



Process of Whole Culm Furniture Making

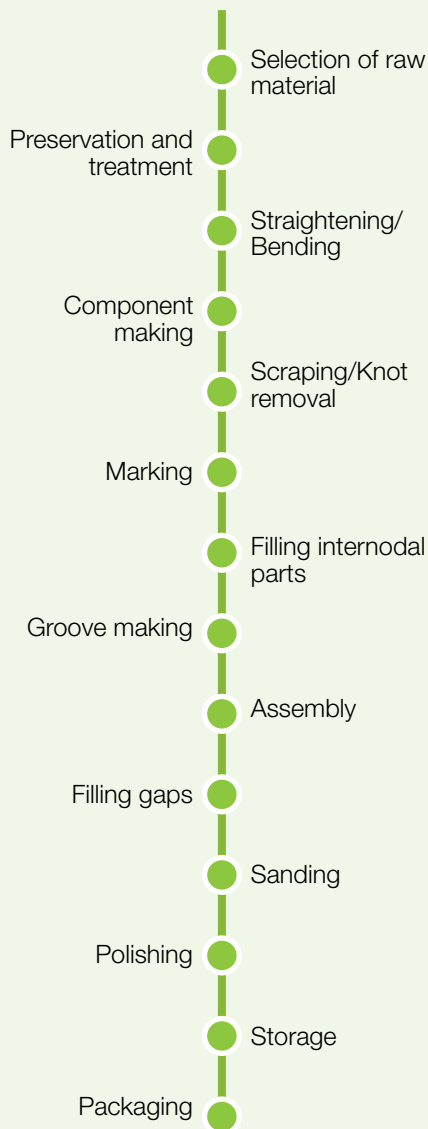
Ethiopia | Madagascar | Tanzania



INTRODUCTION: Traditional Bamboo furniture is widely produced and used in many developing countries across the globe. Bamboo is a locally available low-cost material which is strong and durable; and makes elegant, light weight and eco-friendly furniture, providing enormous opportunities for craftsmen and entrepreneurs (both rural and urban) to establish enterprises with low investment.

This technical bulletin illustrates the step-by-step process of production of whole culm bamboo furniture. These techniques can be applied and adopted for producing bamboo furniture from different bamboo species / varieties. Specifically, this technique is suitable for bamboo varieties of medium to large diameter (3-30 cm) and with medium to high wall thickness (1 cm+).

A quick guide to the processes involved in making Bamboo furniture



STEP BY STEP PROCESS

Selection of Raw material

Bamboo culms used for furniture making should be mature (~ 3 years of age) to minimize insect and fungal attack. Species / variety of bamboo used for furniture production should be in accordance with the design and strength requirements. Bamboo poles with deformities, insect and/or pest attacks should be avoided.

Preservation and Treatment

Treatment of bamboo drastically improves the durability of the product. Please refer to Preservation and Treatment technical bulletin for details.

Straightening/ Bending

Bamboo poles used in furniture production should be straightened for accurate joinery, ease in assembly and quality final product. Cross cut the bamboo poles of desired length (7 or 8 feet long), as the maximum component length of furniture is 7 feet.



How to make straightening Jig / column

A straightening column can be a wooden log of 7-8 feet long X 20-30 cm in diameter. Depending on the diameter of the bamboo poles to be bent, prepare holes on the wooden poles for easy front and back movement of bamboo poles during bending. Peg the wooden poles firmly in the ground. The height of straightening column could be adjusted according to the height of the craftsman and the length of bamboo poles to be bent. Alternately sawn timber with grooves can also be used.



Straightening/ Bending

Apply heat on the specific portion of the bamboo poles and its surrounding area, where straightening needs to be performed. Move the blow torch or bamboo back and forth to avoid heating at a single point). Blow torch connected to a gas cylinder or kerosene blowers or traditional blowers using charcoal or wood can be used as a heating source. Heating increases flexibility of bamboo, which allows bending or straightening of bamboo.



STEP BY STEP PROCESS

Straightening/ Bending

Using the support of bending column (holes on wooden logs to accommodate the diameter of bamboo), straighten or bend the bamboo poles in the desired form by applying force. Use eye alignment to check the straightness. As soon as the specific bent is straightened apply water with the help of the cloth to the heated part for cooling down, which enables the pole to retain the new shape / form. Continue the process until the entire bamboo pole is straightened.

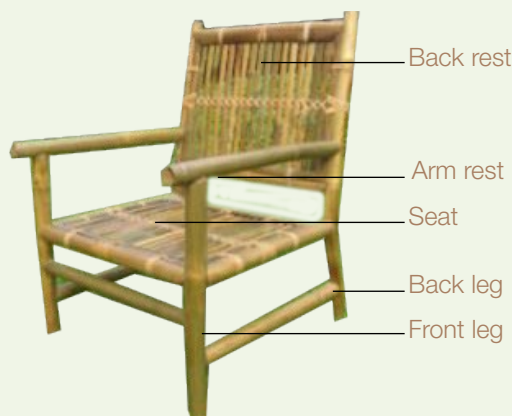


Component making

Depending on the design of the product, list the various components needed along with the accurate measurements. Mostly the bottom portion of bamboo culms is used for structural components (front legs and back legs), and depending on strength and design requirements, other parts of bamboo can be used as supporting frames, seat support, slats etc. This is also referred to as 'Grading' (or selection of bamboo poles depending on the design). (You can add this picture to show various components – this is optional depending on the space)

Do marking on the bamboo poles as per the specification of each component using a measuring tape and pencils / markers.

Note: While selecting bamboo components, keep in mind the symmetry of the various components as per design and make the selection of bamboo components accordingly (in terms of diameter, wall thickness, surface etc.). Discard the poles with any kind of blemishes or deformity.



STEP BY STEP PROCESS

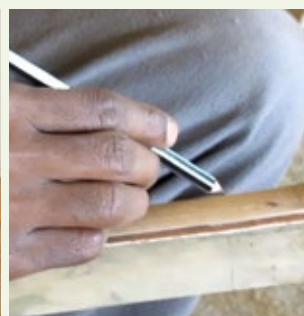
Scraping/Knot Removal

Remove the knot portion using hand planer or machine (angle grinder) to smoothen out the surface. Then, using curved knife or scraper, scrap the outer skin of bamboo pole (similar to scrubbing). This is best achieved when done manually.



Marking for different kinds of joinery

Mark a straight reference line on the entire length of component using straightened bamboo slat or meter tape or wooden ruler. Mark the locations of joinery using measuring tape and pencils by keeping the straight line as reference. Marking aids are vital in making accurate joinery, assembly and thereby standardized product. Depending on the design of the product and/or location of joinery, different methods or techniques are adopted (shown below).

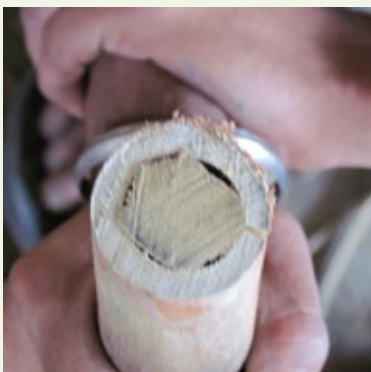


Clockwise from top left:
Drawing reference line,
Marking for tongue cutting,
Measurement for Grooving,
Marking for groove making,
Marking for fish mouth curve,
Marking for tongue making
(Length), Marking for tongue
making (Width).

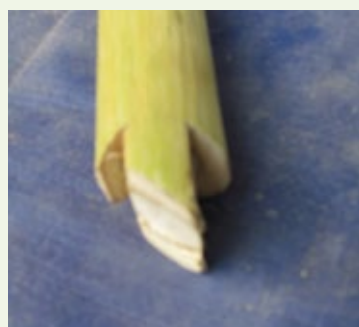
STEP BY STEP PROCESS

Filling internodal part

On locations of joinery, fill the hollow inter-node portion of bamboo with split solid bamboo pieces or with other wood.



Please note, in locations where there is a need for joinery of two components, cut the edges of both the tongue to 45 degrees for an exact fit.



Mortise and Tenon or Tongue and Groove Joinery

After marking, use a chisel (Flat Chisel) and a hammer to make the grooves on the bamboo. The depth of the groove should be slightly more than half of the diameter of bamboo.



Tongue making

To exactly fit the groove as well as the curvature of the bamboo, carve out the joint in the shape of a flat tongue / tenon with curved edges or shape similar to a fish mouth. Firstly use the hand saw to make a cut on both sides of the flat tongue. Secondly using the knife or chisel, scoop out the bamboo above the cut portions of bamboo.

The tongue should exactly fit in the groove to ensure strength / sturdiness of the product. While making joinery, number the components / joinery, (two components of joinery - tongue and groove should have the same number), for ease in assembly.



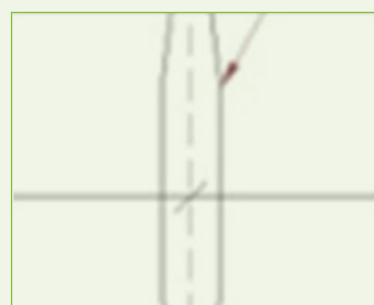
STEP BY STEP PROCESS

Corner Joint / 45 Degree Joint Round Hole Joinery

Cut the edges of both components to 45 degrees, so that both the edges exactly fit each other.



Using round chisel or bench drill make hole until half the diameter of bamboo. Curve the other component of furniture to exactly fit the hole prepared.



Assembly

Once the components are ready with markings, joineries have to be assembled to complete the product. Assembling the furniture usually involves the following steps:

- Step 1** Assembling the separate components together.
- Step 2** Applying adhesive or glue in the joineries
- Step 3** Clamping the product with rope or clamps to ensure symmetry or dimensions.
- Step 4** Fixing the components into a single product using bamboo nails.

Note: Apply or prepare different types of joinery (Mortise and tenon; Corner joint; round hole joinery) based on product design and/or location of joint.

STEP BY STEP PROCESS

Assembly

Immediately after application of glue, firmly clamp or fix the product using steel clamps or rope. While clamping, do not forget to do cross measurement/ diagonal measurement and check the dimensions of the furniture (Both the diagonal sides measurements should be same).

Please note: clamping and diagonal measurement should be done simultaneously. Ensure clamping is done on a flat floor or surface.



Once clamping is done (firm fixing after ensuring the dimensions of product), drill holes diagonally at two or three locations for each joinery using electrical or manual hand drill. Size of the hole can range from 4-6 mm. Peg bamboo nails using hammering inside each hole, so that it firmly fixes each component of the product.

Please note, dip bamboo nails in adhesive or glue for firm fixing. Trim or cut the extra portions of nails using chisel or knife.



How to prepare bamboo nails

Split a bamboo into square sections of which the size depends on the application. Chisel and taper to get a nearly pointed end. The diameter of the bamboo nails should be slightly more than the size of drill bits used for making holes.



STEP BY STEP PROCESS

Slat Preparation

Measure the length of slat required (slats are generally used for seat and back rest). Split the bamboo into required width (usually slat sizes ranges from 1.5 to 2.5 cm). After splitting, trim the slats to uniform width using a width sizing jig. Also, plane the extra materials (inner core), to make the thickness uniform.



Slat Fixing

Fix base frames on the structural components to fix the bamboo slats on it. Place bamboo slats on the base frames using a jig. Nail bamboo slats at equal distance from each other to ensure symmetrical look. Drill holes using hand drill or electrical drill to avoid splitting of bamboo slats during nailing. Fix the slats on frame using bamboo nails.



STEP BY STEP PROCESS

Filling gaps / open spaces in joinery

Use the bamboo saw dust collected during the various processes and sieve it. Add adhesive to the fine powder (of saw dust) and make a paste (ensure that the paste is not very viscous).

Fill gaps in joinery using paste. Wipe the extra paste left on the bamboo with the help of a wet cloth simultaneously. Leave it for drying for about 2-3 hours.

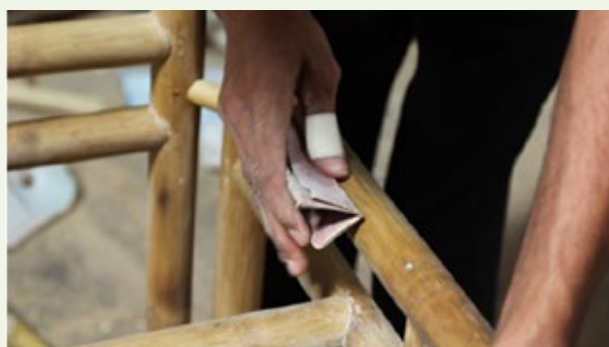


Sanding

In case of very rough surfaces, use chisel / planer / grinder to smoothen the surface.

Then, use a sand paper for smoothening the surface. Firstly use sand paper number 80 to smoothen rough surface, followed by sand paper number 120 and 220 for fine finishing.

After sanding, remove the sanding dust using dry cloth or brush.



STEP BY STEP PROCESS

Polishing

Apply two coats of varnish / polish for a smooth and even finish. In the first coat, mix one litre of varnish/polish along with 100 ml of thinner (alternately kerosene or gasoline can be used).

Apply first coat uniformly with the help of a brush / air sprayer / cloth on all the surface of product. Allow it to dry for 6-8 hrs in a well ventilated place.

After drying apply second coat (1 litre varnish: 200-250 ml thinner), allow it to dry for 6 – 8 hours.



Please note

- The direction of applying the polish should be unidirectional i.e. the stroke of the brush should be either top to bottom or left to right.
- Ensure that no air bubbles are trapped inside, do not apply excess paint, and the polish coat should be applied uniformly.
- Ensure that there are no dust particles in the area where polishing is being carried out, even if the surface looks dry within the first hour, leave it for drying for a minimum of 6 – 8 hrs

Storage

Store the finished product in a dry and well ventilated place; protecting it from dust and moisture.

Packaging

Packaging can be done before storage or at the time of shipment or transportation. It is recommended to use foam/ bubble wrapping sheet/ cardboard / news papers / jute sacks to fully cover all parts of products; and tie it with a rope.

TOOL GUIDE

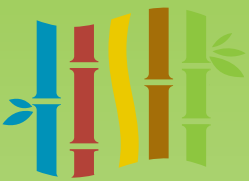
PROCESS	TOOLS REQUIRED
Straightening	Blow torch (gas / kerosene) with accessories, Straightening wooden column
Component making	Measuring tape, saw, marker / pencils
Scraping	Knife
Knot removal	Hand planer or Angle grinder or Knot removing machine
Marking joinery	Marking Jig, measuring tape and markers
Joinery	Saw, chisel (Flat and round chisels of different dimension (5 mm, 10mm, 12mm, 20 mm and 25 mm)), hammer
Assembly	Measuring Tape, Long Clamps (F Type), C-Clamps, Hammer, Adhesive / Glue, Chisel, Hand Drill / Electrical Drill, Bamboo Nails
Filling gaps in joinery	Fine bamboo saw dust, adhesive / glue
Sanding and finishing	Sand Paper (60, 80, 100, 120, 220 Nos)
Polishing	Varnish / polish, thinner, brush / cloth or air sprayer with compressor
Packaging	Bubble packing sheets, cardboard, paper, jute bags, ropes, scissors.





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