

Internship At Uravu

Final Report

Gautham Rajaraja Varma
136130005
Product Design
Batch 2013-2015
IDC, IIT Bombay

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Disclaimer

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Gautham Rajaraja Varma
136130005
2013- 15 Batch
I Year M. Des I Product Design
IDC, IIT- Bombay

Completion Certificate



— INDIGENOUS SCIENCE & TECHNOLOGY STUDY CENTRE —

Regd. No.122/96, Thrikkaipetta P.O.
Wayanad Dist., Keralam- 673 577
Phone: 04936-231400, 275443
e-mail : uravu.india@gmail.com
www.uravu.net

Date: 25/6/14

Ref:

This is to certify that Mr. Gautham Rajaraja Varma, MDes Product Design, Industrial Design Centre IIT Bombay has done his Summer Internship for a period of one month (from 12th of May till 13th of June) and has assisted in the following projects/fields:

1. Solar Workstation
2. Redesign of Bamboo Pen
3. Accessories
4. Furniture design

Mr. Gautham Rajaraja Varma has been found to be keen in conceptual and technological explorations and their respective mock-ups and has succeeded in formulating new ideas and concepts. His conduct has been good throughout the internship period and we wish him all the success for his future endeavors.



For URAVU

President

Acknowledgement

I would like to extend my thanks to Prof. B. K. Chakravarthy, the HOD , Industrial Design Center, Prof. R Sandesh for giving me the permission to proceed with my internship in Uravu.

This internship would not have had its true meaning without the guidance I received from Prof. A G Rao.

I am grateful to Uravu, Mr. Baburaj (President), T. Shivaraj (founder, President), Mr. Manoj (Manager) and the staff there , especially Mr.Thomas, Mr.Rakesh, Mr.Balan, Mr.Lenin, for supporting, encouraging and appreciating my work and helping me adjust into the dissimilar environment of Uravu.

Lastly, I would like to thank my parents and my classmates, especially Anulal VS, Manu Revi and Isaac Junior for providing me with mental support and discussing my work from time to time.

I am grateful to all those people who wished me well and helped me making my days at Uravu most memorable one.

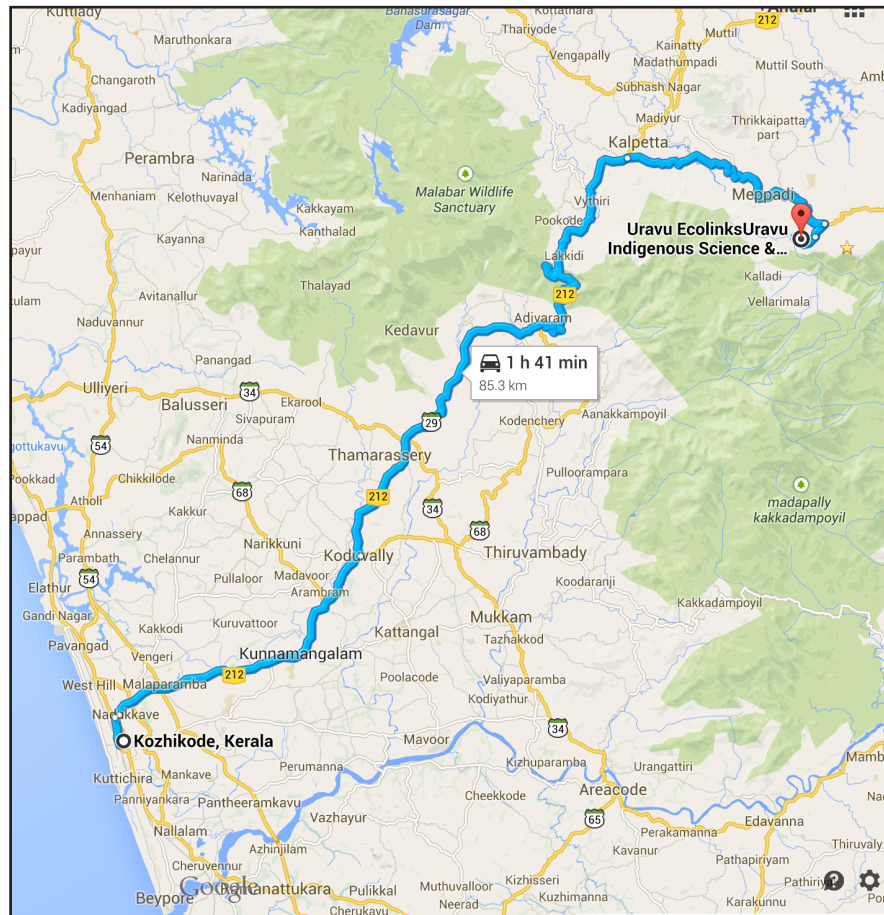


Figure 1: Showing the location of Uravu with respect to Calicut
Source: Google Maps

About Wayanad, Kerala

Wayanad is one of the fourteen districts in Kerala, situated about three hours from Calicut which is the nearest city [Fig.1]. Wayanad has its headquarters in Kalpetta. It is also the least populated district in Kerala.

Wayanad is set high on the Western Ghats with altitudes ranging from 700 to 2100m.

About Uravu

‘Uravu’, set in the heart of woods on the Western ghats in Kerala among the misty mountain range and lush green backdrop, is an organization of international recognition acclaimed for promising a new path for many who missed out on their opportunities to live.

A non- government organization, currently focused on bamboo- centered products and services, believes in sustainability in every aspect it throws light on. Uravu implements integrated, end-to-end programs in the bamboo sector, which include providing skill training in bamboo processing, establishing micro enterprises, marketing of bamboo handicraft, cultivation of bamboo and promotion of eco-tourism.

Uravu is located in Thrikkaipetta village in Wayanad district.

Uravu Bamboo Nursery

Bamboo, essentially, is a grass. It is one of the fastest growing plants and its vertical growth depends on the geographical locations. In the Mediterranean regions bamboo grows only to a limited height of about 1-1.5 feet, whereas, in the equatorial regions, they would grow to its full potential, up to height of about 20-25 feet.

There exist more than 1250 varieties of bamboo across the world, out of which 136 are identified in India and 28 among them in Kerala.

Growth Pattern

During the early stages, the growth is less and is more confined beneath the ground at root level. From the middle of second year, shoots start coming out and roots propagate beneath the ground. In the subsequent years, more and more shoots sprout up. By fourth and fifth year onwards harvesting of the matured bamboo begins and the same can be continued from then on. Patterns start showing on the bamboo once its matured enough to be harvested. To make it easier for the on-site workers, colour coding is done, with respect to each year, to the shoots that come up.

Identifying different types of Bamboo

Natural methods for identifying different types of bamboo are:

By observing the development of the Sheath
The forms and patterns on the leaves

Types of Growth of Bamboo

- Monopodial - Bamboo grows individually, where different shoots sprout at a certain distance from each other.
- Sympodial - Bamboo grows as a bunch and shoots sprout close to each other

Bamboo Varieties Used for Construction

Guadua augustifolia [Fig.2]

A bamboo variety from Columbia

Monopodial

Non- Bendable

Diameter same for first 15m and then tapers to top

One thorn at a node

Used singularly or can be bolted together, as per need

Lifespan of about 70 years

15% more BTU than other fuel woods (alternative fuel)



Figure 2: Guadua augustifolia

Bambusa bambos [Fig.3]

Native of Kerala Ghat

Sympodial- difficult to harvest

Structural strength- almost double as of Guadua

Thorny

Pruning technique while growing- for easy harvesting

Pruning - if not done, results in wastage of immature bamboo as the whole bunch is harvested



Figure 3: Bambusa bambos

Dendrocalamus strictus [Fig.4]

A tropical genus; similar to Bambusa genus

Best for cantilever structures

Attains a height of 30ft

Also used in furniture

Variants exist within Kerala, in different districts

Comparatively thin cross section of 3-4cm



Figure 4: Dendrocalamus strictus



Figure 5: Denrocalamus brandisii

Denrocalamus brandisii [Fig.5]

Native of Southeast Asia- wet evergreen tropical forests

Also known as velvet leaf bamboo

Lifespan of 60 years

Thornless

Sympodial, but less branches- hence easy to harvest

Used for pillars and roofing

Also used in handicrafts



Figure 6: Dendrocalamus giganteus

Dendrocalamus giganteus [Fig.6]

World's thickest bamboo but not the strongest

Will reach heights up to 46m

Pillars can be made out by splitting this bamboo and filling concrete within

Lifespan of 100 years



Figure 7: Bambusa balcooa

Bambusa balcooa [Fig.7]

Indian origin

Strongest, thorn less

Called a semi solid bamboo as the cavity within is comparatively small

Inner wall thickness of 4-6 cm

Bambusa nutans [Fig.8]

Grows at altitudes between 500-1500m

Thrives on moist hill slopes and flat uplands

Commonly found in the North East, Orissa and Bengal

Thorn less

Strong bamboo used for scaffolding

Sympodial growth, but still can be cut out individually with skill

Used for creating ladder, pillars etc

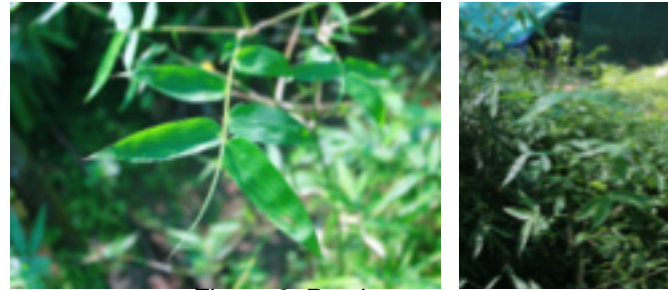


Figure 8: Bambusa nutans

Schizostachyum dullooa [Fig.9]

Grows up to an altitude of 1200 m

Found in the North-eastern region of India

Thorn less

Sympodial

Thin cross section

Grows straight without bends

30 ft in height

Comparatively less strong



Figure 9: Schizostachyum dullooa

Rostretta [Fig.10]

25 ft in height

3-4 cm wide cross section

Used in furniture making too

Easy to harvest

Interior hole is comparatively small

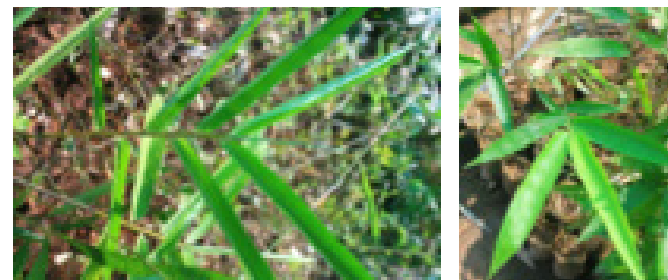


Figure 10: Rostretta



Figure 11: Dendrocalamus sikkimensis

Dendrocalamus sikkimensis [Fig.11]

Similar to Brandisii but shorter and thinner
40 ft in height
Branches are normally orange in colour
Used in pillars as strength is more
Immature ones used in weaving too

Burmese bamboo

Just below Dendrocalamus giganteus in height, width and strength
Used in pillars

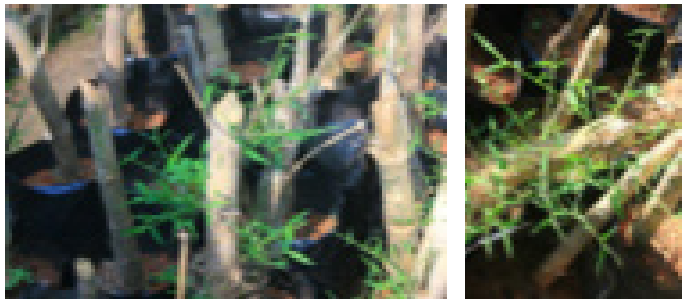


Figure 12: Siamensis

Siamensis [Fig.12]

No hole inside
Bendable
Used more in furniture
20 ft in height
Bends sideways while growing

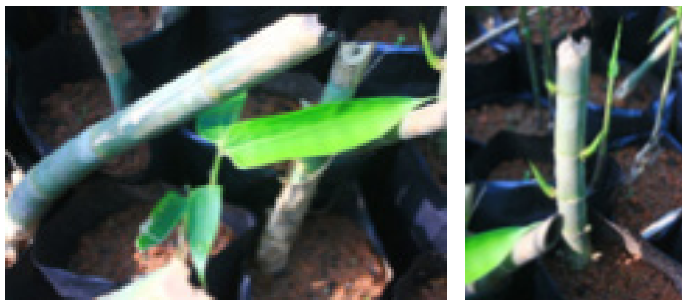


Figure 13: Melocanna baccifera

Melocanna baccifera [Fig.13]

25 ft in height
Grows in tropical region
Monopodial - one metre between successive shoots
Thorn less
3-4 cm wide

Dendrocalamus longispathus [Fig.14]

Glaucous green when young, grayish-green on maturity

Grows straight

Distribution: Thailand, Malaysia, Bangladesh and India

Thorn less: good for construction

Requires shade to grow

Grows up to 50ft in height and 1.5 to 2 inch wide



Figure 14: Dendrocalamus longispathus

Thyrsostachys oliveri [Fig.15]

Distribution: Thailand, China, India

Needs less space to grow

Thick sympodial

Tough to harvest

2-3 cm width

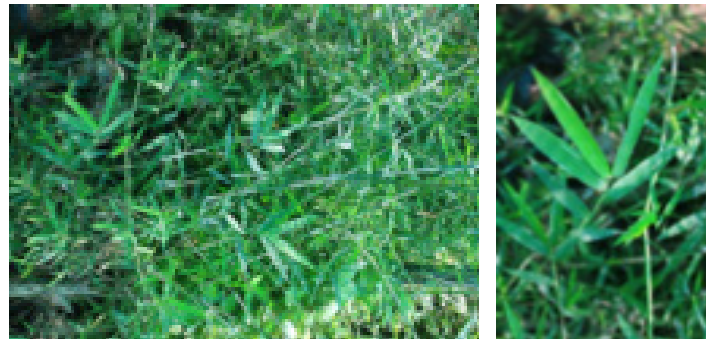


Figure 15: Thyrsostachys oliveri

Unidentified Species

Soft and lush green

Thickness of 3-4 cm

Has lots of branches

Big hole inside

Hollow, but used in roofing



Figure 16: Bambusa Tulda

Bambusa Tulda [Fig.16]

Similar to balcoa

Medium diameter hole inside

Branches at base

Sympodial



Figure 17: Pseudoxytenanthera ritchii

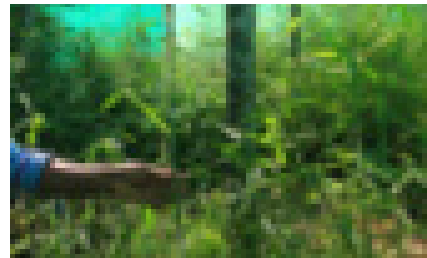


Figure 18: Palida



Figure 19: Dendrocalamus membranaceus

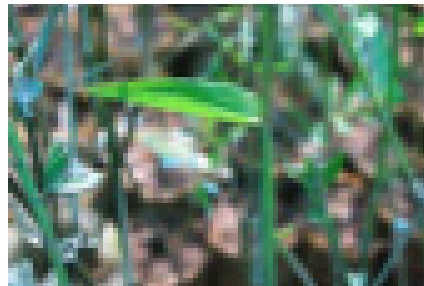


Figure 20: Dendrocalamus Asper

Pseudoxytenanthera ritchii [Fig.17]

No hole and bendable
2-3 cm wide and 20 ft height
Suitable for furniture

Palida [Fig.18]

Grows straight
2 inch wide and big hole

Dendrocalamus membranaceus [Fig.19]

Used for construction
Grows up to 60ft tall
Bigger hole
Used for making ladders

Dendrocalamus Asper [Fig.20]

Native to Southeast Asia
Used for heavy construction
Shoots are consumable

Bamboo Used for Ornamentations

1. Buddha bamboo (*Bambusa Vulgaris Wamin*) [Fig.21]

2. *Bambusa multiplex* [Fig.22]

Can be used for making pens

3. Bush Bamboo [Fig.23]

4. Golden Bamboo [Fig.24]

5. Creeper Bamboo

6. *Bambusa multiplex vangata* (it has white striations on its leaves)

7. Chinese Bamboo (*Phyllostachis Bambusoides*)

8. *Bambusa vulgaris*- Green

9. *Bambusa vulgaris*- Yellow

10. Black Bamboo

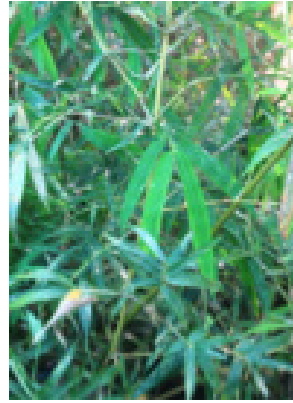


Figure 21: Buddha bamboo

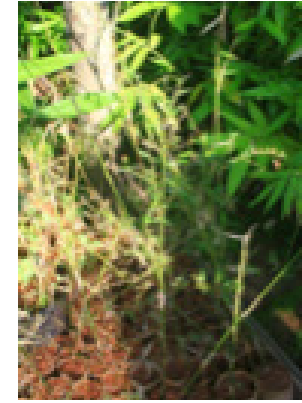


Figure 22: Bambusa multiplex

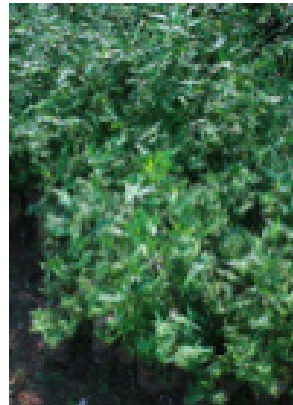


Figure 23: Bush Bamboo

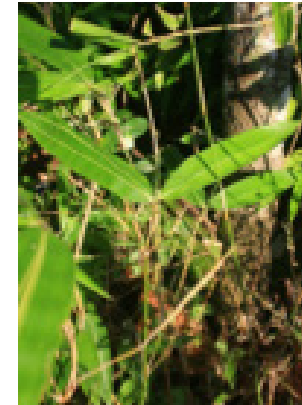


Figure 24: Golden Bamboo



Figure 25: Ochalndra Travancorica



Figure 26: Ochalndra Scriptorla



Figure 27: Explaining the Hormonal Process

Bamboos Used for weaving

1. Ochalndra Travancorica [Fig.25]

2. Ochalndra Scriptorla [Fig.26]

Used for making pens and jewellery

3. Schisostachium Bedomi

Need shade to grow

Cultivation techniques at Uravu

1. Growing seeds

2. Hormonal Process

A small hole is made on a bamboo stem. A mix containing 7gm Naphthalic acid, 100ml alcohol and 900ml water is made. This mix is added to 9L water and poured inside the bamboo through the hole till brim. Then it is wrapped up with plastic and buried in ground. Shade is provided. New bamboo shoots grow from the nodes [Fig.27].

3. Replanting from a bunch after taking one plant (with root and shoot) out.

Units Associated With Uravu

As part of getting familiarised and understanding the different stakeholders associated with Uravu a visit was done to the different units that work under / obtain guidance from Uravu. The micro enterprise units were established under the Rashtriya Sam Vikas Yojana (RSVY) programme, providing employment in bamboo craft to rural people [<http://www.hindu.com/2005/11/09/stories/2005110912410300.htm>].

The visit encompassed Bhavm Mural Arts, Niravu, Soubhagya and Unarvu. These units laid out pictures of achievement, struggle, stagnation and hopes that people live with as they continue to be part of the craft industry in Kerala. These following are the short glimpses into the lives of many who help constitute the fragile craft sector in and around Uravu.

Niravu - A self-help group run by women, Niravu has been creating variety of craft products such a The Rainmaker, phone stands, pen stands etc [Fig.28]. for more than nine years. The products created are as per the requirement / orders which are delegated from Uravu. Employees at Niravu receive their income based on the number of products that they deliver to Uravu. The unit is still not self-sustained even after being in operation for a decade. Even though there are opportunities for them to attract craft orders on their own, such a potential has not been realized and they still depend heavily on Uravu.



Figure 28: Craft products at Niravu



Fig 29: Bamboo murals at Bhavm(top),

Fig 30: Book of spices design at Soubhagya (bottom)

Bhavm Mural Arts [<http://bhavmarts.blogspot.in/>] –

This unit showcased a successful story of creating a steady market for craft products. The unit focuses on mural art works. *Dendrocalamus Gigantus* variety of bamboo is used to create mural paintings. Bhavm are no longer under Uravu, and require assistance only regarding raw material and guidance. The mural paintings from Bhavm were done on walls, canvas, and on all things that had utilitarian value [Fig.29]. They progressed in a way where they utilized the technical knowledge about bamboo along with their creativity to create a niche sustainable market that nourishes craft and creativity.

Soubhagya – Another self-help group run by women, situated in Parathode. The unit has adequate machinery in terms of sander, grinder etc. The workers are paid a fixed salary per month. Their output is also based on the orders delegated from Uravu [Fig.30]. Training for the workers are imparted from Uravu and their working hours are from 9am to 5 pm every day. The transporting of products / raw materials in between Uravu and Soubhagya are through public transport buses or via hired goods vehicle.

Self-sustainability has not been achieved by the unit even after being operational for about 5-7 years. Soubhagya is still heavily dependent on Uravu. They still have not attained the level to ensure quality check and to manufacture totally finished final products. Semi-finished goods are transported back to Uravu for the final steps and quality check. The members have the skill to work with bamboo, but are not able to explore additional products owing to the lack of time. Most of the members are housewives and mothers.

Unarvu – Another self-help group run by women situated in Moorikkappu, Vengappally. Unarvu showcases a story in which the bamboo craft training imparted to them were put to use in accessory design, creating earrings, necklaces and other jewellery for women [Fig.31]. They faced difficulties to own a working space and hence registered their self-help group as a society and built a space using a loan. They devised a strategy of employing only married and settled down women who belong to the nearby villages, thus ensuring that there were no fallouts once the members were trained.

After breaking even to a certain extent, they even started to source raw material on their own without the assistance from Uravu. They use minimal machinery for the production. Students and Interns specializing in accessory design provide their valuable input in jewellery design. Unarvu is also active in conducting exhibitions across India.



Fig 31: Bamboo jewellery designs at Unarvu

Bamboo as a material

Bamboo in the pure and natural form is less resistant to the biological degrading organisms. The large amount of starch content present in bamboo attracts the degrading organisms like fungi, termites, and becomes the food for these organisms which are generally called Borers. The average natural durability of bamboo is less than 2 years. However if stored with care, the untreated bamboo may last up-to 4-7 years that too very rare. Bamboo is also known to be rich in silica, but the entire silica content is present in the outer layer. Even though it has minor amount of waxes, resins and tannins, but none of these have enough toxicity to improve its natural durability.

Compared to timber, bamboo has a low natural durability, hence few chemical treatment methods are used to improve the durability of the bamboo columns. The treated bamboo are completely safe from the borers and the durability increases many folds.

Bamboo Treatments used in Uravu

1. Gas pressure impregnation [Fig.32]

The bamboo columns are placed in a pressure chamber and the air inside the chamber is sucked out. With the help of a vacuum pump, the chamber is then pressurised with vacuum. The chamber then slowly filled with the treatment chemical (Borax and boric acid powder) and pressure is applied to a predefined value of 16kg/cm^2 . Due to this pressure the chemical gets pushed into even the small pores in the bamboo and the entire bamboo column gets soaked in chemical. For a 100 litre of water , 3 kg of boric acid powder and 2.5 kg of borax is used as the chemical . The entire pressurised chamber is kept untouched for a day and the columns are removed from the chamber the next day. The treated bamboo's are then dried, and used for further manufacturing processes.



2. Hot dipping [Fig.33]

The fresh cut branch less column with punctured nodal walls are weighed down and boiled in a container with chemical solution (Boric and Borax powder). The minimum process time is 4 hours. The treatment is done for splitter and small diameter bamboo in small quantity.



Fig 32: Gas pressure impregnation(top), Fig 33: Hot dipping(bottom)



Source: www.ecowatch.com



Fig.34: Planting bamboo shoots in the nearby school

June 5 - World Environment Day

June 5th is World Environment Day. As a patron of green movements, the environment day was well celebrated at Uravu. A gathering was called for, to remind and remember the ecological imbalance faced by earth at present and how we, as humans, are responsible to change or rather slow down its course as it has reached an extent where it seems the catastrophes are irreversible.

It was also said that, at Uravu, Environment day is not just for a day. It is a social responsibility every human has to carry with him through out his life for the sake of the planet and for the sake of the future generation.

The Environment day was celebrated in the nearby schools also. There were rallies by the students pledging themselves to be a part of this social cause. Bamboo shoots were planted at Uravu as well as in the school [Fig.34].

There was also a performance by a student trainee, Mr. Vibhu, who made beautiful musical instruments with bamboo.

Uravu ECO Links

Uravu has come up with novel solutions to housing problem at wayanad, especially how to tackle uneven terrain in a sustainable way [Fig.35].

The main structure rest over a base made of palm pillars containing concrete [Fig.36]. Main structure that houses the bedroom is has wall made out of mud plaster (mud+sand+lime+1-2% cement) on the inside as this does not come into contact with water and the outside wall is lined with bamboo strips (*Dendrocalamus Giganteus*). Each structure has an attached bathroom which is lined using ferrocement due to the constant exposure to water. Interesting part of eco links structure is its butterfly roof, the 2 flaps of which are held together by ropes to prevent it from transferring excess weight to the pillars. The roofs are lined by 2 layers of bamboo (*Dendrocalamus brandisii*) mats, chicken mesh and 2 layers of ferrocement. Bambusa bamboo forms the pillar structure, while *Dendrocalamus brandisii* is used for beams.

Water management is one issue when it comes to housing and the way its managed is what makes eco links stand out of the rest. Water from reservoir is fed into a fresh water tank, which goes directly into shower, wash basin and kitchen. This water is then fed into a grey water treatment tank and then to grey water tank. This treated water is fed into the flush system which is again send for water treatment and finally into the landscape. This process ensures safety of ground water at the same time ensuring proper water supply to respective areas.



Fig.35: Bamboo houses at Uravu ecolinks



Fig.36: Palm and concrete structure for base construction

Book Of Spices

About the book:

The Book of Spices is a unique product made in the Arrive Claptrap Bamboo Cluster, which has won much appreciation on account of the perfect match of innovative concept and utility value as a gift product. The Book is basically a box in the form of a book that can hold samples of spices (and for that matter many other items such as dry fruits, chocolate etc.) [Fig.37] and be sold as a gift/memento. Arrive has been using the Book filled with organic spices as a memento of Wayanad.

The present form of the Book comprises of front and back covers made of bamboo veneer board (8.25 X 5.25 inch) size. The inner portion of the back cover holds a rectangular frame made of giant bamboo reapers of 6 mm thickness which functions as the box. There are partitions(4 to 9) in the box made of thin strips of bamboo, which acts as a container for spices.

How is it made

Earlier Uravu was making the book covers by joining and gluing together 4 strips of giant bamboo longitudinally, using fevicol. The glued planks are then pressed but keeping stones on top.

Issue faced with current design

Under hot and cold climates in India as well as abroad, the strips displayed a tendency to gradually bend or warp. This appears mainly do to presence of moisture in the bamboo due to non uniform drying process.



Fig.37: Book of spices designed in Uravu

Methods tried so far

- A cross-stitch with thinner bamboo strips were placed on the inner side of the front cover, taking out a groove on the board and inserting a strip of bamboo. This could not prevent warping to the required extend [Fig.38].

- A certain type of Bamboo Veneer boards (4 mm thick altogether with 0.5mm bamboo veneer sheets pasted on both sides of a 3 mm wooden ply board) were used [Fig.39]. Scarcity and weight-age period to procure the raw material made it a difficult choice of replacement, even though it helped in mitigating the problem to a certain extend.

- Hand-made slivers of *D. giganteus* (around 0.5 mm- 1 mm thickness) were pasted on both sides of a mechanically hot-pressed industrial board (of 3 mm thickness). The process involved taking slivers of uniform thickness which were glued uniformly on both sides of the board followed by application of uniform pressure on the board to fasten the slivers without air blotches. Even though this could prevent warping, Uravu faced the following issues in this regard:

- Hand slivering combined with rotary sanders had to be used as machines were not able to provide the required uniform thickness (0.5 - 1 mm). This required proper training and skilled labour.

- Glues had to be applied in a uniform manner which required proper training and skilled labour.
Lack of hot press system.



Fig 38: Warping issue at extreme temperatures

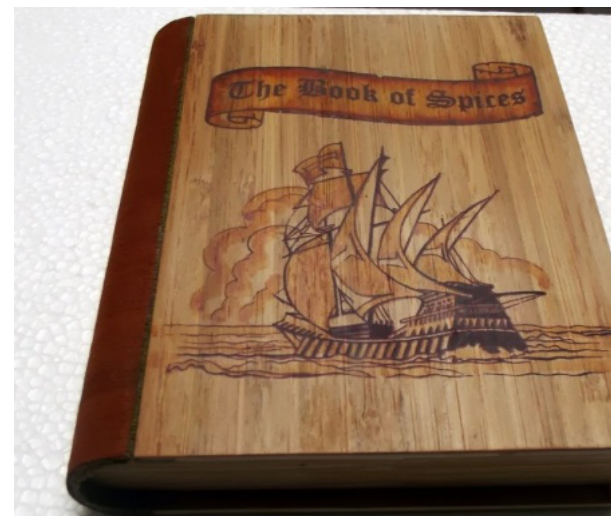


Fig. 39: Book of spices made from bamboo veneer boards

Solutions suggested to prevent warping

Redesigning book of spice

After a brainstorming session, suggestions were put to redesign the book of spices. It was observed that warping was localized to only the front side, as the back side had its strength coming from the box like wood structure attached to it. Question was, why not bring in a similar structure to the opening flap where warping is observed. To an extent this could solve the problem, but at the same time gave rise to some issues like:

- Training artisans to the new designs
- The whole philosophy of opening a book to its starting page becomes non-existent.
- Need for extra raw materials.
- Cuts had to be more precise due to existence of male and female pieces locking together.
- These issues led us into leaving behind the idea of redesigning book of spices and we started looking for new solutions to counter warping.

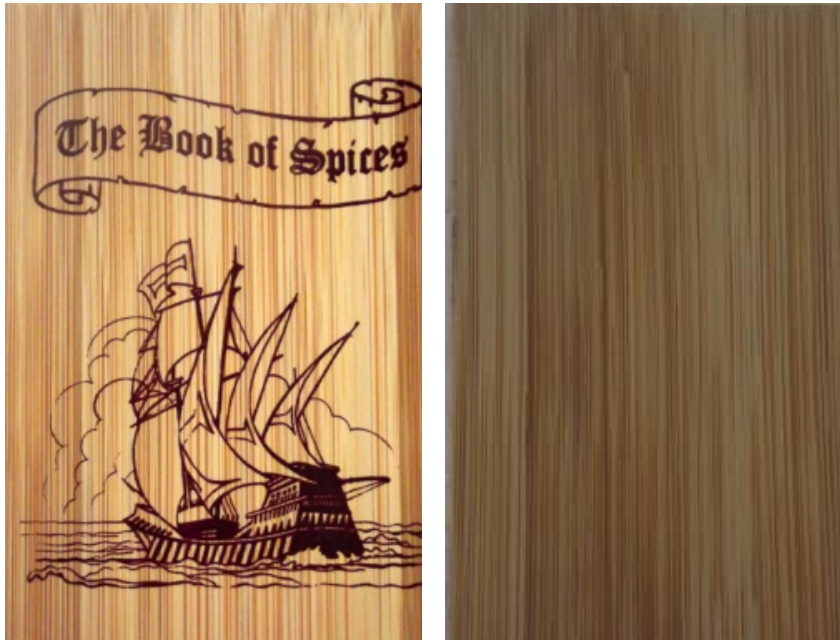


Fig.40: Book cover constructed from bamboo slivers

Into the world of adhesive

Absence of a hot press and cold press being the only choice, made us look into various options when it came to the choice of adhesive while laying out bamboo strips [Fig.40]. We approached various organizations having prior experience in bamboo ply, one among which was Bamboo Corporation, Nallalam and got insights into adhesives like Starke D3, Blue coat D3 and Henkel food grade which could be directly used. They also suggested using Urea Formaldehyde combined with Ammonium Chloride catalyst.

As most of the above adhesives could not be locally procured, we contacted the local manufacturer of urea formaldehyde - Poly Formalin Pvt Ltd and paid a visit at their factory to arrange for test samples as well as to understand ways of adhesive application. Following actions were suggested to prevent warping :

- Using 65% Urea Formaldehyde resin with catalyst formic acid(both of which could be locally procured)
- Mixing clay powder or starch with the adhesive to enhance bonding.
- Bamboo strips should be placed in a cross fashion to counter warping.
- Application of adhesive should not be too much or too less, preferably one layer of uniform thickness.
- Application of uniform pressure over the planks.

A Solar Workstation

The cottage industry, currently, is a place where a few people join under one roof to work on same or similar projects. This has been the practice for a while now and it has found success in its own realms. Many have been benefited with such small scale industries. But, even in such industries, a small group, especially house wives, are sometimes left out.

Uravu has taken notice of such situations and came up with a different structure for the cottage industry. They have planned to bring down the scale of industry to the table top level so that it may benefit all. Now the idea is that those who cannot leave their homes to work at the cottage industry can make a living by working from their home. The workstation provides the space and equipment to do such kind of work. The equipment are powered with the help of a solar panel kept on top of the house. Thus, the whole industry would witness a shift from 'under the roof' to a 'table top', giving more flexibility and convenience for the folks in work.

The table would hold equipment necessary for working with bamboo, such as, hand drill, hammer, screw driver, screws, nuts and bolts, saws, spanners, bending tool, knives etc.

Design Brief

- The solar workstation has to be made with bamboo
- It should be easily packable and transportable
- The whole table should fit in a box of size 4'x2'x1'
- Should not be more than 20kg
- It has to be assembled.
- There should be enough space for two people to work
- There should be exclusive place for each of the instruments used
- There should be a space for the inverter and battery. [Inverter for controlling the electric power]
- The whole workstation should be economical and low budget

The Approach

The design brief was carefully studied by the team and some changes were made after a quick brainstorming within the team.

The changes are:

Size of the box should be 4.5'x2.5'x1'.
It can be folded.

A resource base was made after the brainstorming session. A collection of images and text to identify the on-going trends in furniture/ workstations.

Different ideas were sketched out on a preliminary basis. The ideas which needed some background study and experimentation were carried out.



Fig.41: Showing the design methodology followed for this particular project.
Source: Author



The Present Workstation

The workstation which the craftsmen have built at the institution is found to have many problems.

- It is not a knock-down furniture
- Not easy to transport
- Very Heavy
- Ergonomic issues
- Over designed
- Heavy labour requirement
- High cost

They had made two tables, but both of them had the same issues [Fig.42].

The requirement, anyhow, was to negate all these issues.



Fig 42: The work stations made by Uravu before i started intern-ship.
Source : Author

The New Workstation

The new approach of designing the workstation was with the intention of semi-mechanizing the work load, putting up within the parameters and environment of the institution. It cannot be fully-mechanized since a lot of people depend on the institution for their livelihood. By converting it into semi-mechanized, the production rate would go up as well as a check on the quality. Also it won't threaten the livelihood of the workers.

The workstations can be mass produced and the new design would liberate the product from the craft sector. This would also help cutting down on production costs. The design is in such a way that the workstation could easily be packed at the industry and assembled on-site. Since there is a constraint in packaging size, the new design for a workstation is challenging.

Design Philosophy

Constraints shape-up designs. They act like a framework within which new designs take shape with an aim of breaking those barriers. Therefore, the one who understands the properties and limitations and sees the opportunity in each constraint can develop a better design.

Bamboo, as a material itself, has a lot of limitations in terms of shape, size, rigidity and form. So working with such a material is definitely challenging. In such situations, using the material in different ways and forms help break the barrier.

Parallel Product Study

An online search was done to explore various kinds of tables made in bamboo as well as other wood. This included tables which could be folded and where bending is also used [Fig.44].

The study helped in getting an idea of the new trends and the bench mark in terms of design in the market.

Other Inferences

Getting hold of various folding mechanisms

Different forms and colour schemes were studied.

Material exploration was also done.

A study on structural stability

Fastening mechanisms [Fig.43]



Fig 43: Various kinds of fasteners.
Source: www.lesmac.co.uk



Fig 44: An example of a folding table.
Source: www.btooffice.co.uk



Source: www.furniturefashion.com



Source: www.questushospitality.com



Source: www.bamboofurnitureguide.wordpress.com



Source: www.s13.zetaboards.com



Source: www.hahoy.com



Source: www.dezeen.com

Fig.45: Showing various existing products in the market

Source: Various Sources

Concept of the New Workstation

Keeping the design philosophy in mind, an exploration was done to find out how bamboo is being used in its multiple forms. As expected, the answers were there right within the boundaries of the institution.

Bamboo reapers from Aanamula (*Dendrocalamus giganteus*) are being made at the institution. Using the reapers, instead of the whole bamboo, would definitely cut the cost down. Utilizing the different properties of reapers was a key point in designing. It gave a whole new dimension to the form.

The basis for the design was to make the whole furniture knock-down and manufacturing semi-mechanized. Thus the materials, its properties and the whole design has to be such.

The design has to also look into the inventory available at the institution as well as the skill level of the labourers.

Iterations

With all the said aspects in mind, several iterations were made [Fig.46]. Mock-ups were made to check the mechanisms and feasibility of manufacturing.

The idea for the table stand was inspired from the traditional folding easy chair.

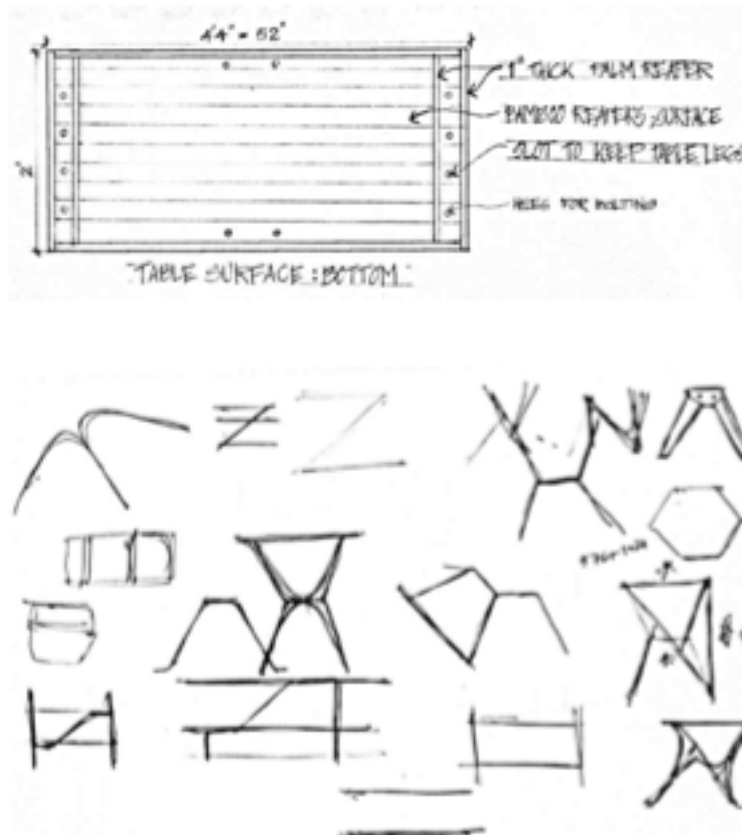


Fig 46: Showing different sketches for the workstation
Source: Author

Concept 1

Folding Table

The idea for the table stand was inspired from the traditional folding easy chair [Fig.47]. The idea was to design a table which could be easily folded and packed. A folding table would also give more space where the table is being in use.

The mechanism of folding was transferred to the table. A mock-up was made to test the mechanism.

Issues

This concept faced three major issues.

1. The folding mechanism called in for a lot of additional labour in terms of manufacturing as well as functioning.
2. The rack for keeping the batteries and inverter is a hindrance to the folding mechanism.
3. All the major load was coming to the hinges, which would, at the end, make the furniture weak.

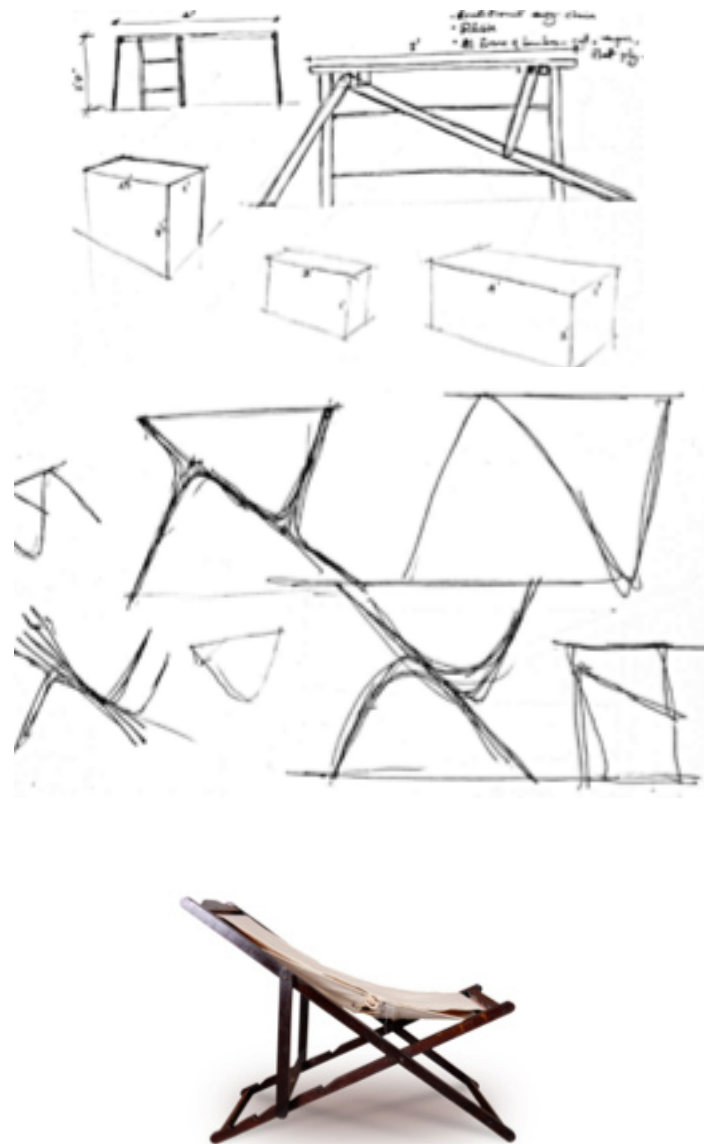


Fig.47: Showing a traditional easy chair
Source: www.greatpriceindia.com

Concept 2

The new concept was to explore into different combination of materials with bamboo. This time, bamboo and metal were combined to form a fold-able support [Fig.48]. The metallic part would take care of the folding mechanism and bamboo would become the support for the table to stand.

The concept would work theoretically. But this time, the issues were pragmatic.

Issues

The scope of working with different materials especially metals is currently out of the realms of the institution.

The workers don't have the expertise to work with materials other than metals.

Availability of other materials is also scarce.

Working with other materials mean the institution has to depend on some other organisation for raw materials and Uravu would just become an assembly unit.

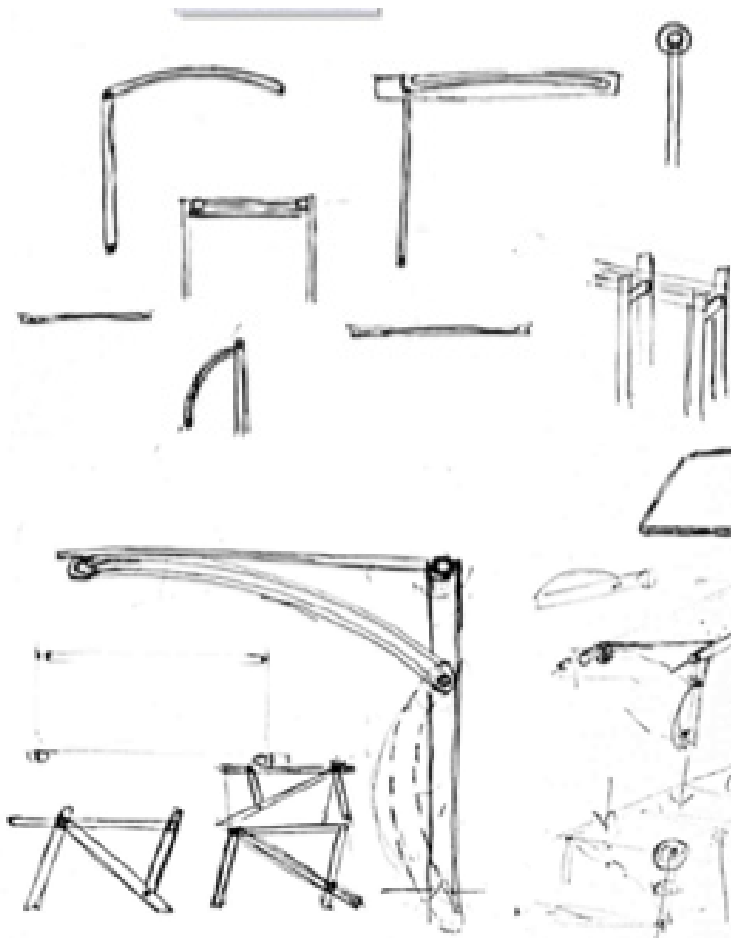


Fig.48: Showing sketches of different folding mechanisms with metal and bamboo combination
Source: Author

Concept 3

Concept 3 is actually an extension of Concept 1, but this time, without folding. Removing folding out of the scope gave a lot more flexibility in using the material and its properties.

The property of bending the bamboo was used considerably in the new concept. This approach gave a whole new outlook to the furniture [Fig.49,50].

Resources could be saved substantially and gave the furniture a modern feel. The furniture, now, has the capability to make the user feel proud in owning one of the tables.

Issues

Though the new concept was welcomed by the supervisors there were some issues regarding the stability.

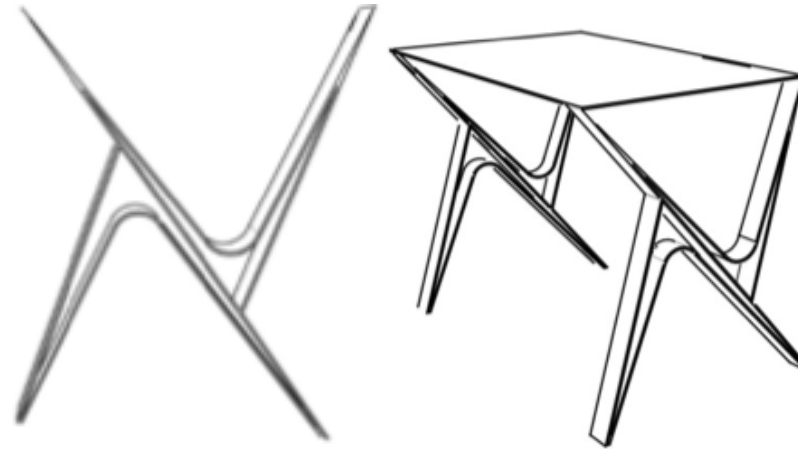


Fig 49: Showing elevation of the table stand
Source: Author

Fig.50: Isometric view of the table
Source: Author

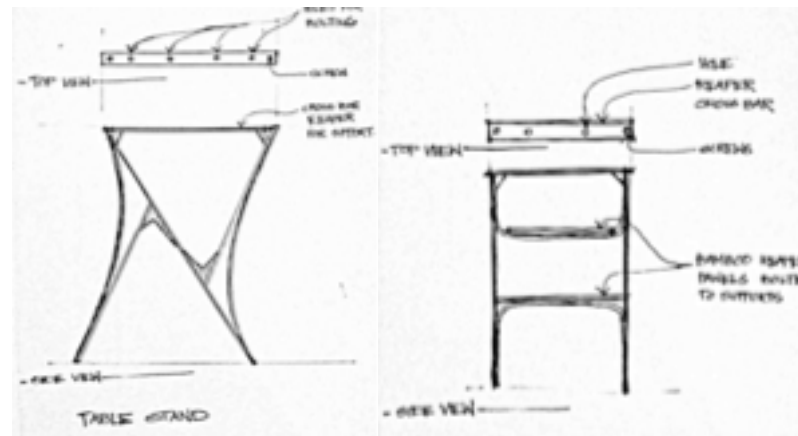


Fig 51: Showing sketches of table and rack legs
Source: Author

Flattening of Bamboo

As part of the new exercise, many experiments were done. One of them was to flatten a bamboo culm by the method of quenching.

The skin of the bamboo culm was first peeled off. A vertical cut was given, from where it would start flattening. The face of the culm was heated using a gas burner and water was sprinkled immediately after the burner is taken out. By repeatedly doing the same process, it was able to flatten the bamboo piece to a certain extent [Fig.52].

But because the bamboo culm was not properly dried under the sun and also because of the haste, it was a failure at the final stage, though Mr Rakesh said that he was able to find success with the same process while designing a one piece tray with bamboo.

The same process is used for bending a bamboo reaper, which was later applied in the making of the workstation.



Fig.52: Showing the various stages involved in flattening a bamboo culm

Photo courtesy: Sayujya Suresh Babu

Concept Detailing

When the concept of folding was taken out, it gave a lot more possibilities. Concept 3 was taken further ahead to make a mock-up to test the stability, strength and load handling capacity.

The Leg

The 'U'-bend, earlier given on the upper and bottom side, was taken to the sides to increase the strength [Fig.53].

Supports were given were two reapers joined.

At this stage the table stand was quite strong but not strong enough to hold the load coming on the table while working. Therefore,

A cross bar was fixed so that the tension load could be taken [Fig.54].

The cross bar would also help in fixing the stand to the table top.



Fig 53: Elevation of table stand
Source: Author



Fig.54: Modified Table stand
Source: Author

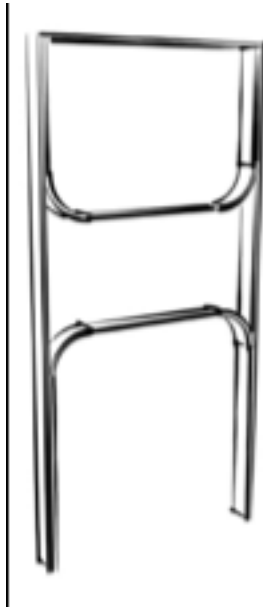


Fig 55: Rack Stand
Source: Author



Fig.56: Completed Rack
Source: Author

Concept Detailing

The Rack

To begin with, there were many constraints for the design of the rack.

- It should accommodate all the accessories like batteries, inverters and tools.
- The form should be in line with the form of the whole table [Fig.55].
- Should be easy to manufacture, pack and transport.

A rack was designed using the bending property of bamboo reapers. This is capable of holding the weight of the inverters and tools. It will also act as an additional support to the table normal to the support of the legs.

The cross bar on top would provide the tensional support and also helps in fixation with the table top [Fig.56].

Prototype

A prototype was built simultaneously to test the concepts in working [Fig.57]. As the reapers were of standard dimensions, it was not a hectic task to build the prototype using the reapers.

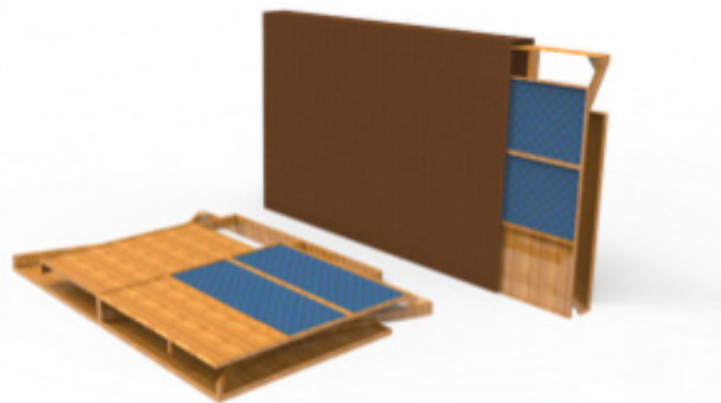
Bending of bamboo reapers was a new domain which was looked into. Since there is no standard method to bend the reaper to the desired extent, it was done through trial and error method. If there is a method by which the reaper could be bent to the desired extent a lot of time and labour could be saved.



Fig.57: Showing the prototype of workstation
Source: Author



Fig.58: Showing the prototype of workstation, When packing and the total thickness.
Source: Author



Unpack



Assemble and Fix



**Fig.59: Showing various stages of building the workstation.
Source: Author**

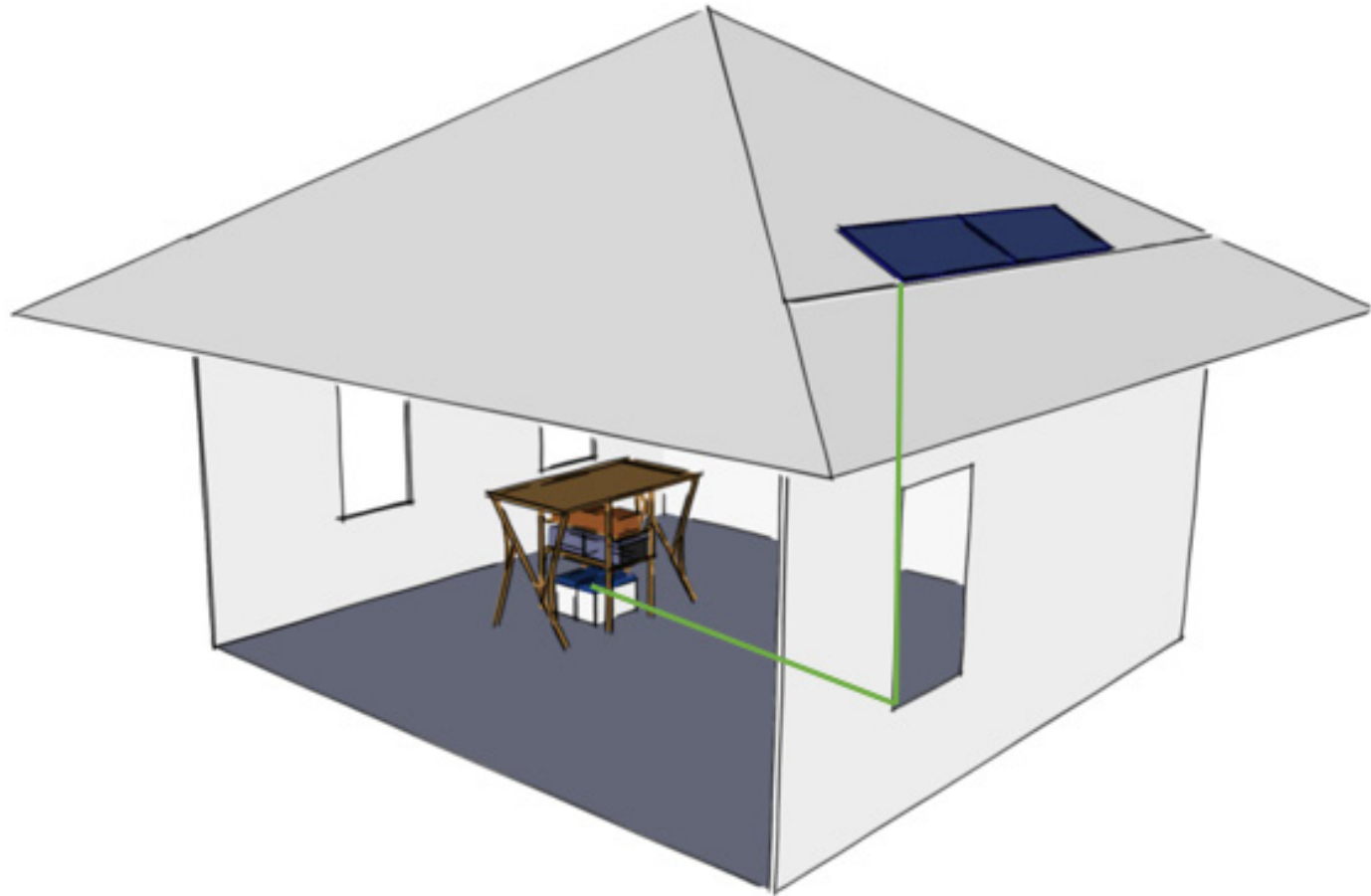


Fig.60: Showing how the workstation is in use in a house
Source: Author

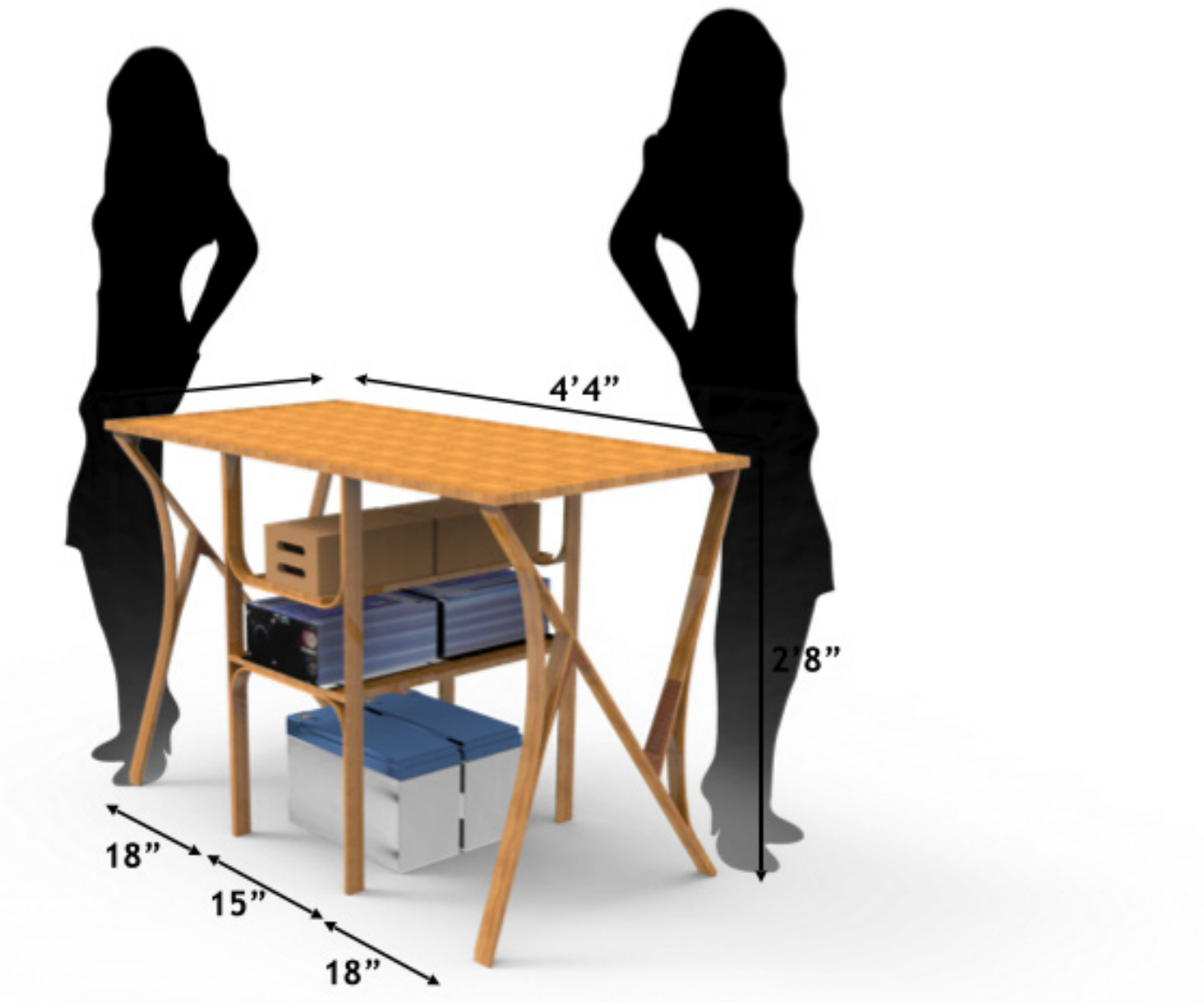


Fig.61: Showing the dimensions of the workstation
Source: Author

Water Tap from Bamboo

Concept

From the ancient times, bamboo holds several traditional values in many cultures, be it Indian, Chinese or Japanese. In almost every Asian culture bamboo symbolizes the harmony between the nature and humans.

A water tap made of bamboo, perhaps would not be a new idea, but beyond the physical product, it holds a different layer of understanding. In the Japanese culture, it is said that to find wisdom, we need to empty ourselves from the pre-conceived notions. The hollowness inside the bamboo reminds us not to be pre-occupied by ourselves and our conclusion. We need to make room for the new knowledge from nature and humans. When we are freed from our prejudices, we become open to the new possibilities.

To symbolize these virtues of bamboo, a water tap was designed [Fig.62]. While it is in a closed position, it is hollow, the way our minds should be. While the tap is in an open state, water runs through and there is nothing better than water, which expresses the power of knowledge, wisdom, purity, innocence and above all, the life, which bridges the gap between nature and humans and bringing a harmony among them.

A whole set of bathroom accessories, which would give out the same 'close to the nature' experience to the user was in planning stage.

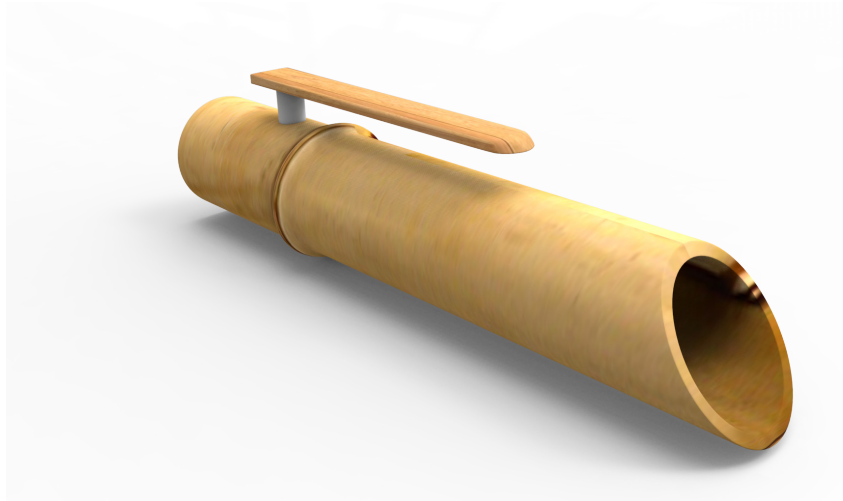


Fig.62: Showing a rendered image of the bamboo tap
Source: Author

Water Tap from Bamboo

A tap is basically a valve. A single valve was bought from an outside shop. A bamboo culm of about one foot was taken. This was carefully chosen with a node, to suit the size of the valve.

A small hole was made using drill on the node. The valve was fitted behind the node after cutting through bamboo.

Basically the idea is the valve should open and close the circulation of water through the hole. But to prevent water from leaking, many methods had to be tried.

Even though it was not successfully leak proof, the concept worked well to represent the harmony [Fig.63].



Fig.63: Showing a rendered image of the bamboo tap in open position
Source: Author

Conclusion

The foundation course during the first year has been of great help when it came to understanding the need and purpose of design. It has created a flare for exploring new realms in design.

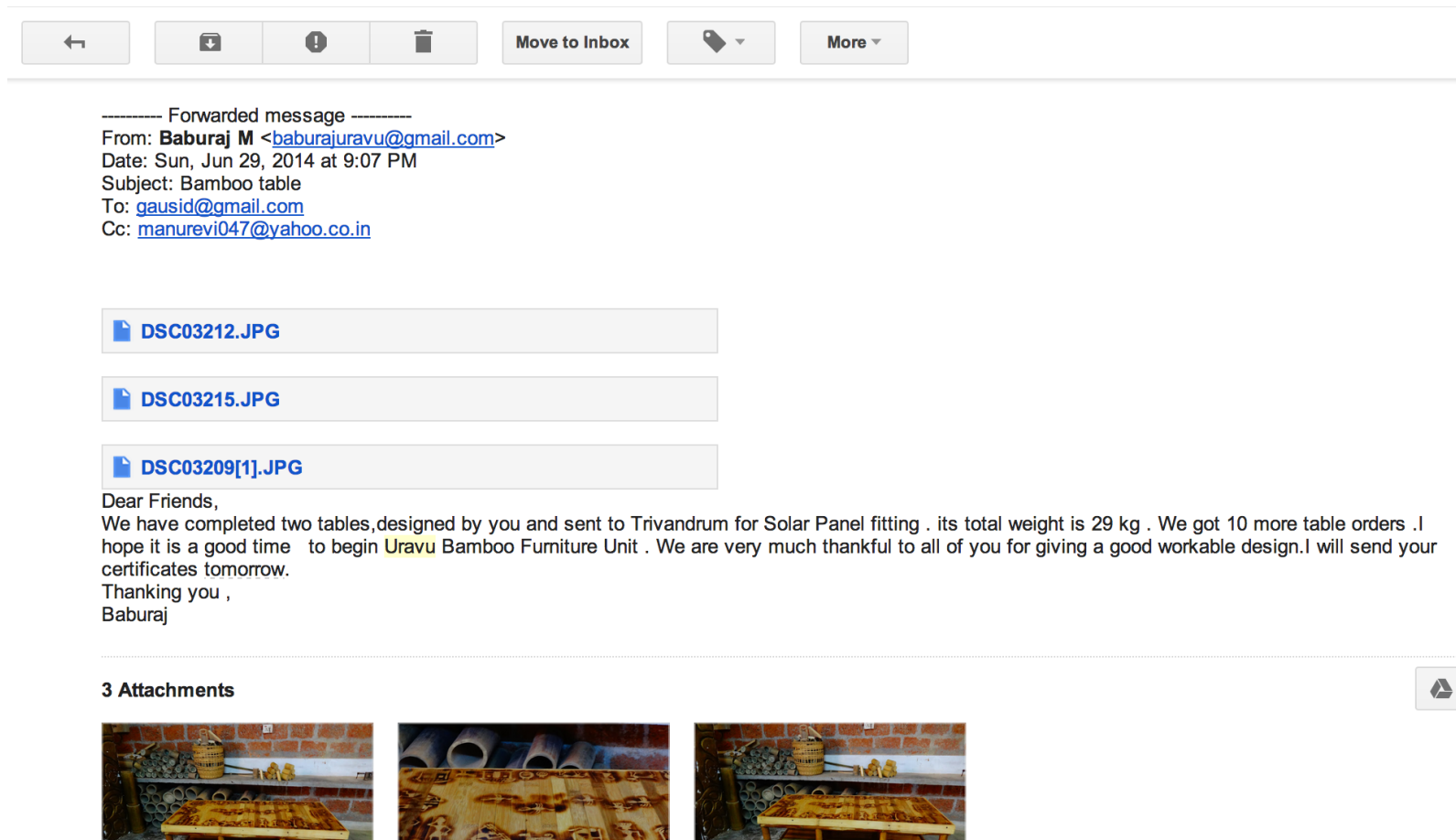
From that spark, came our enthusiasm to understand the issues faced by people in various domains and trying to put some thought into it.

The intern-ship was a platform for us to understand a new material in which we never had prior hands- on experience. It was important for us to understand the material and its properties, physical and chemical, to use it well. We understood how a material could be used in its own various forms and how it affects the entire design. We also learnt the practical difficulties and constraints while working with bamboo.

Uravu, is of-course, a good place to learn about bamboo as well as a good environment to discover yourself. It is definitely a great place to get closer to nature.

The Response From Uravu

The response from Uravu had been sent by mail to us regarding the workstation we designed. The screen-shot of the mail is given below.



The picture showing the mail received from the side of Uravu as response to the workstation design

Bibliography

Uravu <<http://www.uravu.net>> as seen on 04.07.2014

World Environment Day logo <<http://www.ecowatch.com>> as seen on 06.07.2014

Skovby SM101 “Multi-purpose” Small Space Dining Table <<http://www.furniturefashion.com>> as seen on 05.07.2014

Folding Dining Table <<http://www.questushospitality.com>> as seen on 05.07.2014

Bamboo Table <<http://www.s13.zetaboards.com>> as seen on 05.07.2014

Sustainable modern bamboo table <<http://www.hahoy.com>> as seen on 05.07.2014

Sustainable bamboo chairs <<http://www.bamboofurnitureguide.wordpress.com>> as seen on 05.07.2014

Artek Bamboo furniture <<http://www.dezeen.com>> as seen on 05.07.2014

Fastners <<http://www.lesmac.co.uk>> as seen on 05.07.2014

Modern foldable table <<http://www.btooffice.co.uk>> as seen on 05.07.2014

Contacts

Uravu Eco Links Ltd.

&

Uravu Indigenous Science & Technology Study Centre

Thrikkaipetta P.O,

Wayanad Dt. , Kerala State

INDIA- 673577

Phone: 04936 231400

Mobile: 960 5770702

E-mail: uravuecolinks.india@gmail.com

uravu.india@gmail.com

Web: www.uravubamboogrove.com

www.uravu.net

Mr. Baburaj M (President)

Phone: +91 9747075610

E-mail: baburajuravu@gmail.com

Mr. T Shivaraj (Founder, President)

E-mail: sivaraj.uravu@gmail.com

Mr. Manoj Arayamparambil

E-mail: manojkumar.arayamparambil@gmail.com

Mr. Rakesh (staff)

Phone: +91 9947874834