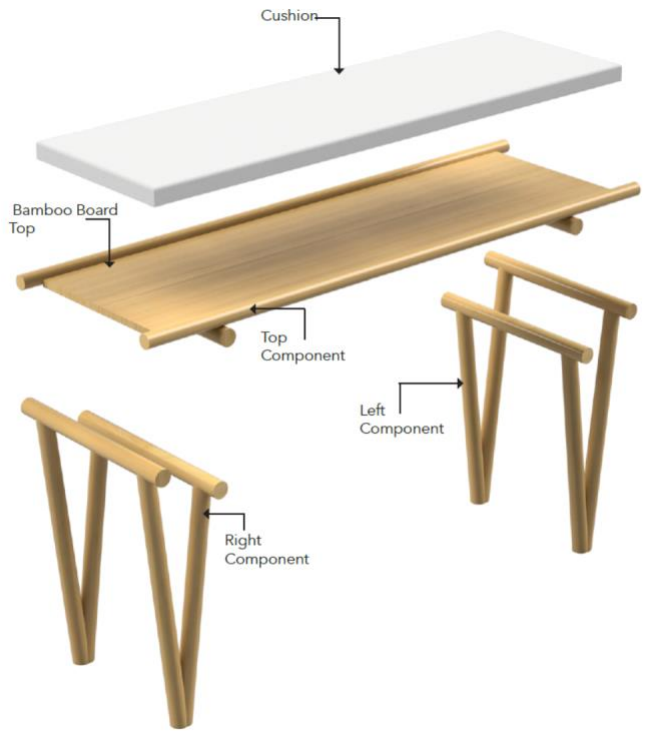

Figure – 18 – the image shows the assembly system of bench

The Difference of New System from Existing Design

In India many designers and institutions including NID have been involved in designing solid bamboo furniture from the beginning of 2000. This was mostly concentrated in Tripura State and in Central India. Even as a young designer I had the opportunity to work on solid bamboo furniture during 2002-03 with the artisans and entrepreneurs in Tripura through NID's consultancy project. However, the approach was mostly adopting the methods used in making wooden furniture. The style, construction, structure, joints etc. where borrowed from traditional carpentry techniques. Gradually it had evolved into a more refined design according to bamboo as material and it took different directions. It was

Figure – 19 – the image shows various chairs designed at NID

produced by local entrepreneurs and artisans in Tripura with their local solid bamboo species from the farms. Many furniture was developed in the similar line and introduced with good demand from other parts of the country. However due to various issues in transportation to outside market the production reduced to few numbers. Meanwhile a new set of designs where introduced using joints with hardware system. This also could not survive due to the number of components, differences in the material dimension etc.

So learning from my past experiences, I introduced the new system which reduced number of components, with a systematic approach in component design and connectors. This new system makes solid bamboo furniture making very unique from the previous approach.

Conclusion

Bamboo sector can employ a large number of people at various levels and can be a major source for livelihood generation in rural as well as urban India. Starting from systematic cultivation according to species, primary process, then production, transportation, marketing and selling can really accommodate many number of people. A systematic approach in this can help to develop such a model in India with the support of Government and local bodies. Gradually it will also help in promoting green living by using bamboo based products.

Finally, bamboo is an eco-friendly renewable natural material when it connects with society, culture and with economic development of the region it become a truly sustainable eco-friendly renewable natural material. That is what the above mentioned experiments and design method can bring in this country. So design is a very strong tool for such kind of economic growth through a systematic approach which can certainly shows some positive and healthy growth in the society.

(Susanth C. S, author is the Head of NID Centre for Bamboo Initiatives and the information stated in this paper is based purely on the experience collated during the experiments and exploration with bamboo at NID along with other designers and team members.)

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