

Design guideline for bamboo chair integrating with rubber material from local wisdom for decorating element.

Surat Chitsing^{1, a} and Assoc.Prof.Sataporn D.Na-Chumphae^{2, b}

¹Department of Interior Design, ²Department of Innovative Product Design, Faculty of Architecture, Kasem Bundit University, 60 Rom Klao Rd, Min Buri District, Bangkok, Thailand

^a< surat.chi@kbu.ac.th >, ^b< sathaporn.dee@kbu.ac.th >

Abstract

The objective of this journal is to publish suitable design guideline for bamboo chair integrating with rubber material which correspondence to local wisdom for using in household or as a decorative element. This study used research procedure, studied multiple documents on material and bamboo chair design, along with research experience from integrating local materials in furniture design. This study also conducted surveying on various communities which had correspondence local wisdoms of bamboo chair, acquired knowledge on their bamboo chair design methodology. These collective data had been analyzed and synthesized to generate the suitable design guideline for Bamboo chair integrating with rubber material.

The result showed that the bamboos in the Northeastern Thailand are more suitable for furniture design than Central Thailand and other provinces that have rubber plantation. For community financial benefits, the rubber was designed for seats and back rest of bamboo chair. This study proposed 3 bamboo chair designs, correspondence to local wisdom. Moreover, form and material selection of bamboo chair designs will be an alternated approach for communities and others to develop further or for manufacturing.

Keywords: *Bamboo chair, Local wisdom, Furniture design, Interior decoration*

1. Introduction

Bamboo is the monocot plant, which belongs to grass family. Bamboo has straight stalk, with the highly durable property, can be found mostly in Tropical climate. There are 30 bamboo species out of 1000 species in Thailand. Bamboo cultivation had many various benefits for planting bamboo, for instance, creating land boundary, visual blockage, bamboo shoots for food. Moreover, the bamboo is easily obtained, economical, high durability, and high flexibility. Therefore, Bamboos can be used in various aspects are as followings;

Building material: Column, beam, stair, floor, door, window, and roof

Furniture material: Bed, Table, Chair, and Shelf.

Traditional household objects: container, animal traps, crafts, decorative elements, and etc.

Rubber plant is the perennial plant, originated in Amazon biome, South America. Rubber plant had been introduced in Trang province approximately 100 years ago, the plantation had been spread throughout 14 provinces in the southern region of Thailand.

Later on, the rubber had been developed which can be planted and cultivated in East region, Northeast region, Central region, and Northern region to increase rubber product. Therefore, Thailand became one of the largest natural rubber producer and exporter in the world.

The benefits of Rubber plantation are not only the plank that can be used as building material and furniture, but also, the rubber sap can be processed for multiple industries usage, including sponge that used in chair seat and back seat.

Bamboo and rubber cultivation in Thailand had been conducted for a long time, mostly for producing household objects, furniture, building material and daily life equipment, used within their communities. Therefore, this particular knowledge had been constantly developed and implemented, generated the various interesting products.

This study aimed to gain benefits from these materials, provided alternated approach for communities' production for financial benefits, and providing information to others who interested. This aimed can be achieved by generated bamboo and rubber chair design guideline that suitable for interior decorations, also, this guideline generated derived from local wisdoms.

2. Study Objective

- 2.1 To study Bamboo, Rubber, and other related material property for chair designing
- .22 To study and develop household furniture from bamboo by using local wisdom procedures.
- .23 To propose Bamboo and rubber chair design guideline for interior decoration, related to local wisdoms design.

3. Study Methodology

- 3.1 Literature review
 - 3.1.1 Study Bamboo, Rubber and other related material for chair design.
 - 3.1.2 Study Design theory or design criteria for furniture design.
- 3.2 Surveying in selected area and gathered data on bamboo furniture or equipment Products, using investigation, interviewing, product testing method.
 - 3.2.1 Study Design concept and development of Bamboo chair on various communities.
 - 3.2.2 Study the Local wisdoms and techniques.
 - 3.2.3 Identified Suitable material used in communities (Economical, easily obtained)
 - 3.2.4 Study communities' perception on bamboo chair product, its functionality in todays society.
- 3.3 Data Analysis: Data was analyzed to explore any variables occurred in the study framework and during study procedures.
- 3.4 Data Synthesis: Discovered possibility theory and guideline applicable for Bamboo chair design and development.
- 3.5 Design bamboo chair and generated proposal which will benefits for others to develop further or manufacturing.

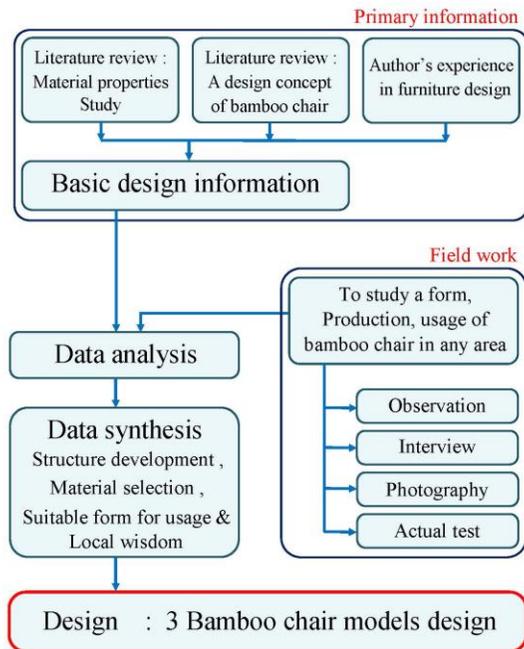
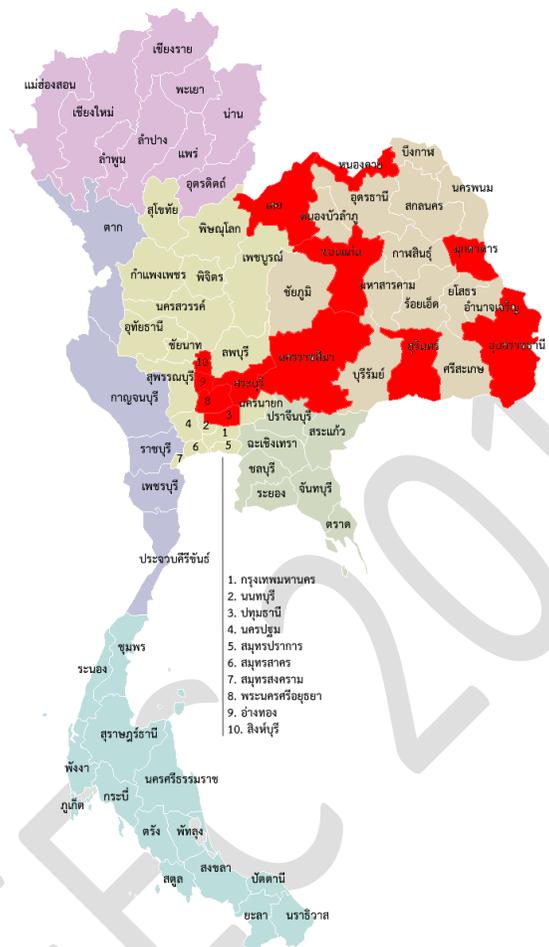


Figure 1 Study methodology diagram

4. Scope of study

4.1 Scope of study on Data: Study Bamboo property in furniture design, Design criteria, Local wisdoms, communities' perceptions to generate Bamboo and Rubber chair design criteria.

4.2 Scope of study on Area Selection: Data gathered from 5 provinces in Central region, which are Pathum thani, Ayutthaya, Angthong, Singburi, Saraburi. Also, the data was gathered at 7 provinces in Northeast region, which are Nakhonrachasima, Khonkaen, Loei, Nong Khai, Mukdahan, Ubon Ratchathani, and Surin.



5. Result

The bamboo and rubber chair design used the furniture design theory as its criteria, which consisted of multiple aspects, focusing on functionality, aesthetic, comfortably usages, marketing respectively.

The proper chair design should consider functionality in terms of comfortably seats suited its categorization. Also, the comfortably usage aspect needed to be analyzed in mechanics, and ergonomics data, to create the design that suited sitting posture, dimension, and proportions. The chair needed to distribute human load onto its surface evenly, decreasing structural stress in critical area.

5.1 Fundamental in chair design

Fundamental in chair design consisted of multiple aspects which are as followings;

5.1.1 **Functionality:** suitable for usage, work properly in accordance with its purpose, e.g. office chair should have wheels, cozy or relaxing chair should be used comfortably enough to relief stress or should have neck support for generating relaxation.

5.1.2 **Safety:** User should be able to use chair without risk of injury. Chair need to have durable base, legs and wheels.

5.1.3 **Durability:** Strong enough to withstand any unexpected circumstances.

5.1.4 **Economic:** appropriate material for reasonable production cost. Material should be easily obtained.

5.1.5 **Material:** Material selection should consider its function, durability, reasonable price.

5.1.6 **Construction:** Easy assembly technique, suitable for its functions, and material selection.

5.1.7 **Ergonomics:** Chair design should have appropriate size, proportion, and height for served particular chair's category and function.

5.1.8 **Aesthetic:** The chair design should be attractive in terms of shape, form, and colour.

5.1.9 **Characteristic:** The design should have specified attributes for increasing its value e.g. Children chair, Elderly chair, etc.

5.1.10 **Productivity:** Easily assembled, precise production template, can be mass produced.

5.1.11 **Maintenance:** easily restored in a reasonable price.

5.1.12 **Transportation:** product needed to be transported without obstacles and risks of any damaged e.g. Knock down chair.

5.2 Design Criteria

5.2.1 The design should consider an appropriate load-carrying capacity of the chair.

5.2.2 The material using in seats design that and vary in density, thickness, porosity, and strength, affected the user sitting posture. The design should consider the material property, such as material softness texture.

5.2.3 The curved and slope of the back seat should be design related to the characteristic of the chair. Back seat should support users' back and their sitting posture.

5.2.4 The depth of the seat should be considered. The seat should support hamstrings, back of the knees should slightly shift from the edge of the seat, preventing knee joint pressure.

5.2.5 The width of the seat should not design less than 400 mm.

5.2.6 The height of the seat should be designed appropriately, preventing risk of muscle injuries or back pain.

5.3 Fieldwork

The study gathered data from multiple communities in Central and Northeast region of Thailand. The gathered data focused on Material, Form, Manufacturing, chair functionality,

related to their local wisdoms. The information was collected by interviewing producers, farmers, communities, also with observations, and product testing. The result revealed that the bamboo was planted at the end of their crops fields, mainly for ingredients. The bamboo that is more than 3-4 years old, farmers processed bamboo into other products. E.g. fence, furniture, etc.

Bamboo that used in industrial scale came from bamboo fields and communities that specifically cultivated bamboo stalks. Locals tends to plant bamboo species that have straight, thick stalks and produce delicate bamboo shoots for fullest benefits. The bamboo species that were found in this area are *Dendrocalamus*, *Dendrocalamus Strictus* which have straight stalks and diameter of the stalks are approximately 3-8 inch. Also, the *Dendrocalamus Latiflerus*, *Dendrocalamus/Rough Giant Bamboo* have straight, thick stalks, and producing delicious bamboo shoots. The *Bambusa Blumeana* which has gold color stalks.



Figure 3 Bamboo selections criteria : long, straight and thick stalks

Multiple communities tend to establish their bamboo chair manufacturing groups, which help in seeking laborers within themselves. The leader and committee planned production line, designed the product, material selections, marketing, and training to increase the quality and capacity of their manufacturing procedures.

Local wisdom technique in bamboo chair design typically used a straightforward technique, economical, uncomplicated design due to material restrictions. Some communities occasionally included the wickerwork to increase product value. However, the increase of wickerwork causing increase of the time and expense.

Generally, indoor bamboo furniture will have longer lifespan than outdoor bamboo furniture. Approximately 5 years of usage, the texture of bamboo might be brittle, dried out, buckled, and the pattern and durability of material declined. Normally, the Northeastern region bamboo material withstand the insects and woodboring beetles than Central region due to the less moisture, and harden texture.

5.4 Design

The initial concept for bamboo and rubber chair design was using local wisdoms as the design approach method, which recommended using bamboo and other material gathered from communities, and assembled uncomplicated structure. The stability of chair structure achieved by using sturdy, large bamboo stalks, containing more than 4 inch in diameter, and chair leg bracings.

The design guideline suggested that size and height of the chair should be appropriated creating the comfortability usage. The simplified form is used in accordance with local wisdom theory; however, this idea had been developed to modernize its design. The enhanced design included diagonal chair leg, bamboo linear arrangement on the backrest, processed rubber was used for seat and covered with the communities' traditional woven fabric.



Figure 4 Latex seat pad

The enhanced design were developed into 3 design which are as followings;

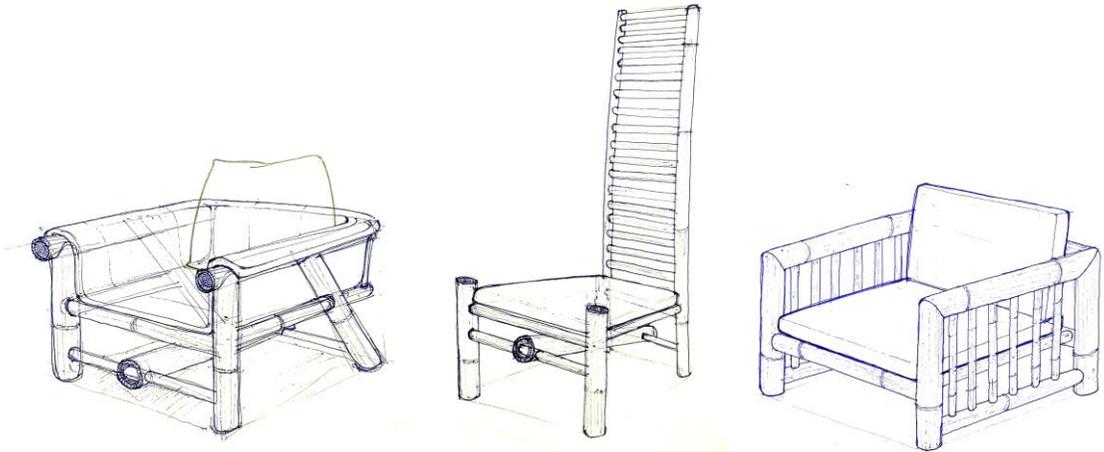


Figure 5 3 types Models Idea Sketch



Figure 6 Final Design Guideline

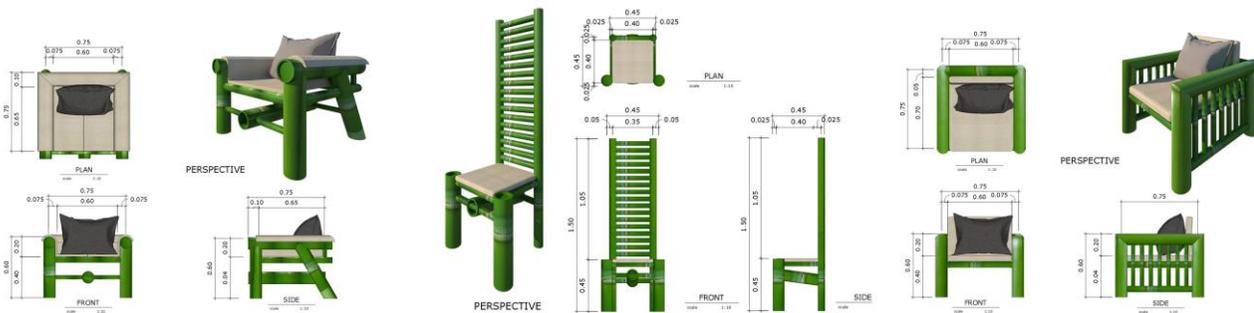


Figure 7 3 types Models Working Drawing

6. Suggestion

The result suggested that design can be developed further in terms of form, details, material selections, that befit various communities. Also, the design can be manufactured, and tested in laboratory for strength tests or other tests. Lastly, the finalized design can be applied as a guideline for any upcoming bamboo chair design.

References

- [1] Sataporn D.Na-Chumphae and Pichai Sodbhiban. (2007). **Study Vernacular Materials Four Region of THAILAND**. Bangkok : Faculty of Industrial Education, King Mongkut's Institute of Technology Ladkrabang.
- [2] Pronpan Kruaroonrat and Sataporn D.Na-Chumphae. (2018). **A Study and Relaxing Chair for The Elderly**. Bangkok : Faculty of Architecture, Kasem Bundit University.



Surat Chitsing, Vice Dean for Administration, Faculty of Architecture, Kasem Bundit University, 1761 Patthanakan Road, Suanluang, Bangkok 10250, THAILAND, (+66) 2-320-2777 Ext.1208 or 2259, surat.chi@kbu.ac.th, M.Arch. Interior Environmental Design. King Mongkut's Institute of Technology Ladkrabang, B.FA. Interior Design (First Class Honer) . Kasem Bundit University, Interested in Interior Environmental Research, A Furniture Design.



Sataporn D.Na-Chumphae, Associate Professor, Dean, Faculty of Architecture, Kasem Bundit University, 1761 Patthanakan Road, Suanluang, Bangkok 10250, THAILAND, (+66)2-320-2777 Ext.1207 or 2259, sathaporn.dee@kbu.ac.th, M.S. Technical Education. King Mongkut's University of Technology North Bangkok, B.Arch. Industrial Design. King Mongkut's Institute of Technology Ladkrabang, Interested in Product Design, Industrial Design, Technical Education Research.