PRODUCT DESIGN PROJECT II

DINING CHAIR IN BAMBOO

for Goan restaurants

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• APPROVAL SHEET

The industrial design project II titled

Dining chair in bamboo for Goan restaurants.

By

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Is approved as a partial fulfillment of requirements for masters in design degree in industrial design centre

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- **CONTENTS**

6. Unique selling propositions . (USP)

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7. PRODUCT BRIEF

8. IDEATION

9. CONCEPTUALISATION

10. FORM EXPLORATION

11. CONCEPT DETAILING

12. FINAL CONCEPT

1. ABSTRACT

The project aims at designing a trendy dining chair in bamboo for goa restaurant.

With the continued rapid development of the global economy and constant increase in population, the overall demand for wood and wood based products will likely continue to increase in the future. The current concern is whether this future demand for forest products can be met sustainability?

This is were thought of using bamboo as a industrial material evoked. As bamboo is the fastest growing biomass, endowed with exclusive, rich, cultural looks it is a suitable material in the soothing place like goa.

For knowing the material better field study at kudal was done. This helped in studding the existing manufacturing processes and joinery details of furniture. At the same time it helped in knowing the system, how bamboo as a material travels from fields to elite class restaurants.

As bamboo is a hollow pipe ,doing joinery in this material is a tedious job. To overcome with this problem other industrial materials like wrought iron is used which has extra advantages in terms of flexibility and joinery. While designing system level considerations are also been thought of. For better

2. INTRODUCTION

Today not only all restaurants but also urban homes and many rural houses are having dining sets in there houses. Dining chair is a everyday life product which we use most of the times in A day while having food. Most of the times these dining chairs are made up of industrial materials like plastic or wood. As increased global warming is a result of cutting trees we should find an alternative for wood

Bamboo is a naturally occurring composite material which grows abundantly in most of the tropical countries. Cellulose fibers are aligned along the length of the bamboo providing maximum tensile flexural strength and rigidity in that direction.

So by combining other complimentary materials and bamboo we can conquer the environmental issues related with extra demand of wood.

Bamboo is a familiar plant from a place like Goa. so using this material for Goan restaurants will give absolutely identifiable feeling to the environment.

3. SCOPE

Bamboo has its own beauty which gives elegant looks, this result in to a calm and soothing environment. As bamboo is earthen material it suits in hotels. In addition with it we can mass produce the furniture's which will reduce the amount of wood used for the same purpose.

But explorative work in bamboo furniture is needed as existing furniture does not give that effective result. Existing furniture in bamboo looks more robust.

Bamboo is a hollow tube, sometimes with thin walls, and consequently it is more difficult to join bamboo than any other material. So there is a opportunity to develop joinery detailing in other industrial materials like wrought iron.

Wrought iron is commercially pure iron. And it is tough, malleable, ductile and easily welded. These properties of wrought iron help making joineries easy.

Enhancing current furniture scenario and giving an appropriate solution for hotel industry using complimenting industrial material like bamboo would further enhance its richness. A well designed and finished chair in bamboo can therefore be positioned as a premium product in niche market. And if this chair has other required functions like stack ability and easy transportation then it has benefits in hotel industries where appearance is a major issue.

4. PRIMARY RESEARCH

The environment-friendly process of bamboo furniture making is increasingly popular in today's decorating world. While being a traditional style in the Asian countries for years, the modern world is finally catching up with this ecological decorating style.

The durability of these furniture is long lasting. Each bamboo stalk used for making the bamboo furniture is chosen especially for its productivity and strength. With an intimate furniture-making process, bamboo becomes a alluring and lasting furniture piece that will be enjoyed for a lifetime.

There are three basic industries where bamboo is used extensively and efficiently.

- Handicraft industry.
- Furniture industry.
- Construction industry.

EXPERIENCING BAMBOO

• Characteristics and applications of bamboo

• Bamboo is a collective name for different species of giant grasses. It is estimated that 60–90 kinds of bamboo exist, comprising approximately 1100–1500 species . These species come in various sizes and forms. Bamboo mainly grows in tropical regions of Asia, Latin America and Africa.

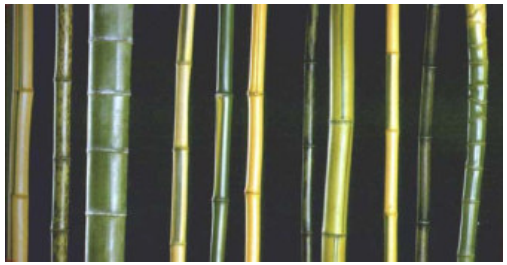


Fig: Various species of bamboo

• Bamboo has a very efficient natural structural design; because of the hollowness and the fibers in longitudinal direction, less material mass is needed than in case of materials with a massive section, e.g., timber. In terms of load-bearing mass, as with all tubular elements, bamboo functions as an I-shaped cross-section, in each direction it is loaded, whereas other cross-sections are most efficient in one or two directions.

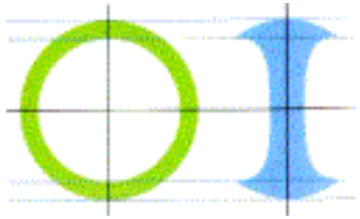
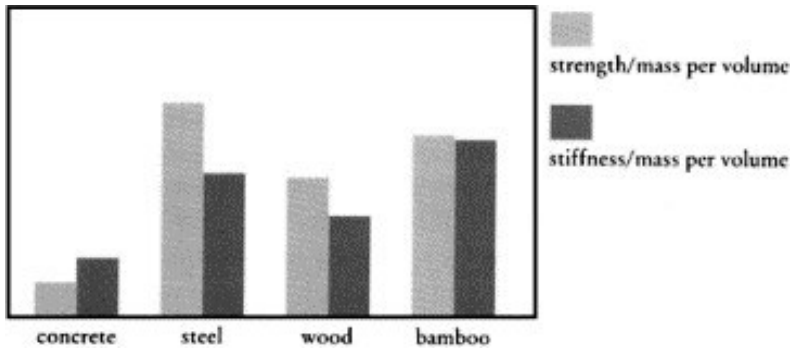


Fig: Cross section of bamboo.

• The efficiency of the natural design of bamboo is also demonstrated , in which the strength and stiffness of various materials are divided by their mass per volume



Comparison of the stiffness and strength of various materials divided by their mass per volume

• Due to the favorable mechanical properties, the high flexibility, the fast growing rate, the low weight and the low purchasing costs, bamboo is a material with many opportunities. It can be used in many applications; from very traditional handicraft (e.g., baskets) to products that are completely industrialized (e.g., parquet and panels)

• Some bamboo species can very well be used in supporting structures as the very high bamboo scaffolds against Eastern skyscrapers demonstrate.

- Bamboo is also used in the paper, food and evidently in the building industry. Especially for the less wealthy population in tropical areas, bamboo plays a very important role in daily lives (shelter, employment, income, fuel, etc.). Recently, bamboo has also found more applications in the West, in industrial applications as well as in temporary structures.

5. DATA COLLECTION

Data collection can be classified into two major parts. In the first part the dining chair was studied to comprehend the basics behind this traditional and every day product. This stage involved researching materials, manufacturing techniques, joinery details and labor work required for bamboo products.

The second stage mainly focuses in the system. How bamboo from fields reaches to the elite restaurants. This journey of bamboo as a material to bamboo as a furniture involves various intermediate stages. Study was focused to make this system work more efficiently and reduce the extra expenses.

5.1 FIELD TRIP TO KONBAC, KUDAL

Photograph showing Kudal in India.

Photograph showing Kudal in Maharashtra.

5.1 FIELD TRIP TO KONBAC, KUDAL

Bamboo is one of the most abundant resources available in the Konkan region, as this area is very much suited for bamboo cultivation and bamboo product development. The main species of bamboo found in the area are Oxytenanthera stocksii, Oxytenanthera monostigma, Bambusa bambos and Dendrocalamus strictus. The nature of bamboo crop varies from moderately dense type to regeneration type. Basic bamboo processing skills are available in the region, and the livelihoods of some of the backward communities are dependent solely on bamboo products.

With the objective of strengthening the bamboo sector in the Konkan region, the Centre for Indian Bamboo Resource and Technology (CIBART) established an office at Kudal in Sindhudurg district in June 2004. The strategic reason for setting up the office in Kudal is its proximity to Goa (tourist destination) and Mumbai (India's business hub).

CIBART also established a Common Facility Centre (CFC) at Kudal in January 2005, with funding support from Development Commissioner (Handicrafts) under the central Ministry of Textiles and technical inputs and guidance from the International Network on Bamboo and Rattan (INBAR). (Please see Annex 1 for Project Proposal on CFC).

– The beauty of bamboo lies in the strong, tall and dignified sections of the stalk, as well as in its straight, smooth, and elegant appearance. Its leaves toss in the wind, yet retain their sternness and sharp edges. Although hollow inside, it has strong joints. It can tolerate severe weather and stay green throughout the year.

– Designing of anything in bamboo starts with selecting the bamboo. It is important to see and feel bamboo on site. Which bamboo is required , how much matured bamboo to take, how to cut the bamboo, all these things are very important for making products.

– When I visited the factory at Kudal I got the opportunity to know about bamboo from the people who have spent there generations living and experiencing this plant.

– Bamboo can be divided into two main types one is sympodial which grows in clumps and another is monopodial which grows singly. Here in Kudal bamboo grows in clusters which is called as bamboo ‘bet’. People who own these ‘bets’ sell these to the organization.

– The head craftsman goes for selection of bamboo. If the bamboo is required for craft purpose then almost 2-2.5 yr old bamboo is preferred. And for furniture purpose they use 3 to 3.5 yr old bamboo . After selection bamboo is cut in such a way that tender bamboos should not get damaged

A bamboo in its early period of life is normally dark or deep green in colour. The colour starts changing as it matures over three or five years . As it grows it turns from deep green to yellow . Bamboo is generally ready to use for furniture's when it is 2.5 to 3 yrs old.

The cutting season of bamboo Is in winter, from October to May. New bamboo shoot sprouts only in monsoon season from June till September. Cutting of bamboo is avoided in monsoon to prevent damage to new shoot while cutting.

– mainly three types of bamboo are available.

1. Chiva (Dendrocalamus strictus).
2. Maanga (Oxytenanthera stocksii).
3. Kanak (Bambusa arundinasia).

5.2 CURRENT METHODS:

Current method of using bamboo for furniture purpose include following steps:

1. Sorting:

   In this method bamboo is been sort according to its age , type, and diameter.

2. Drilling:

   After sorting out bamboo is drilled near every node. This allows chemical to spread inside the hollow portion.

3. Treatment:

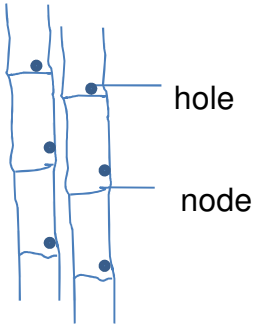
Water- air removing

First they do vacuumed process to remove air from bamboo.

Then they use pressure treatment for chemical to spread all over.

Two hours after processing they remove bamboo and keep it for drying. It takes almost a month for bamboo to dry.

After drying stacking of bamboo is done according to type and diameter of a pipe.

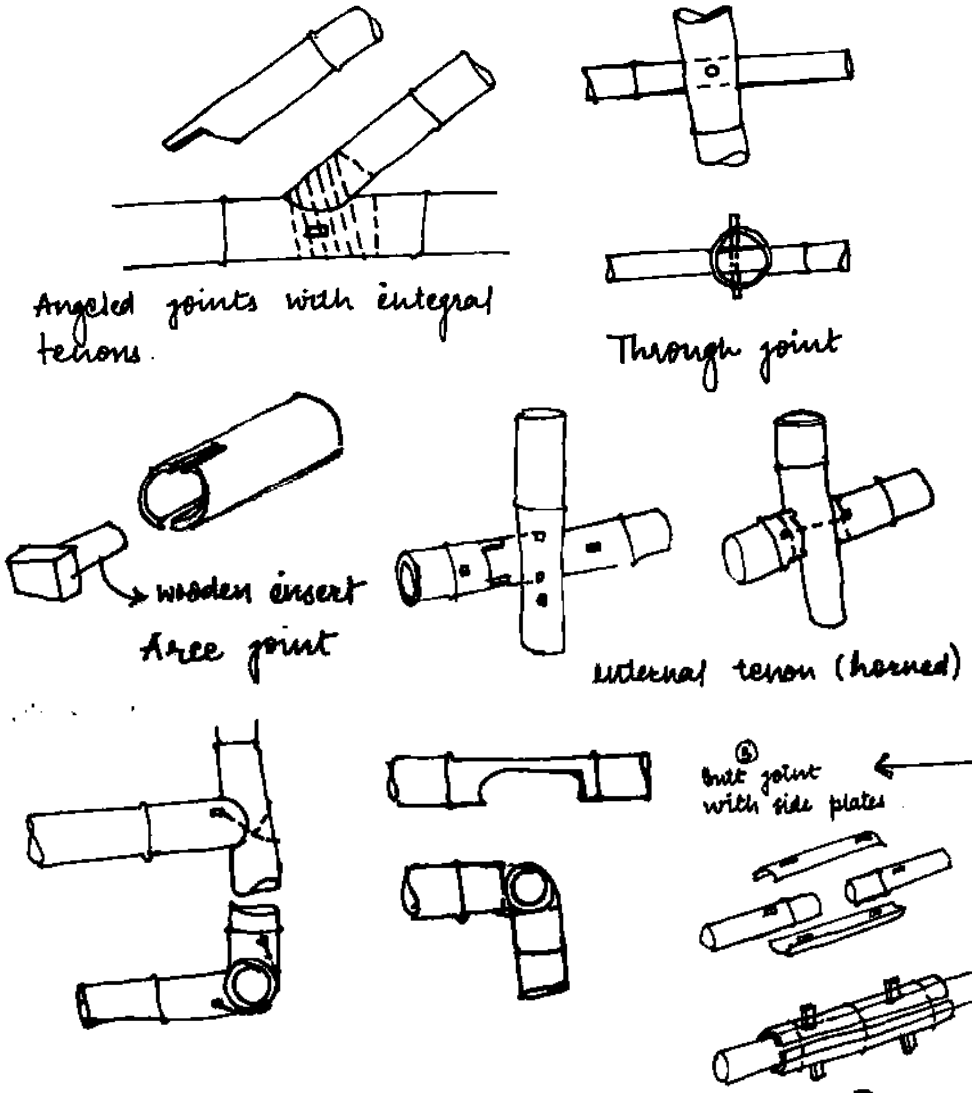


5. 3 EXISTING FURNITURE AT KUDAL

The adjutant image board shows the existing furniture manufactured at KONBAC. The range of furniture varies from kitchen, living room to dining room.

– There are various designs of dining chairs, sofa sets, beds, stools and dressing tables exist in there exhibition space.

– As we can see, though all these chairs are made up of full bamboo it does give the feeling of tough nature.



5.4 EXISTING JOINERY DETAILS USED IN FURNITURE:

– Most of the joinery details I saw were right angle with each other. Though the joints were strong they were not aesthetically appealing.

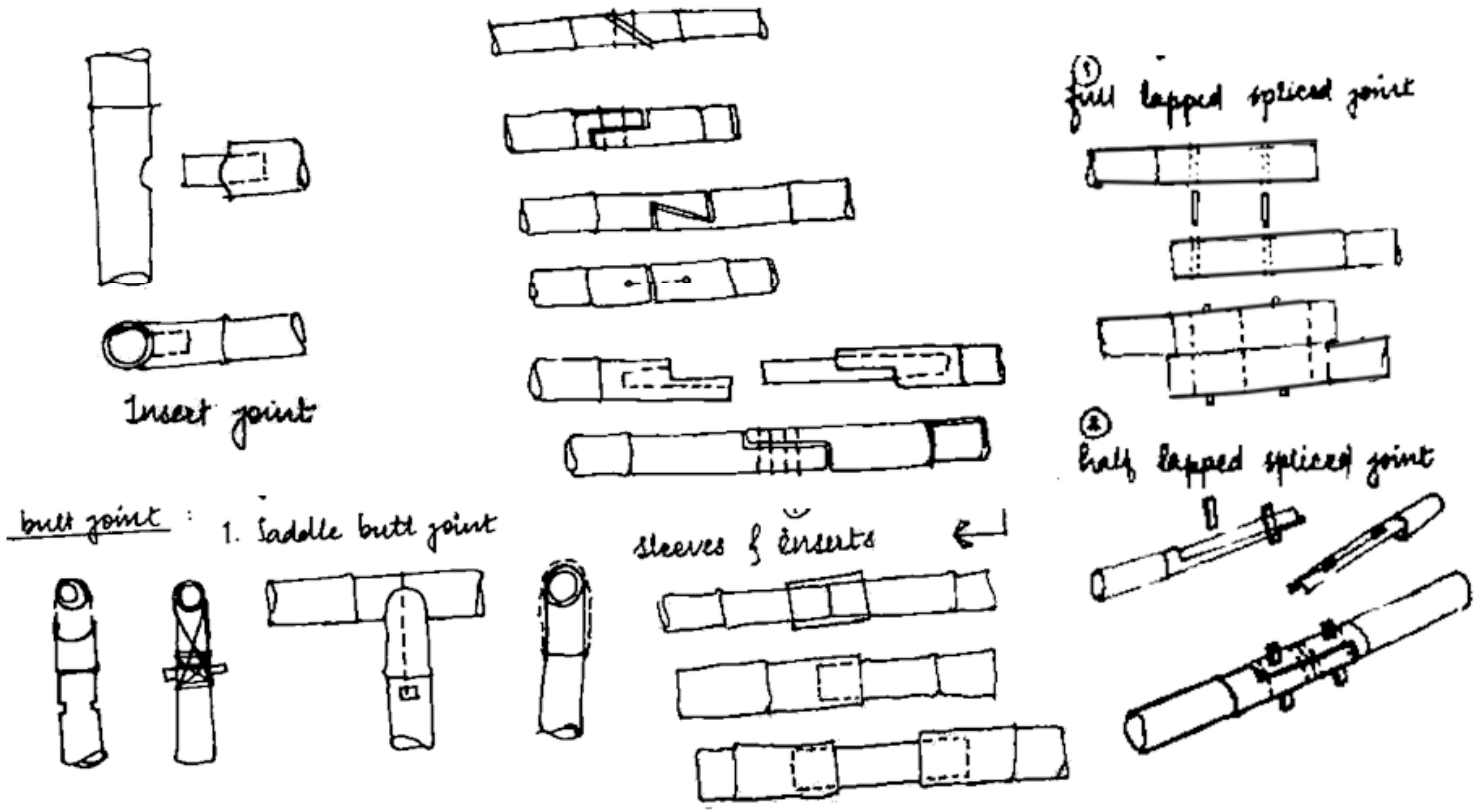
– Most of the furniture's had cane rapped around the joints to hide unfinished joints.

– As nailing causes splitting and notching, drastically reducing the strength of a bamboo lashes are generally used as binding elements in framing.

– Soft galvanized wire is also used for binding. When bending, bamboo can be kept from splitting by boiling or steaming and bending it while hot.

– The joints are made by drilling holes and inserting a bamboo bar (bamboo pins).

5.4 EXISTING JOINERY DETAILS USED IN FURNITURE:



5.5 Problems they are facing with production

- Lack of treatment plants:

  Though KONBAC has one bamboo treatment plant in there workshop, it is not enough for the existing demand of production.

- Telescopic growth of bamboo

  Telescopic growth of bamboo doesn't provide equal thickness through out so there is a need of cutting more than one bamboos for making a chair with equal leg thickness.

- Joineries of bamboo:

  Most of the joinery are exposed and as it is in bamboo material it looks robust. For hiding these kind of joints they use cane as a rapping material which consumes additional time and extra labor work.

- Existing cost of a product is 3000-3700 which is comparatively high for the impression that chair offers.

- Lack of skilled labors.

  Though people from Kudal has bamboo crafts as a traditional business, most of the younger generations are not aware of their predecessors' skills.

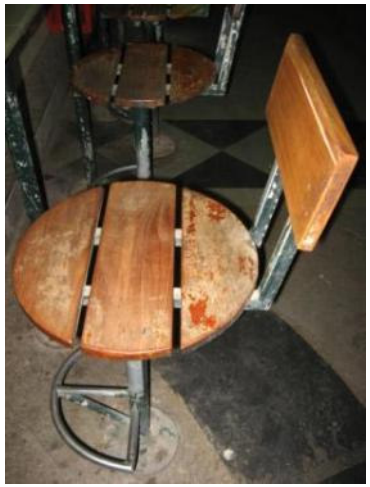
5 b. SYNCHRONIC ANALYSIS




- **Existing dining chairs in restaurants:**

– (middle class restaurants)

- For getting an idea of what kind of dining chairs are there in market I went out and studied almost 37 types of chairs in different restaurants.
- Most of these restaurants were for middle class people. The chairs in these kind of restaurants were very much common in looks.
- Most of them were made up of wood for getting distinguished looks , and most of the seats were made out of foam with either Rexene cover or thick cloth covers.
- some chairs had rubber bushing to their legs as it spoils the floor surface.
- Not a single chair had hand rest but some of the chairs had foot rest.



- **Existing dining chairs in restaurants:**

- Existing furniture in Indian restaurants (middle class restaurants)

List of some of the restaurants:
Mokas
Café Coffee Day
KFC
Pizza Hut
Mc Donald's
Subway

- **Existing chairs in restaurants:**

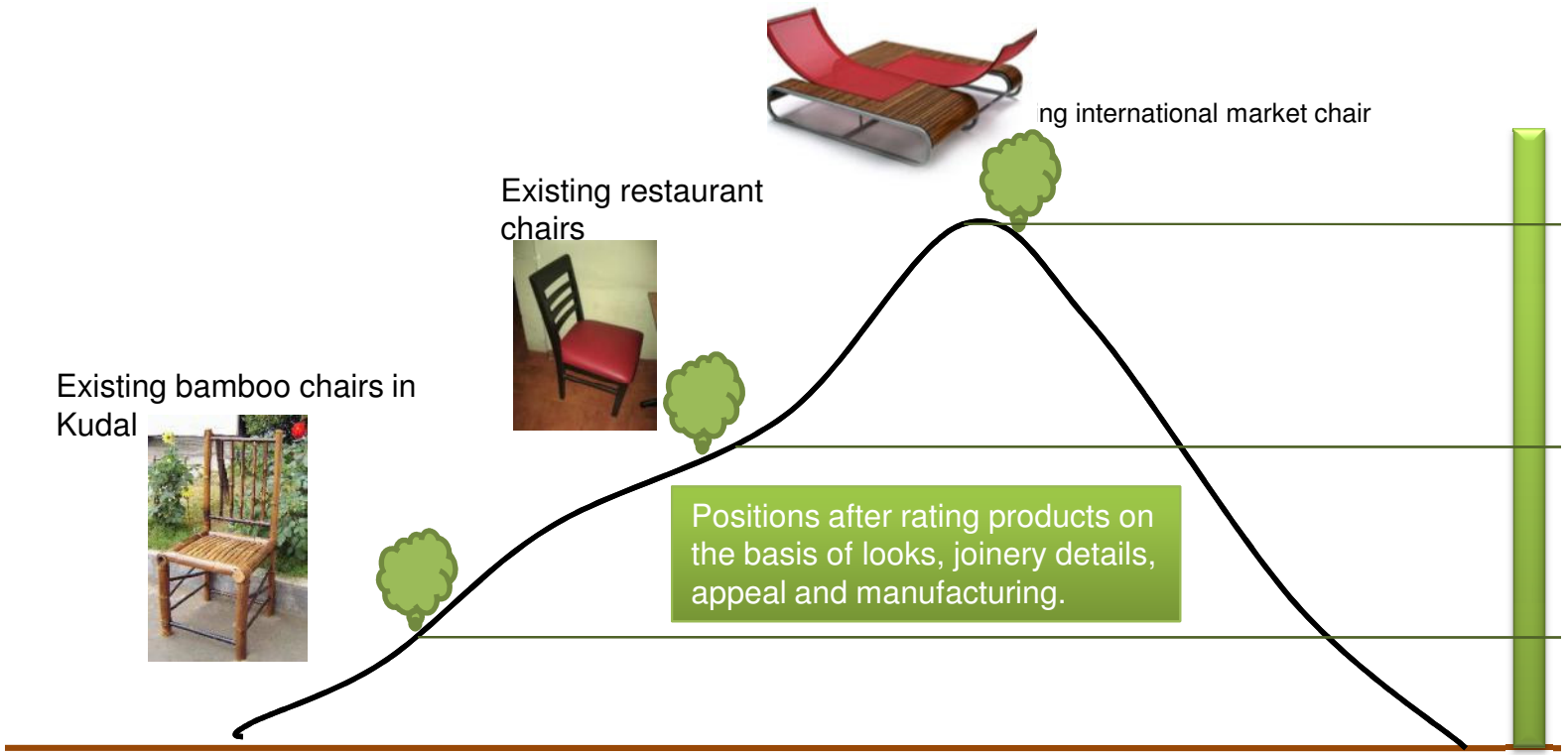
– Elite class restaurants

Furniture in elite class restaurants were mostly made out of exclusive materials like cane and vicker. These furniture's were unique in there own form and overall appeal. The fine workmanship and incredibly done joinery adds into the beauty of the product.

- **Existing chairs in international market:**

  - This image board shows bamboo furniture developed internationally, here we can see the use of bamboo with various complimenting industrial materials. These exclusive, stylish furniture looks elegant because of well finished materials and precisely done joinery details.

- **GRAPH OF EXISTING FURNITURE:**



How to raise the position of existing bamboo chair in terms of all aspects???

5c. WHY DINING CHAIR???

– The decision of selecting dining chair for this project is an outcome of analytical approach adopted which led to selection of dining chair. It involved following steps

– Use of bamboo as a industrial material.

– Feedback from the KONBAC.

– Interviewing restaurant staff owner and users.

– Expectations from project.

Feedback from the KONBAC

Furniture made by KONBAC is very robust in looks, they were looking forward to sell their products in international market.

The existing furniture made by KONBAC is not stackable and its very expensive in terms of transportation because of these disadvantages demand of products is not increasing.

They were looking at some stackable furniture which will help them to reduce the transportation cost and which will take lesser area for functioning.

Interviewing restaurant staff, owner and users.

For taking interviews I selected various restaurants in the city. It include some middle class and elite restaurants also. When I started with my interview I came with very shocking insides. One of which was wrong perception of bamboo. Most of the people were not able the differentiate between cane and bamboo.

owners point of view

Most of owners who were aware of bamboo furniture said bamboo is not a kind of material which will go with our style of interiors. According to them bamboo gives very unfinished and robust look.

If its not stackable then creates problem for storage. While cleaning the floor everyday is very disturbing.

Cushioning gets dirty very easily and is not possible to change it every 2-3 months because of cost.

Users who were not aware of bamboo furniture was shown pictures of bamboo furniture made by KONBAC and some other international manufacturers some of them were worried about cost and some of them were strongly apposing about looks.

Customers point of view

Few people who have seen bamboo furniture in exhibitions and few show rooms they were very happy with the idea of using bamboo for restaurant furniture's but the only thing they were worried about was the feel and look of the material.

Few other complains they give me from existing dining chairs in different materials are as follows :

After sitting on a chair its very difficult to pull it ahead.

It creates noise.

It was too cold as ac was on and chair was made up of steel

There was no provision for keeping my hand on chair so I keep disturbing a person next to me by keeping my hand on table.

All those plastic chairs look boring and monatomic.

Sometimes the cushions are very dirty

They are very stiff and not wide enough to make one self comfortable.

User perceptions about chair:

It should be light weight and stable.

Consideration should be taken in to account that if its been used in ac areas material should be properly chosen.

It should create soothing and comfortable atmosphere.

It should be stackable

Should be designed in such a way that cushions can be removable.

Should be ergonomically considered.

A restaurant chair should be so well designed that it should not create noise.

Expectations from project:

Exploring bamboo as a material and using it with other complimentary materials. More learning of form and expressions. Working on joinery details.

• Use of bamboo as a industrial material

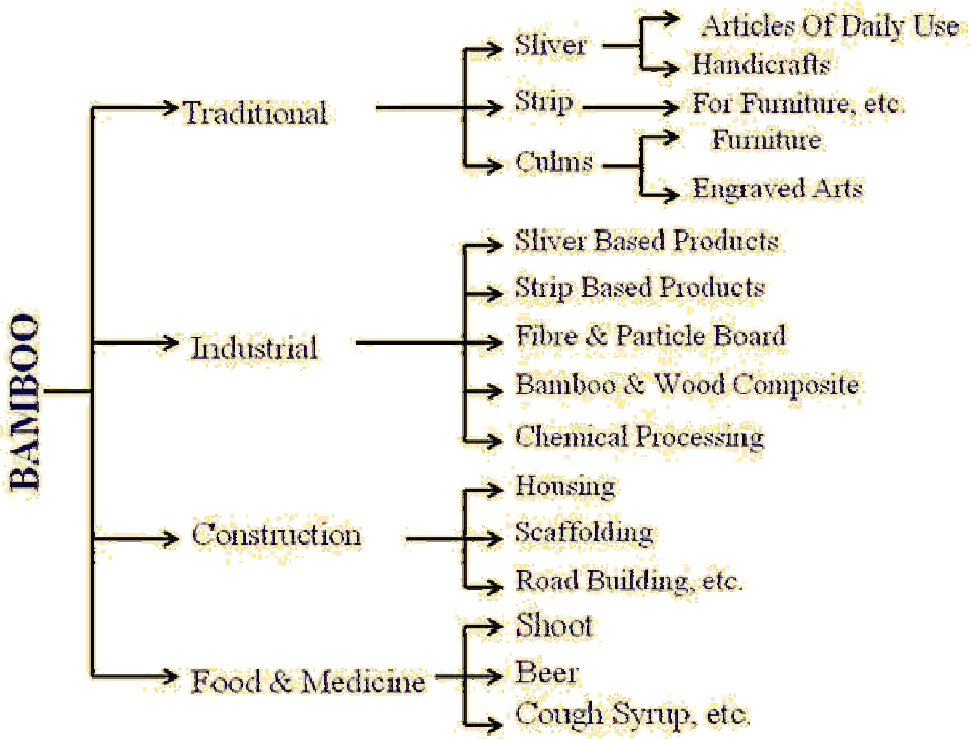
According to a FAO (food and agriculture organization) global outlook study on the trends of demand for wood products, there will be an increase in demand of the order of 20% by 2010. Such huge requirement of wood can lead us to increase environmental imbalance.

Over 1200 bamboo species have been identified globally. Bamboo has a very long history with human kind.

As a cheap and fast-grown resource with superior physical and mechanical properties compared to most wood species, bamboo offers great potential as an alternative to wood. Since bamboo species are invasive and spread very fast uncared bamboo species also cause environmental problems. Increased research during the recent years has considerably contributed to the understanding of bamboo as well as to improved processing technologies for broader uses.

Bamboo is also one of the oldest building materials used by human kind. It has been used widely for household products and extended to industrial applications due to advances in processing technology and increased market demands.

- **DIFFERENT USES OF BAMBOO**



WROUGHT IRON:

Using only bamboo for entire product was not a difficult task but bamboo as a material has some restrictions for overcome this problem wrought iron is used as a complimentary material

Wrought iron is commercially pure iron. In contrast to steel, it has a very low carbon content. It is a fibrous material due to the slag inclusions (a normal constituent). This is also what gives it a "grain" resembling wood, which is visible when it is etched or bent to the point of failure. Wrought iron is tough, malleable, ductile and easily welded.

Examples of items that used to be produced from wrought iron include: rivets, chains, railway couplings, water and steam pipes, raw material for manufacturing of steel, nuts, bolts, horseshoes, handrails, straps for timber roof trusses boiler tubes, and ornamental ironwork.

- **ABOUT GOA**

GOA

People from Goa are known as 'Goans'. This identity is enough to tell the difference especially in their lifestyle. The 450 years' rule of the Portuguese has added a new dimension by introducing their religion, belief, customs, attire, festivals, education, literature, modes of entertainment, and behavior. A lot was absorbed and molded into tradition and incorporated into lifestyle.

In villages, during festivals, the whole village takes part irrespective of caste or religion and becomes a big family. Food is their love. Pao, the bread, is ubiquitous throughout Goa. A gift of the Portuguese, pao has become an essential part of food habit. Fish is another favorite and a must in a goan's plate. Sea-food is a specialty.

Goa's famous contribution is fenny, the drink prepared from the cashew apple. Fenny preparation is in fact a cottage industry in Goa. In villages, fenny is prepared in many a house.

Dance and music is in their blood and traditions. There are almost 40 lovely Beaches in Goa. Most of them are pollution free. The Most developed beach segment is the Calangute, Baga, Anjuna belt in the Bardez subdivision, north of Panaji. The beautiful and untouched beaches in the Goa signify relaxed and calm life.

Goans love spaciousness and nature. Their houses reflect their nature the best way. Come and stay in Goa as a dear guest. You will never know when you have become a member of a family. Goans. In short goa is a inviting city for all.

Some keywords I got, after asking various people what they think about goa are:

Beach, fish, churches, alcohol, boat, coconut tree, culture, slopping roofs, water, shells, etc.

Some emotions people have about GOA in their mind are:

Relaxed life, enjoyment, celebration, party, fun, chill out place, freedom, colors, religious, etc.

COLORS OF GOA

- **Colors of Goa:**

Colors of goa can be described in 3 S's : sand, sea and sky. These three essentials creates soothing environment in goa. Goa is a place which has all earthy colors in its soul, but there are bright colors also in environment which adds in to its beauty.

lovely nature and loving the nature are the part and not only part but heart of goa. bamboo with its nature friendly characteristics and graceful colors adds in natural beauty of this place.

• HISTORY OF A CHAIR:

The chair is of extreme antiquity. Although for many centuries and indeed for thousands of years it was an article of state and dignity rather than an article of ordinary use.

Committees, boards of directors, and academic departments all have a 'chairperson'. Endowed professorships are referred to as chairs. It was not, in fact, until the 16th century that it became common anywhere.

The chest, the bench and the stool were until then the ordinary seats of everyday life, and the number of chairs which have survived from an earlier date is exceedingly limited; most of such examples are of ecclesiastical or seigniorial origin. Our knowledge of the chairs of remote antiquity is derived almost entirely from monuments, sculpture and paintings. A few actual examples exist in the British Museum, in the Egyptian Museum at Cairo, and elsewhere

In ancient Egypt chairs appear to have been of great richness and splendor Fashioned of ebony and ivory, or of carved and gilded wood, they were covered with costly materials, magnificent patterns and supported upon representations of the legs of beasts or the figures of captives. The earliest known form of Greek chair, going back to five or six centuries BC, had a back but stood straight up, front and back. During Tang dynasty (618 - 907 AD), a higher seat first started to appear amongst the Chinese elite and their usage soon spread to all levels of society. By the 12th century seating on the floor was rare in China, unlike in other Asian countries where the custom continued, and the chair, or more commonly the stool, was used in the vast majority of houses throughout the country.

In Europe, it was owing in great measure to the Renaissance that the chair ceased to be a privilege of state, and became a standard item of furniture whoever could afford to buy it. Once the idea of privilege faded the chair speedily came into general use. We find almost at once that the chair began to change every few years to reflect the fashions of the hour.

The 20th century saw an increasing use of technology in chair construction with such things as all-metal folding chairs, metal-legged chairs, the Slumber Chair, molded plastic chairs and ergonomic chairs. The recliner became a popular form, at least in part due to radio and television, and later a two-part. The modern movement of the 1960s produced new forms of chairs: the butterfly chair, bean bags, and the egg-shaped pod chair. Technological advances led to molded plywood and wood laminate chairs, as well as chairs made of leather or polymers. Mechanical technology incorporated into the chair enabled adjustable chairs, especially for office use. Motors embedded in the chair resulted in massage chairs.

WHAT IS A DINING CHAIR ?

A chair is a kind of furniture for sitting, consisting of a back, and sometimes arm rests, commonly for use by one person. Chairs also often have four legs to support the seat raised above the floor.

– Dining chair is a kind of furniture which helps in the act of eating dine by supporting body.

- **What is chair???**

– - views of well known people

- . “A funny thing about a Chair: You hardly ever think it's there. To know a Chair is really it, You sometimes have to go and sit.”
- *–“The Chair,” Theodore Roethke*

- Sitting in a vintage Gideon Kramer Ion chair makes me understand why design connoisseurs obsess about chairs. This simple object—a seat with a back and four legs—virtually transports me to the restaurant at the top of the Space Needle during the 1962 World’s Fair, for which the chair was designed.

Reinterpretations of classic chair styles, such as the simple, straight-lined Biedermeier are always in vogue. This style was built for the middle classes of Austro-Hungary in 1805-1850.

•QUERY AND COUNTER

–**Why** bamboo???
(for reducing demand of wood : **environment concern**)

–**Where** bamboo???
Craft
Construction
Furniture
(I want to explore this particular expanse because furniture in bamboo can replace wood to a certain extent and can give exclusive results.)

Types of furniture used in different areas:
Corporate office interior/ exteriors
Residential interiors / exteriors
Restaurants, hotels, resorts, interiors/exteriors

–Why restaurants:
mass production
material looks and feel is suitable for this place.

–**Which** place???
GOA: viability of **available material** in konkan region

familiar material and traditional craft business.

exclusive **rich cultural looks** of materials.

- **EXISTING DINING CHAIRS IN CONTEMPORARY MARKET**

Existing dining chairs in contemporary market are very classic. Generally all dining chairs come with dining tables as a hole dining set. Most of the times these dining sets are theme based.

Materials and manufacturing processes used for these dining chairs are very advanced. Generally there more than two materials used in making these chairs.

- **EXISTING DINING CHAIRS IN CONTEMPORARY MARKET**






- **EXISTING DINING CHAIRS IN CONTEMPORARY MARKET**

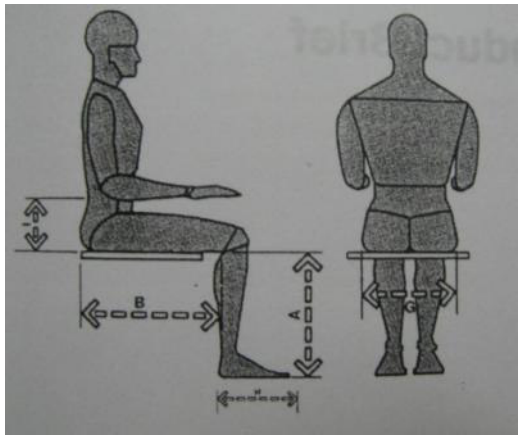
- **EXISTING DINING CHAIRS IN BAMBOO**

- **ERGONOMICAL CONSIDERATIONS**

- **Existing chair data:**

– After analyzing various types of dining chairs I got following data about each part of the chair . Following table contains lowest and the highest dimensions.

feature	observations
Adjustability	Not a single chair was adjustable
Seat height range	30cm- 70cm
Backrest	15cm- 50cm
Seat depth	3cm- 9cm
Weight	500gms- 4.2kg
Surfaces	Tiles, carpets, wooden flooring, vitrified tiles, plastic mats
Stability	Heavy chairs were more stable Light chairs were unstable



	Dimensions (combination)
A. Popliteal	409mm
B. Buttock	451mm
I. Lower lumbar	100mm
G. Hip breadth	326mm
H. Foot length	244mm

Ergonomical considerations:

The thighbones are attached to the pelvic bone by means of ball joints and actuated by very complex arrangement of muscles. It is very important to sit in such a way that the freedom of movement at this joint is not seriously compromised.

When sitting in standard chairs you are effectively sitting on the muscles which move the thighs, thus severely restricting their freedom of movement,

The problem can be solved by sitting on chairs and benches, which are lower, or by using footrests. It is better to sit on hard surfaces rather than on cushioned surfaces.

Fig a: in a standard chair the thighs make intimate contact with the chair, restraining free movement of muscles.

Fig b: by limiting contact of the thighs with the chair the legs can be made more active and postural balance can be achieved.

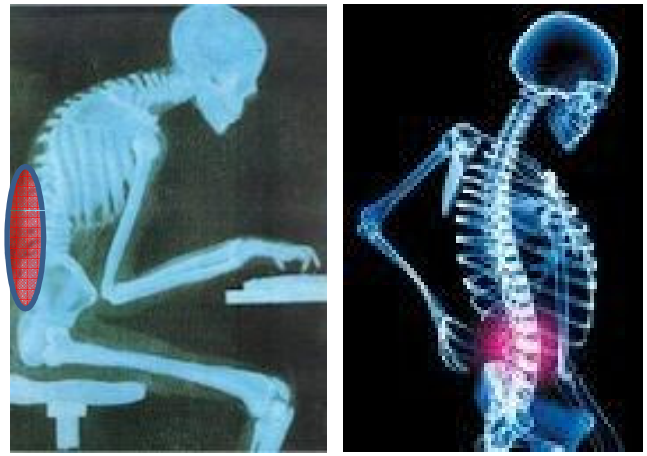
Fig c: soft cushions will prevent free movement of muscles. But for the short time span (30 mints to 1hour 30 mints) it can be relaxing.

Fig a fig b

fig c

- **Ergonomical considerations:**

To clarify what makes a chair ergonomic, one must relate the chair user to his or her work setting, and then explore how the chair can enable the user to make the best of the environment.



Picture showing area of limber support

Feature of the chair	How to treat?
Chair recline or tilt :	This changes the angle of the entire seat relative to the floor. As with angled backrest a reclined chair transfers some upper-body weight to the backrest of the chair
Lumber support :	This is intended to prevent, to the extent possible, the flattening of the lumbar spine that occurs in most people when seated. Lumbar support is usually done through gentle curves in the backrest shape.

- **STACK ABILITY**

STACKABLE CHAIRS :

Dining is a place where family and friends gather for having nice food many a times it happens on special occasions. So The dining room furniture chosen should be welcoming. When the room feels comfortable, looks stylish and accommodates all your guests, every meal you eat there will feel like a celebration.

Restaurant furniture has come a long way over the years, but one thing remains the same and that is 'dining chair'. Restaurant chairs will always be needed in large quantities for various purposes. The versatility of restaurant chairs is immediately seen; they can be used in reception areas, waiting rooms, indoor dining rooms and conference rooms etc.

The great thing about stacking chairs is that when they are not in use, they are easy to store out of the way. An accessory to pick up with stacking chairs is a chair cart. With a chair cart, we can move your stackable chairs from one place to other easily.

- **EXISTING STACKABLE DINING CHAIRS IN CONTEMPORARY MARKET**

6. Unique Selling Proposition

The observation from the field study were analyzed and intentionally extract key points that would form the overall framework of the product. This in turn led to formulation of a product brief with a strong Unique Selling Proposition.

USP – a stackable dining chair in bamboo for Goan restaurants.

7. Design brief:

The main aim of the project is to develop a outdoor dining chair for Goan restaurants which will solve the issues related to transportation and stack ability.

The product will have following features :

A. Material for the dining chair which will be prominently visible would be bamboo.
B. Use of other materials like wrought iron, cane strips , etc.
C. Minimum joinery for reducing the time of manufacturing and as skilled labors are not available these kind of details will take less time for learning.
D. Dining chair will have functions of stack ability which will help in storing furniture while it is not in use.

The product aims at eco-friendly outdoor dining chair which will suit the Goan environment.

The target market for the product will be Goan beach outdoor restaurants.

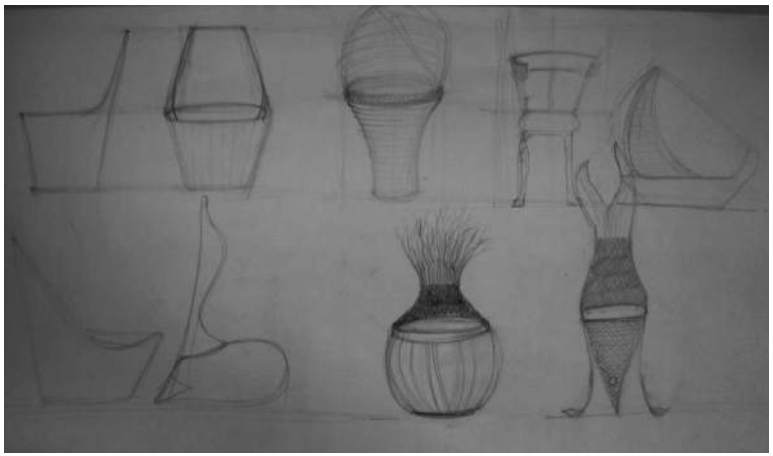
8. IDEATION

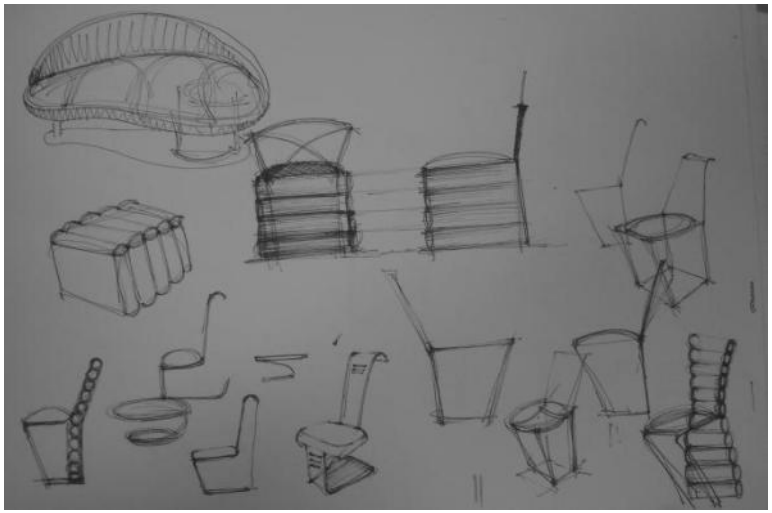
- **Ideation and concept generation:**

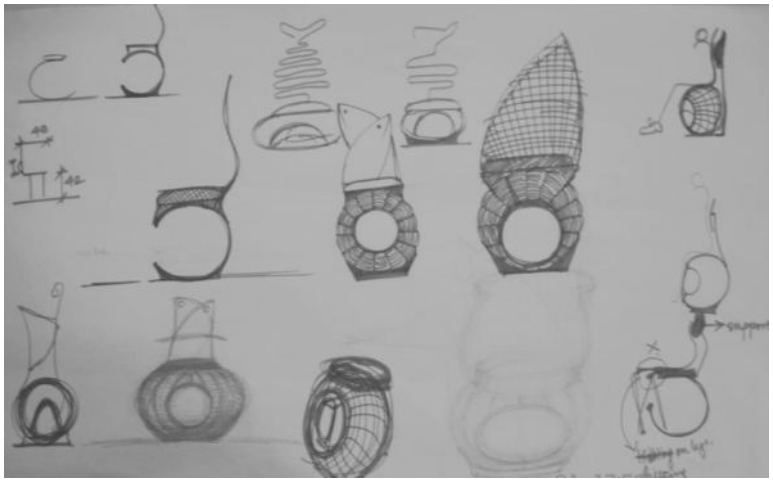
– In very early stages various ideas were made for designing a dining chair excluding all the restrictions related with materials, joineries and brief specifications. Various existing dining chairs were studied and made an image board for fixing the baseline of the product. Various metaphors were used considering the fact that the chair will be placed in Goa. There were many metaphors used from Goan culture, one of which was fish. As fish is a basic food of goa it has become an identity of that place, many restaurants are famous for sea food so fish was the first metaphor used and explored.

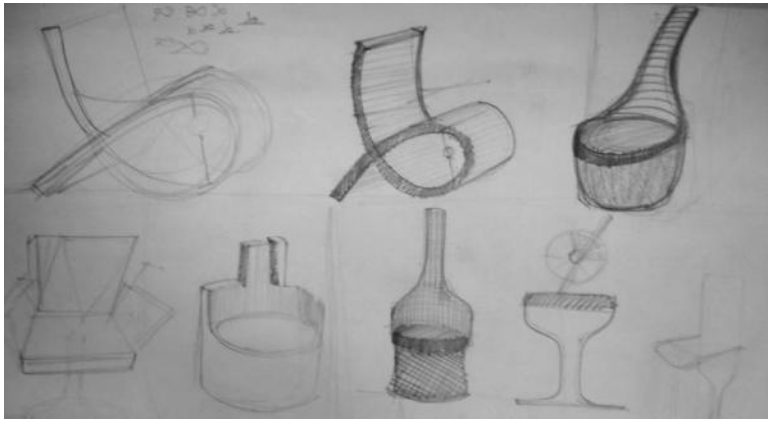
– Following sketches shows some of the very first ideations were full bamboo is used for making chairs . Few sketches shows other materials used for joinery and strength purpose.

- **Initial ideation :**









- **Initial Ideation**
- initial ideation was made considering goa in mind in this ideation existing research on goa gave me different ideas and analogies.
- Few ideas were generated from the keywords of goa.
  For example fish, wine glass, boat etc.

- **EXPLORATORY MODELS:**





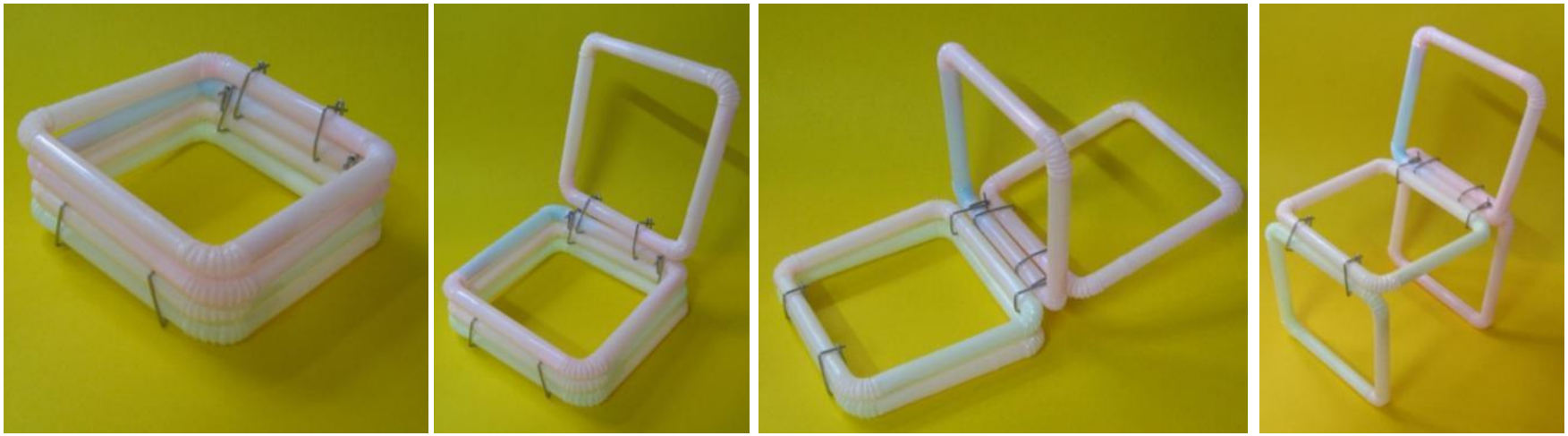


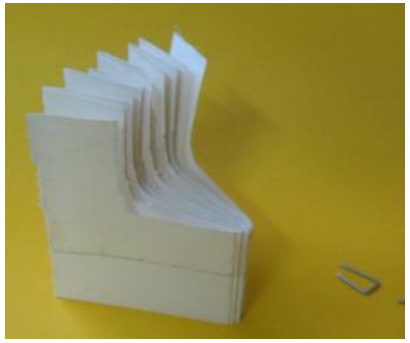
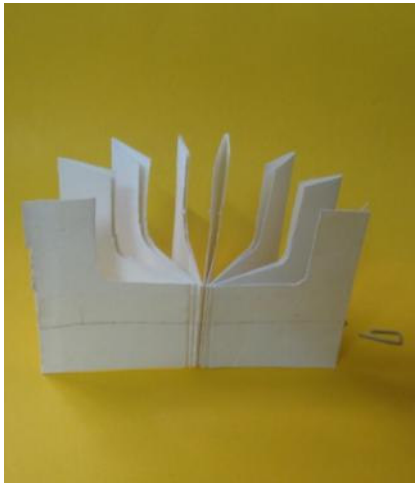
- **EXPLORATORY MODELS:**



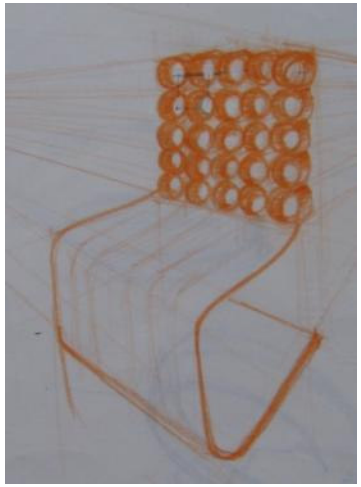



- **EXPLORATORY MODELS:**




- **SECOND STAGE IDEATION**

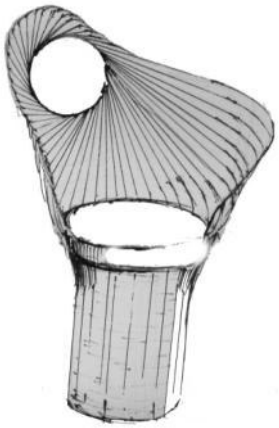


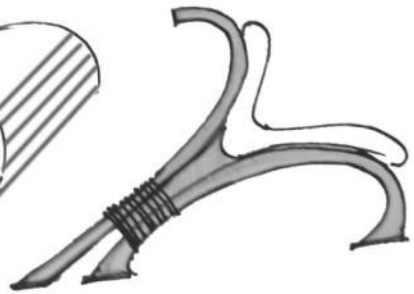
Second stage ideation was done specifically concerning product material. Various forms of bamboo were explored for making innovative looks and techniques.

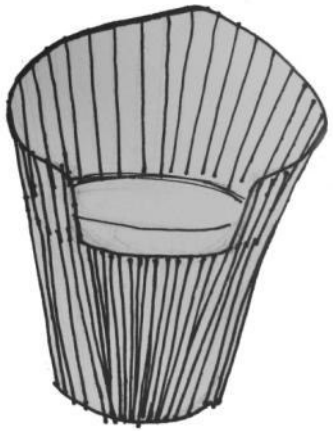
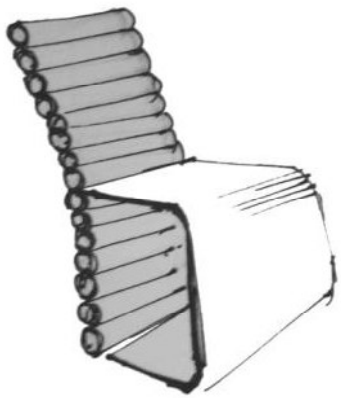
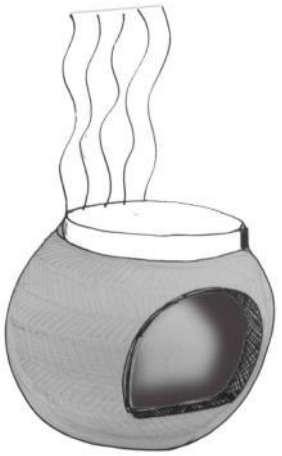
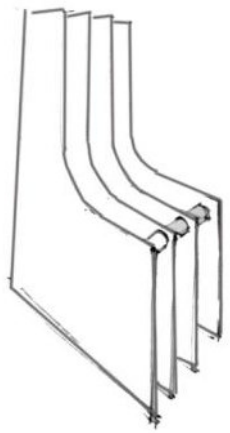
In this ideation bamboo in its various forms like tube, plank, ply, and strips was explored.

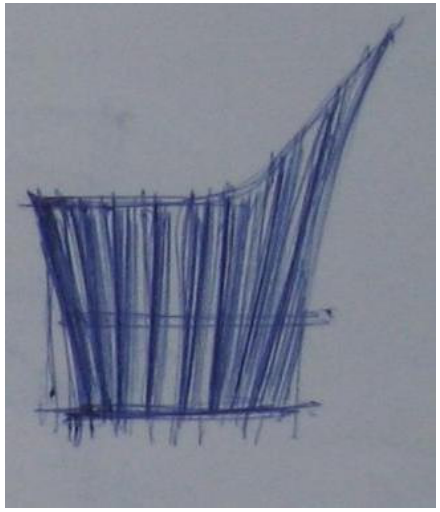
In few designs, bamboo as a cladding material and in few designs bamboo as a structural strength giving material was used.

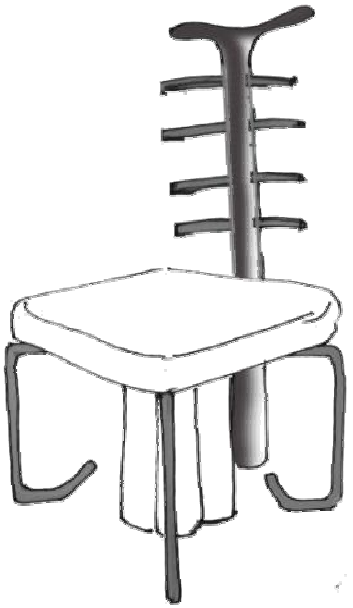
To overcome with the problems like telescopic growth of the bamboo use of small bamboo rings were introduced as a idea.

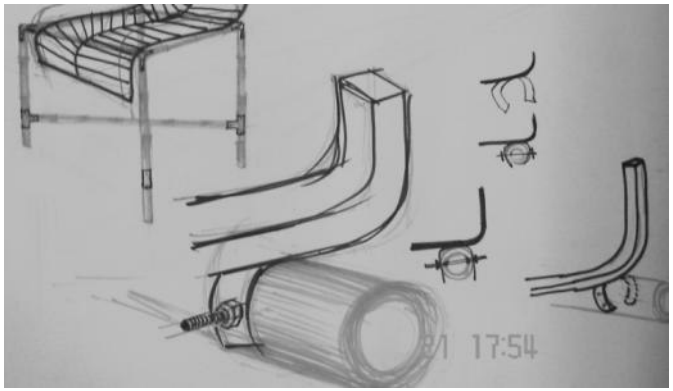






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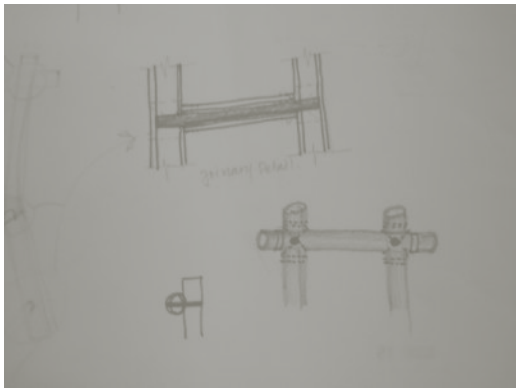
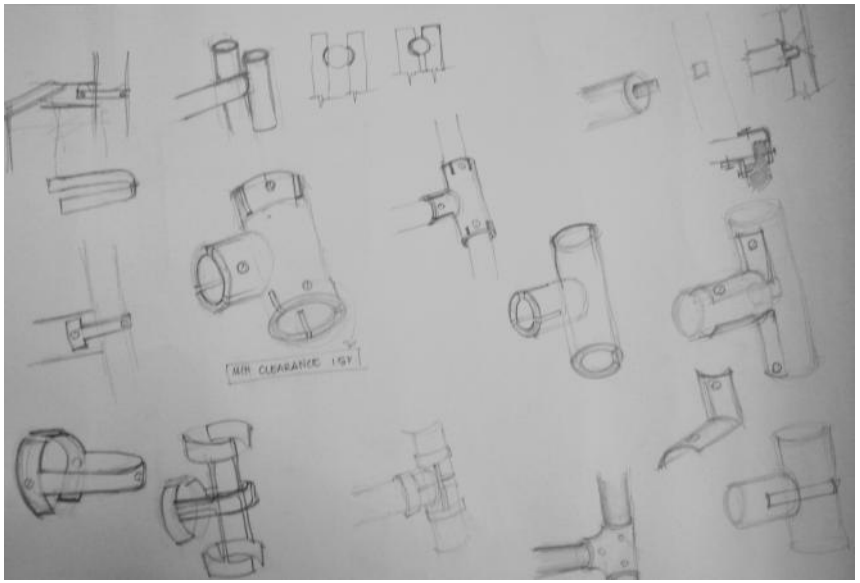
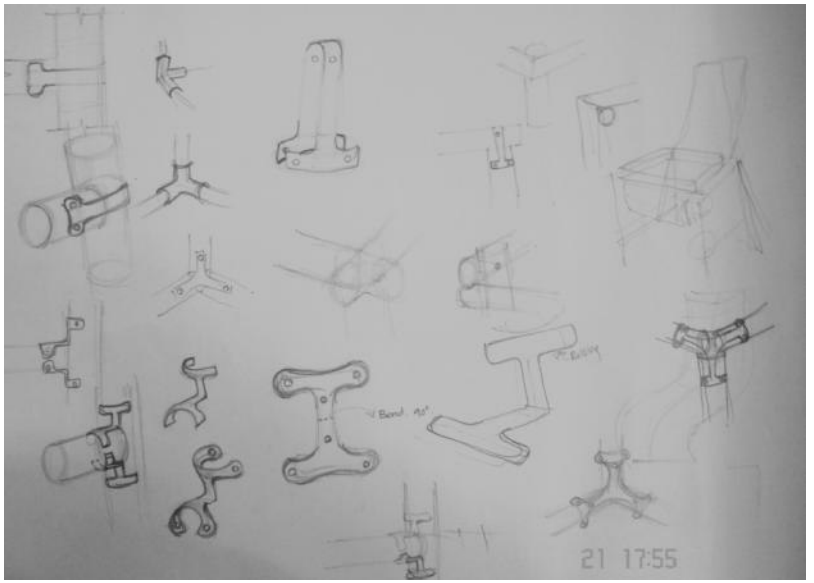



MIN CLEARANCE 150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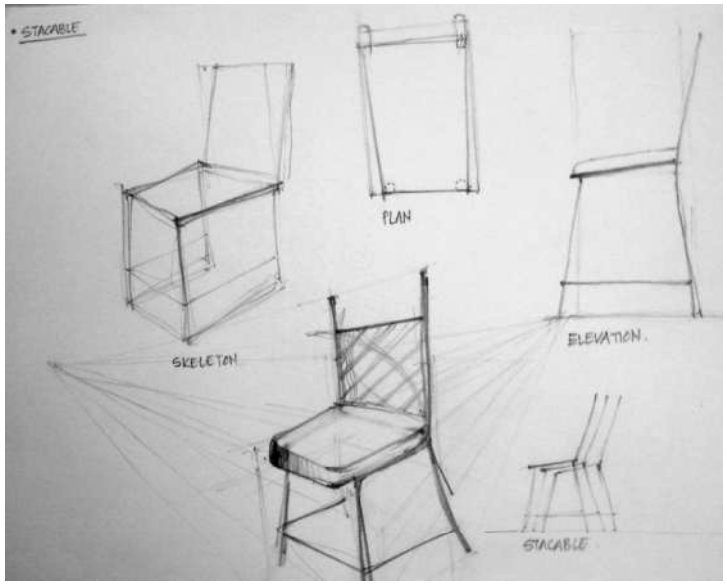
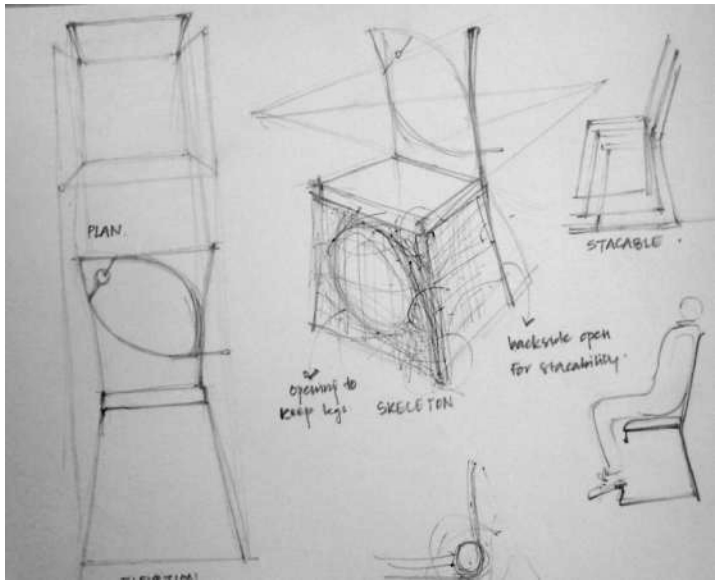
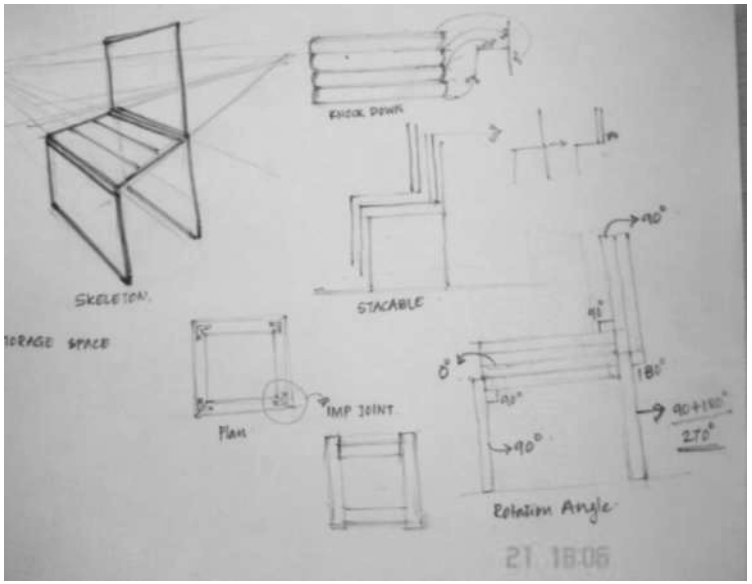
• THIRD STAGE IDEATION

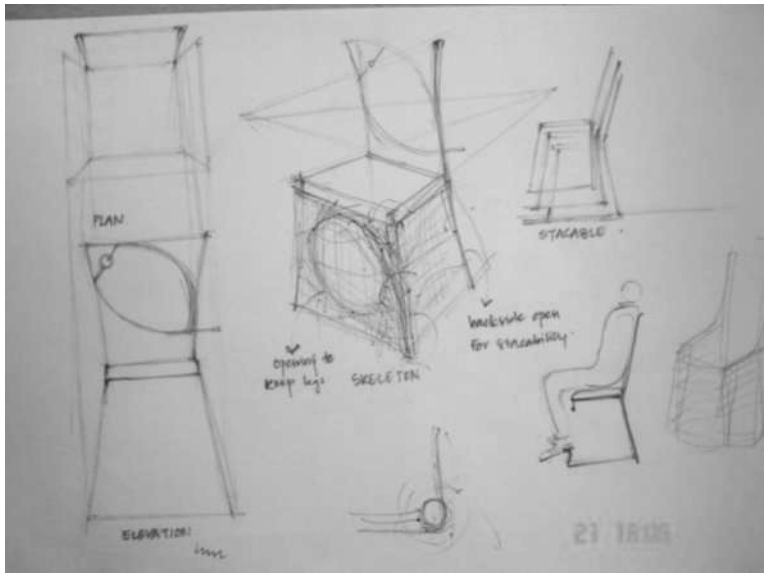


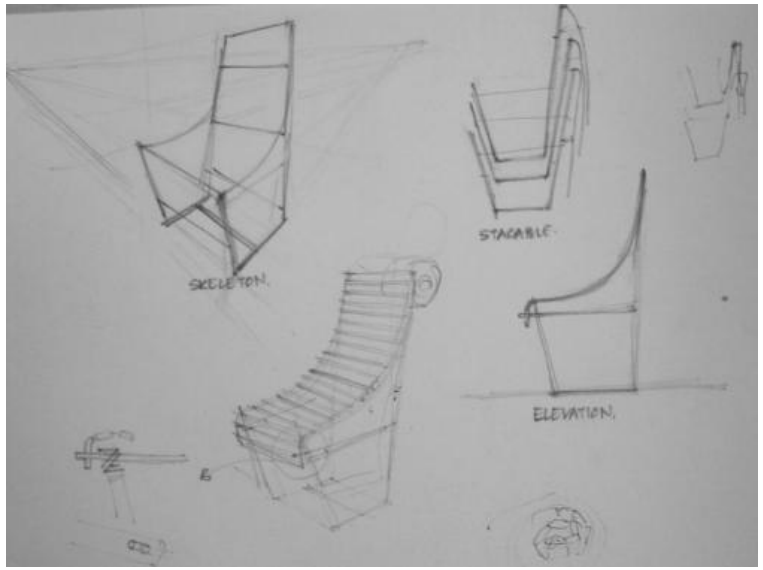


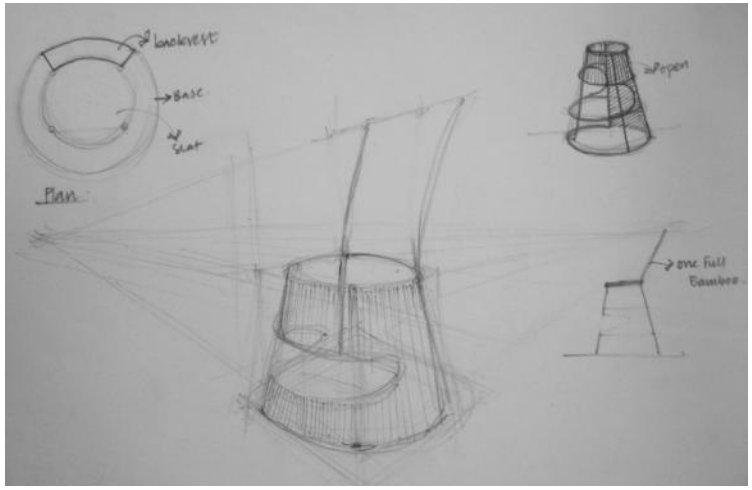
Third stage of ideation was done by concerning system issues in mind. Main problem bamboo furniture manufacturers are facing with the products is transportation, as these furniture's are not stack able the transportation cost increase.

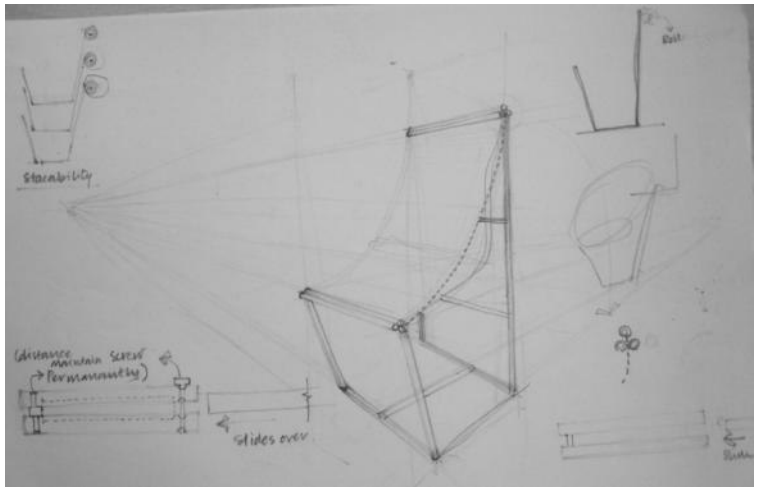
In most of the hotels bamboo chairs were not preferred because of lack of stack ability. They say while cleaning the floor its very difficult if furniture is non stackable.

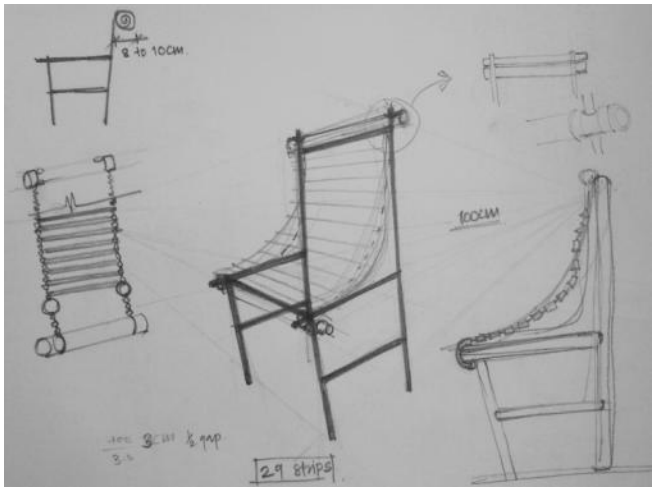

KNOCK DOWN
SKELETON.
STACABLE
STORAGE SPACE
IMP JOINT
Plan
90°
180°
90+180°
270°
Rotation Angle
21.18.06


PLAN
STACABLE
opening to keep legs
SKELETON
backside open for stacability
ELEVATION
21.18.06

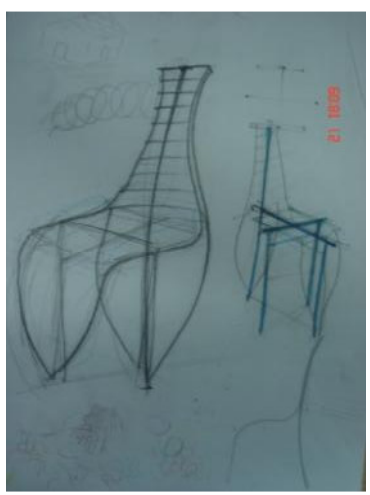

SKELETON.
STACABLE.
ELEVATION.

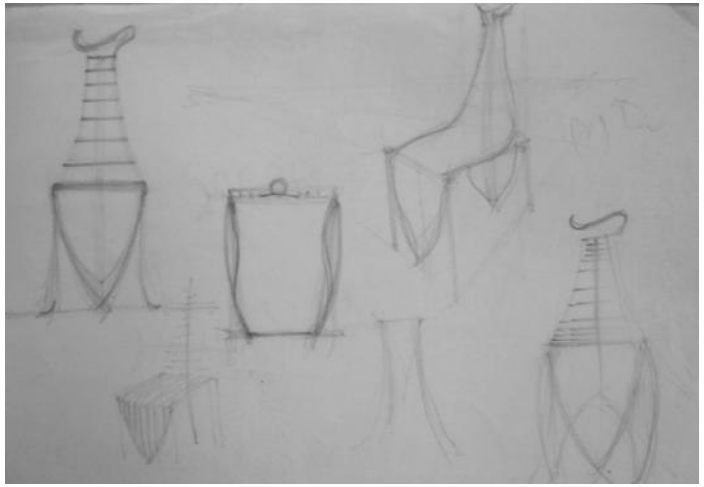

backrest
Base
Seat
Pan
Popcorn
one Full Bamboo

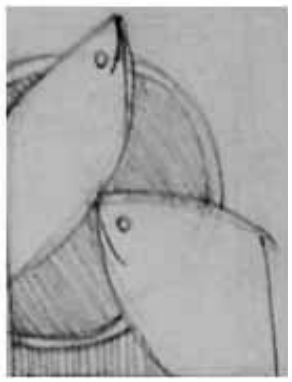

Stackability
(distance maintain screw permanently)
slides over


8 to 10cm
100cm
29 strips

- **THIRD STAGE IDEATION**



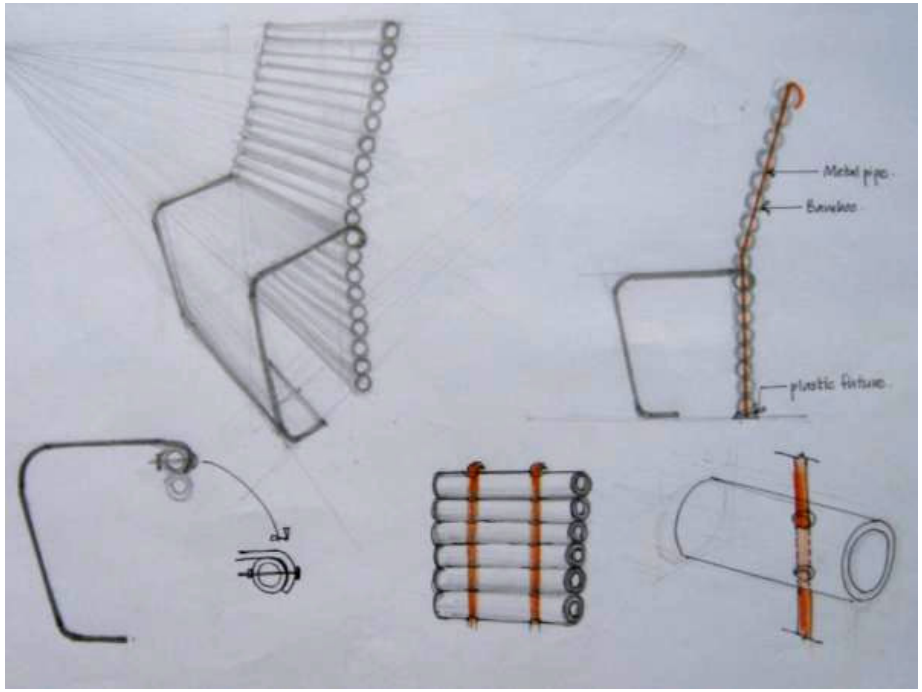


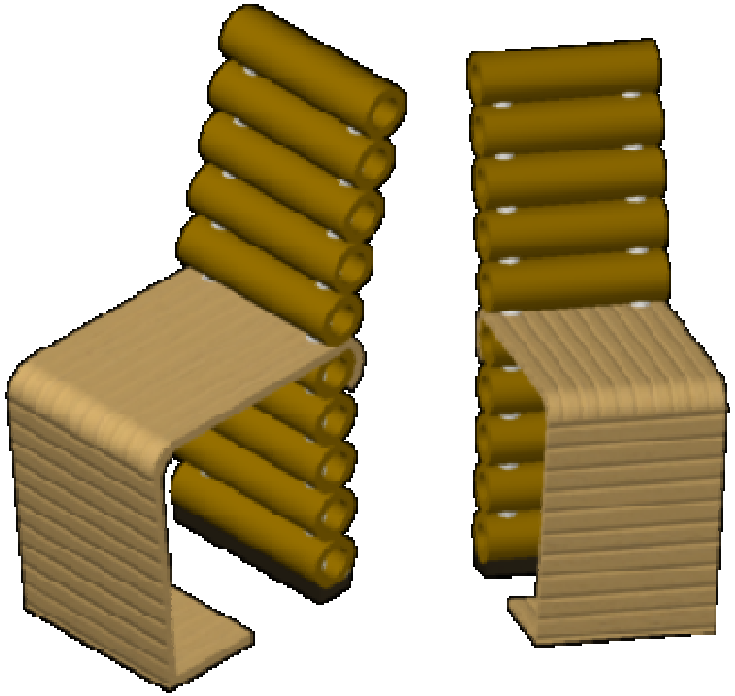


9. CONCEPT GENERATION

Concept 1:

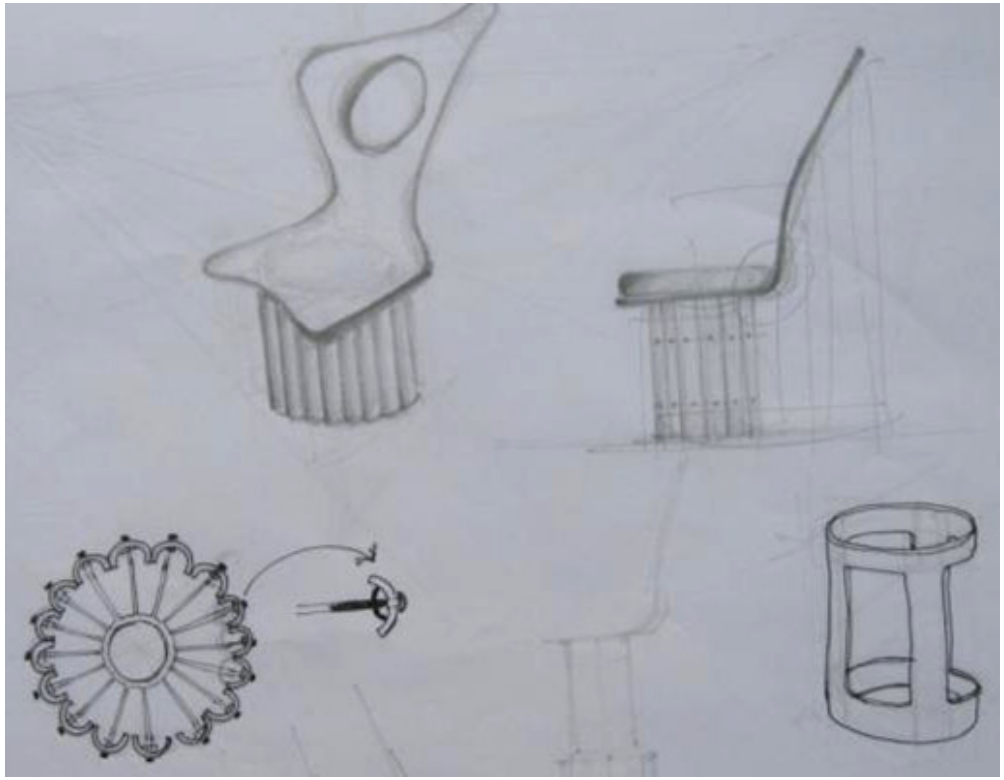
concept one was about using bamboo as a cladding material. Bamboo will come at back rest and it will continuously woven in a steel pipe till ground level.

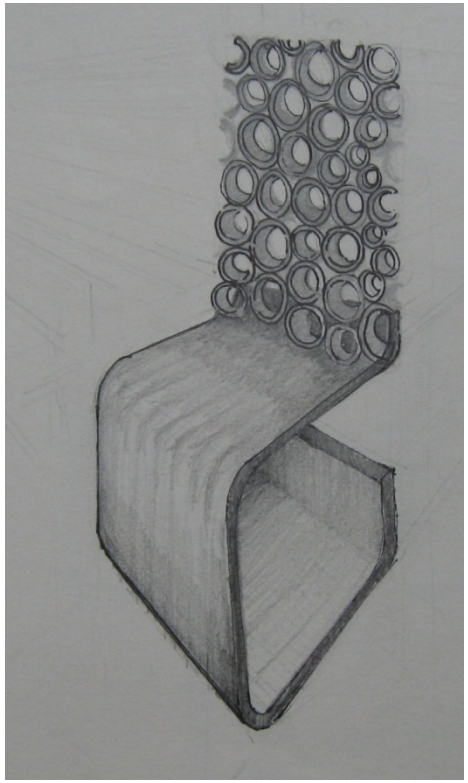


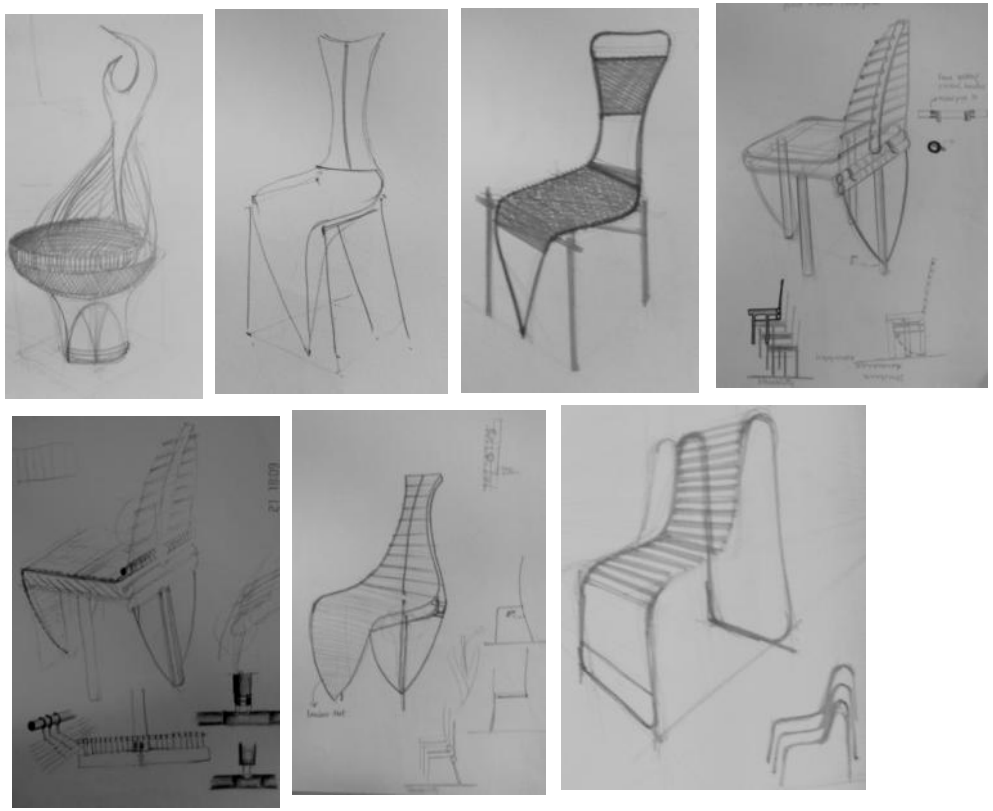


- **Concept 2:**

– Concept 2 was made by focusing telescopic growth in mind. To overcome with this problem small pieces of bamboo were used as back rest. These pieces were fixed with screws. For seat and structural strength bamboo ply was used.



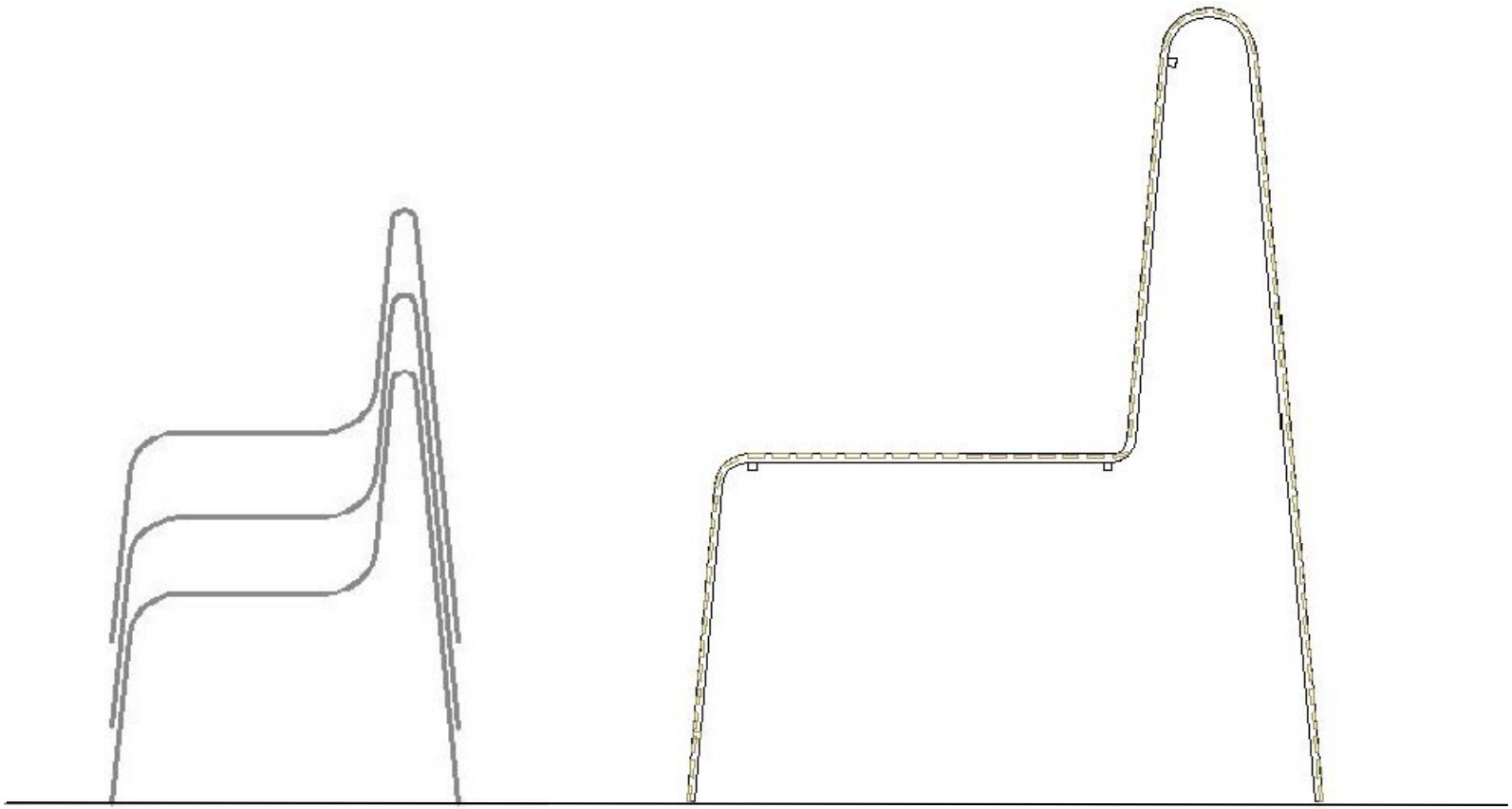




- **Concept 3:**

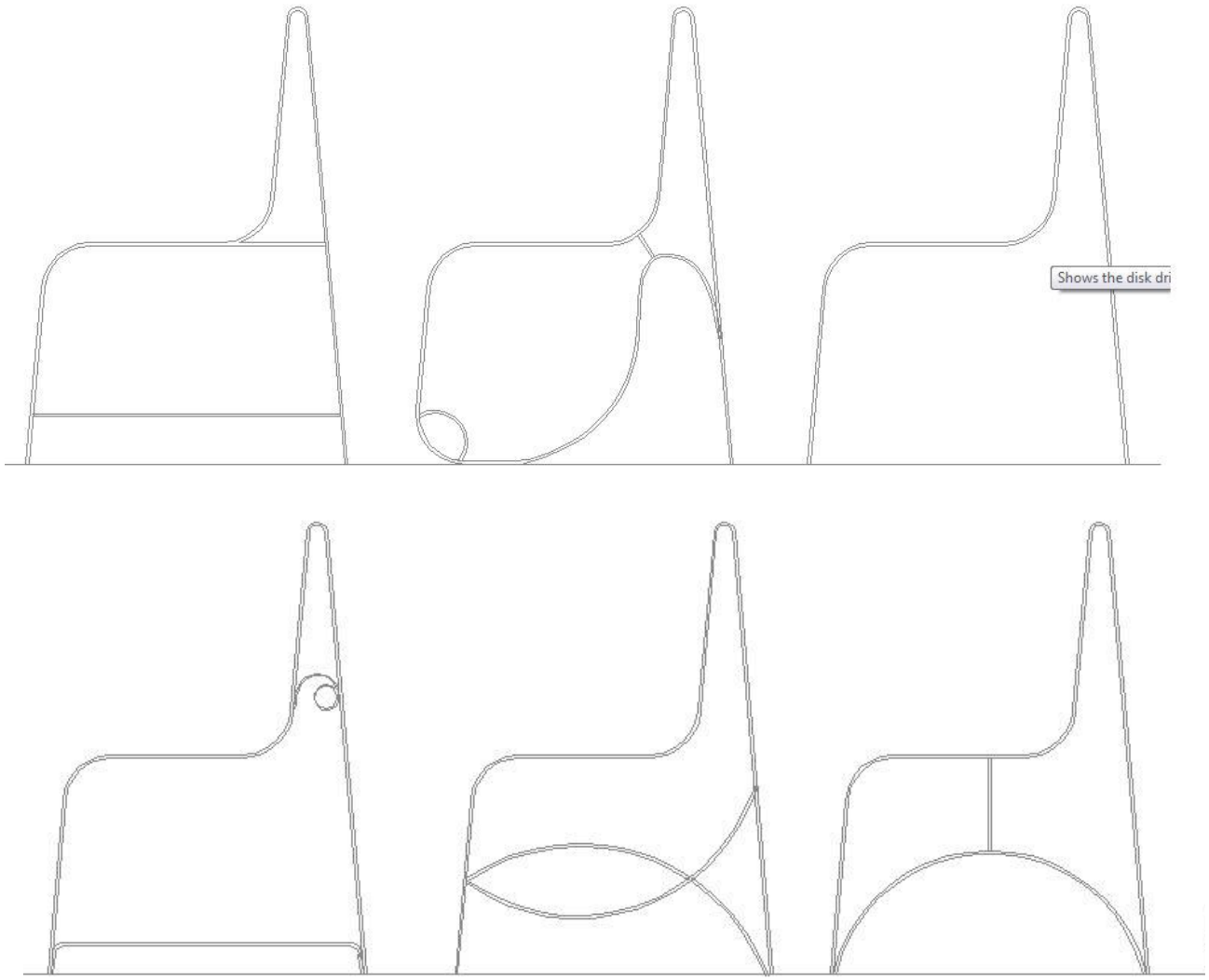
  'Final concept'

– Concept 3 was made focusing production issue and manufacturing processes in mind. Other industrial materials like wrought iron was use for additional functional values of product. Machine pressed bamboo strips were used as seat and back rest supporters. Structural strength was provided by wrought iron rod. Formal expression was also given an importance.

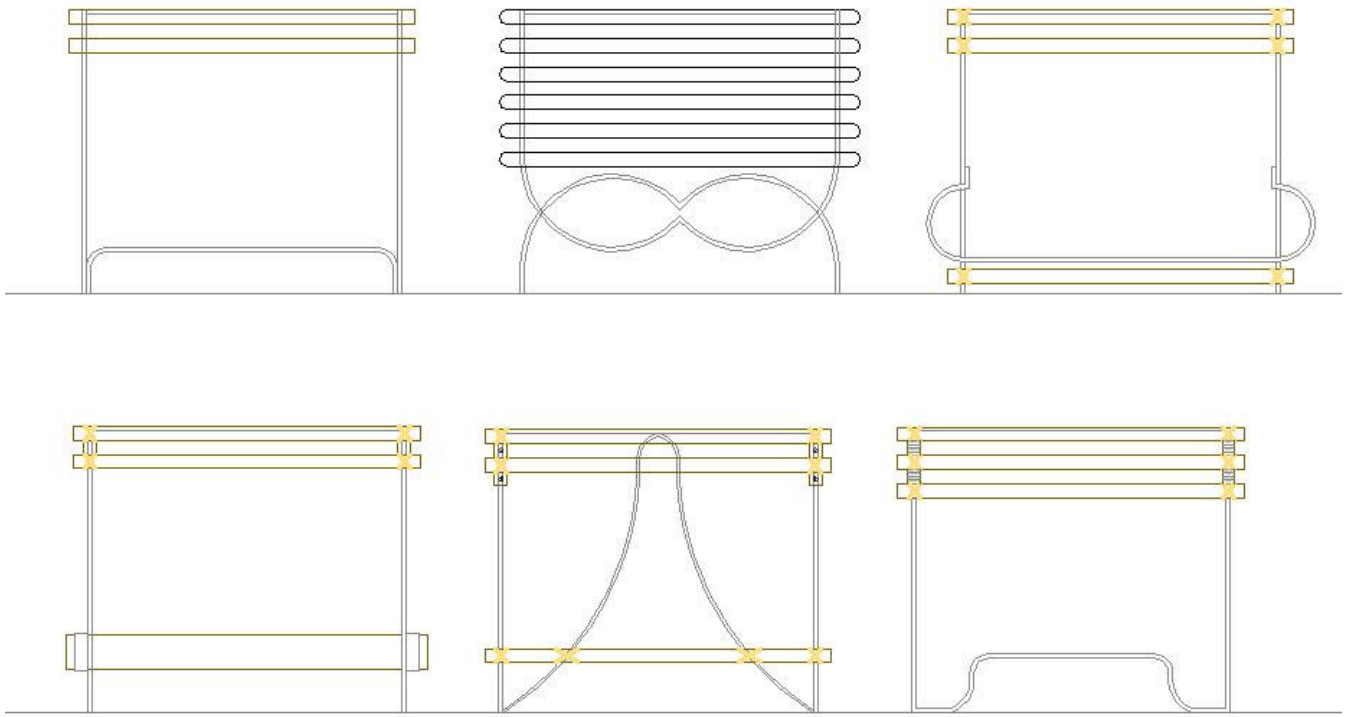


Stack ability.

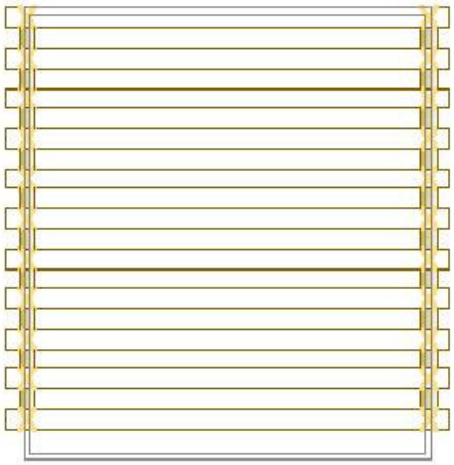
Side view

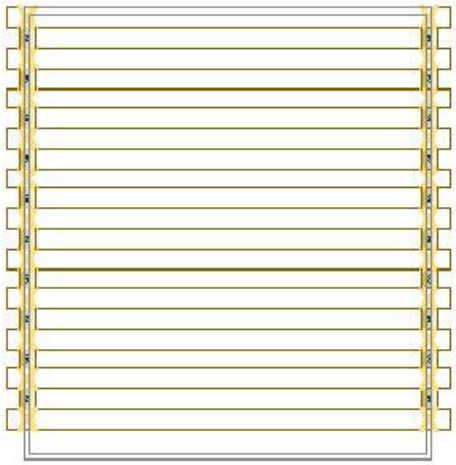


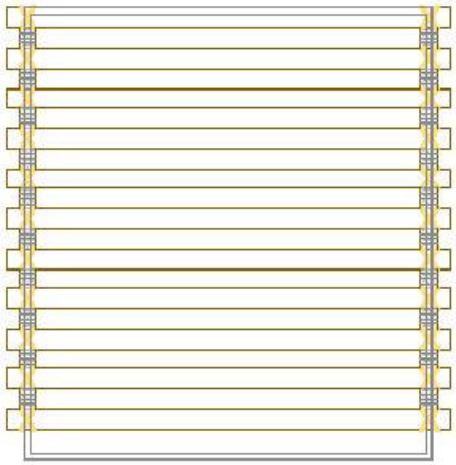
Side view options

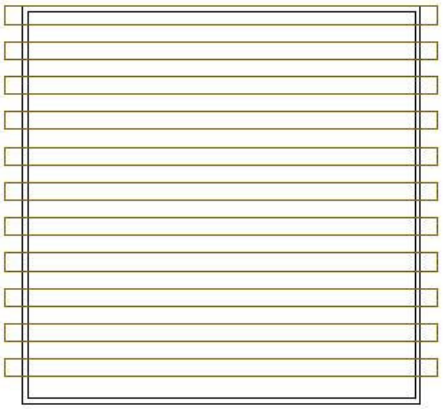


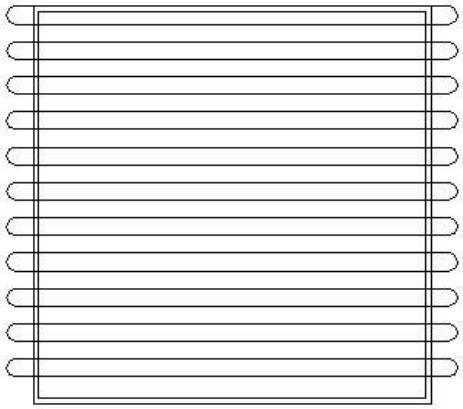
Front view options

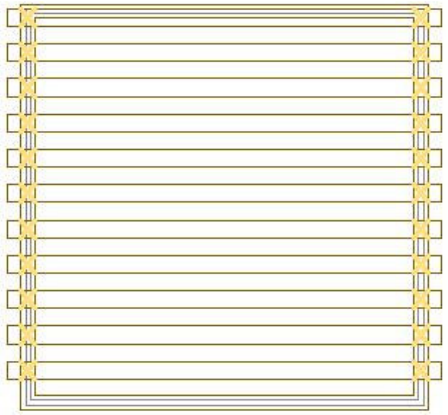




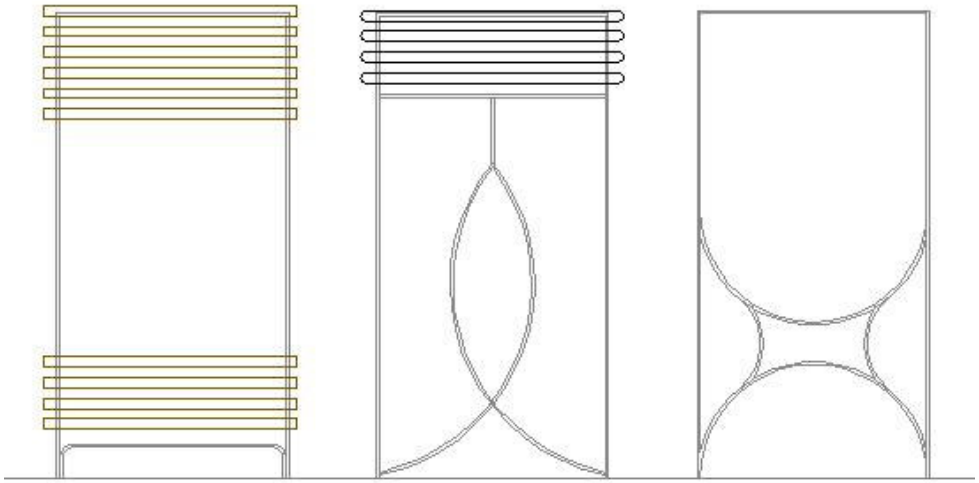


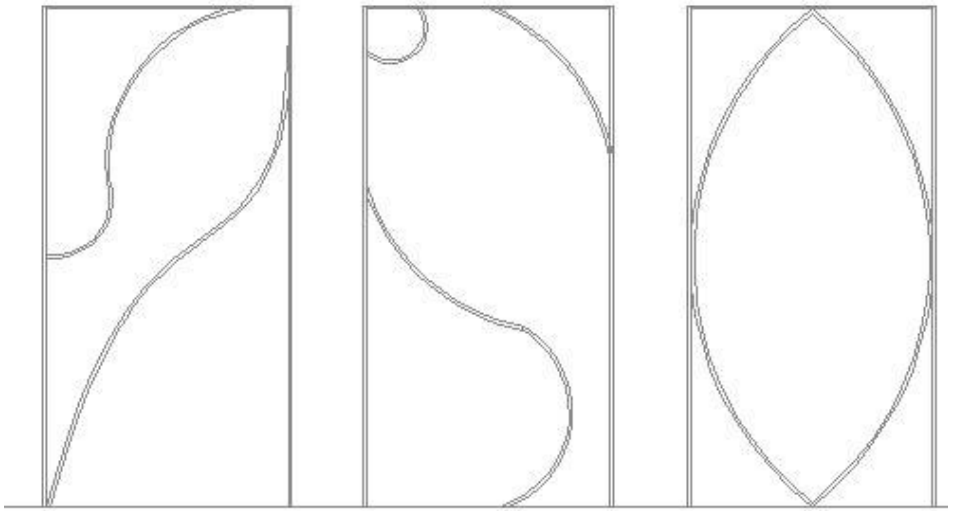






Plan options

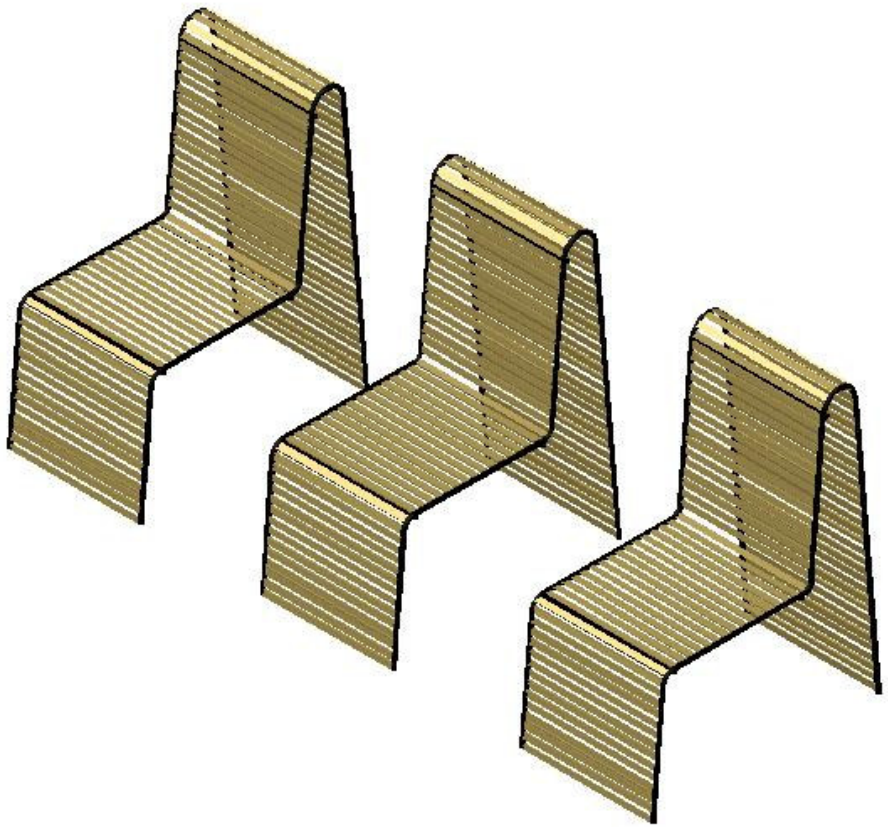




Back side options

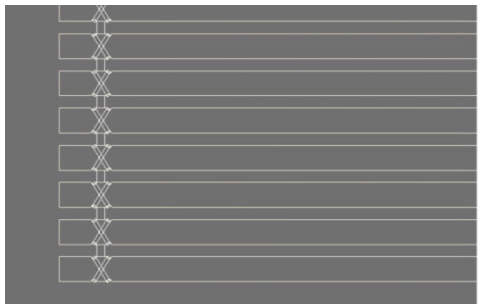


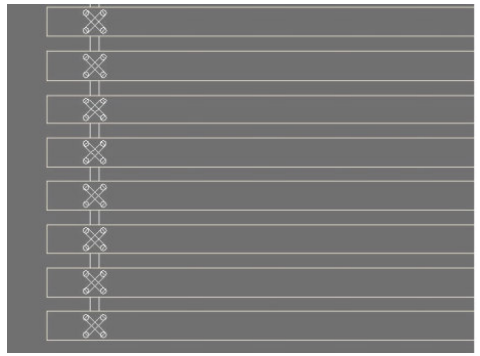
Exploratory model

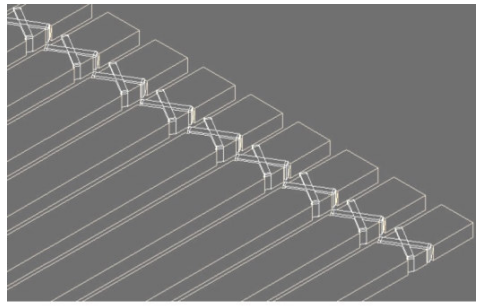


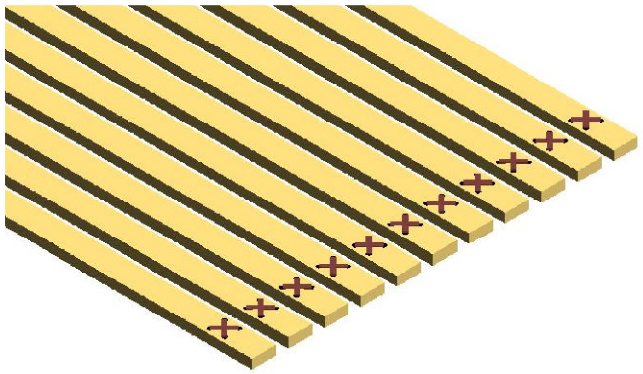
Final concept

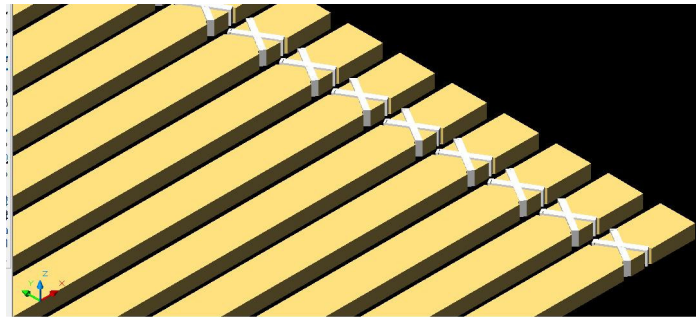
- **WEAVE DETAILING**



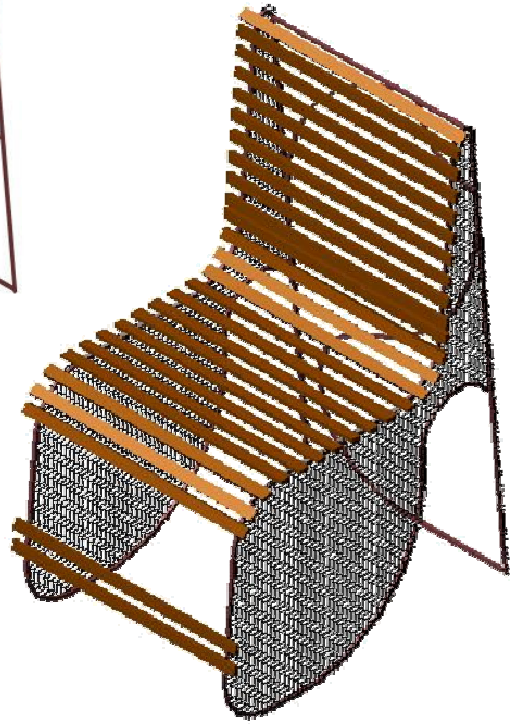






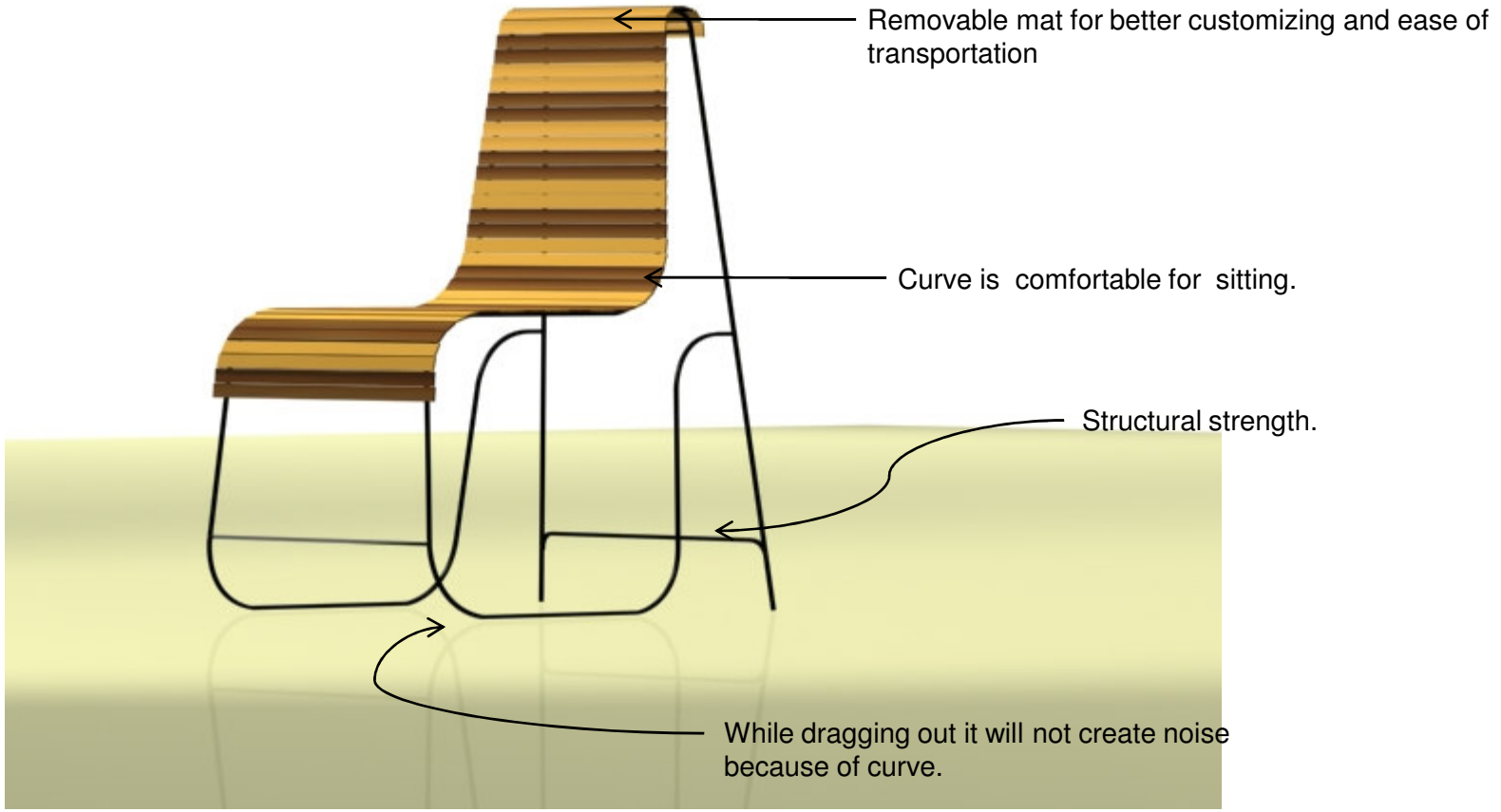


- **Final concept form explorations:**



Product characteristic

- **Final concept**



- **Material used:**
  - Wrought iron squire rod 8mm tick
  - Assam bamboo strips.
  - Cane for weaving purpose.

- **Manufacturing…**

Buying bamboo :

Searching straight bamboo from bunch

Cutting it in to pieces for ease of transportation.

Cutting bamboo in to strips and finishing strips








Various colour and patterns were tried

Dyes used:

Haladi : yellow colour

Alata: magenta colour

Tea: dark brown colour

Dyeing strips (all natural dyes were used)




Same time mock up model was made to test Ergonomical issues, appearance, structural stability, etc.






Various people with different heights were taken in to consideration

At fabricators workshop

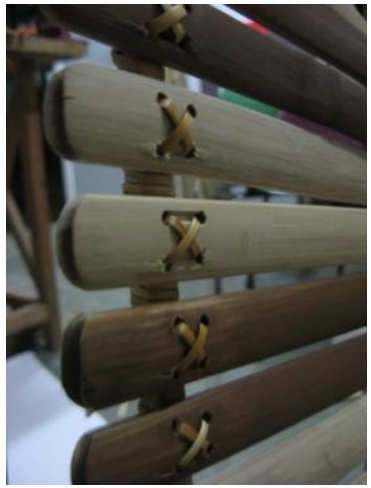


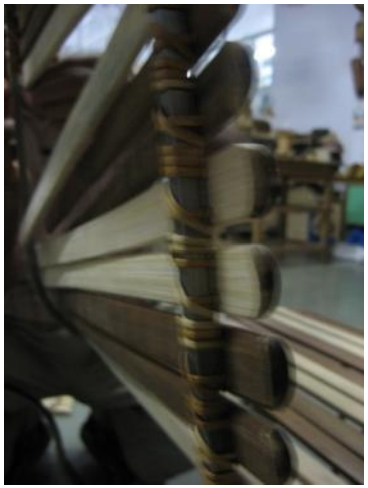




Wrought iron skeleton after polishing

weaving over the frame.





Weaving details.
colour combinations

Testing frame and bamboo mat

Mat making

Putting mat on frame and fixing it.

After binding mat on frame.

Experiencing product

- **Estimate:**

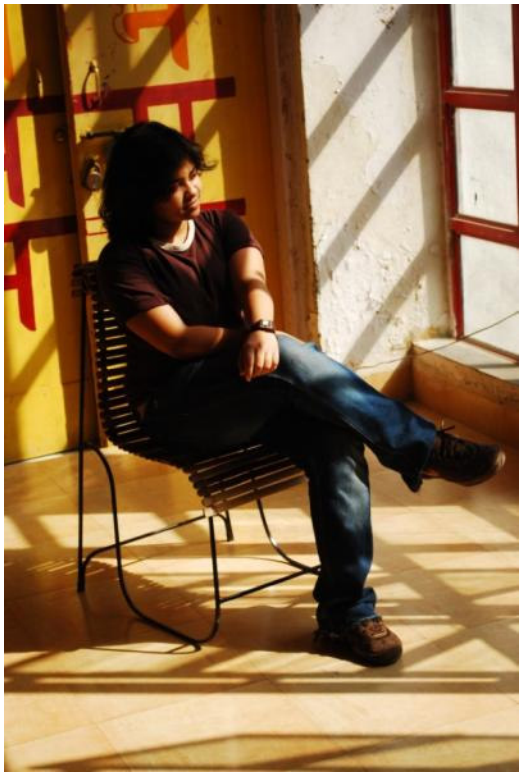
- Wrought iron 8mm squire rod: 10 Rs per feet
- Assam bamboo 18 ft: 60rs
- Bamboo strip with processing = 2 Rs each
- Black paint

- Total length of rod : 25 ft = 250 Rs.
- Total strips: 42= 84 Rs.
- Labor cost : 600 Rs.
- Cane for binding: 50 Rs.
- Powder coating: 50 Rs.
- ----------
- total production cost 1034 Rs.

- **And finally……..**

Final Model

User sitting

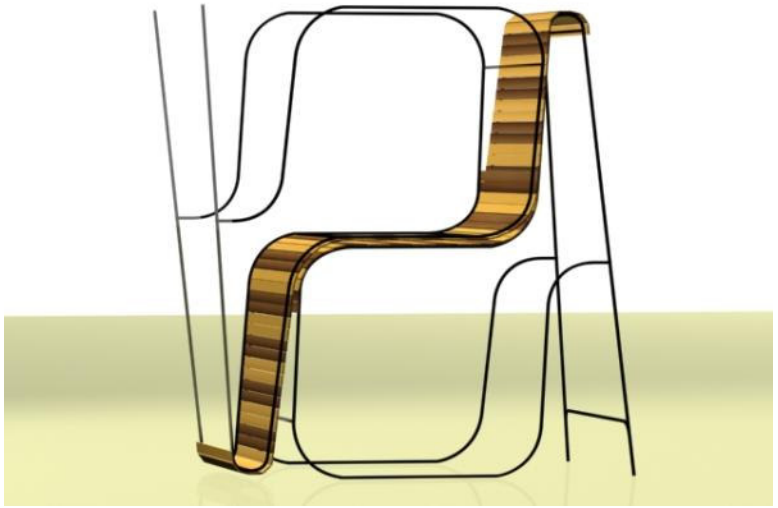


User sitting



Product environment

Possible ways of stacking.



Product USP

Stack ability

Corrosion resistant

Minimize the noise
while moving the chair

Thank you…

- **Referances:**

- Books
- The book of bamboo. (david farrelly)
- Bamboo in construction
- Fifty chairs innovations in designs and materials.
- 50+2y italian design

- Websites:
- www.wikipedia,com
- www.bamboofurniture.com
- www.sciencedirect.com
- www.bambootechnologies.com
- www.joinaryofbamboo.com
- www.google.com