

A Conceptual Framework of Design and Material Process of Kenaf Fibre-Based Furniture Manufacturing

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Abstract — This paper presents a conceptual framework of using kenaf fibres-based as potential application materials for furniture design manufacturing in Malaysia. Kenaf or Hibiscus Cannabinus are currently used in various types of industrial applications to increase strength and to optimize weight and cost of the production. More specifically, this review has discovered that little has been published in the context of material process and design development on furniture design perspective. Issues relating to environmental threatened the life cycle of the environment globally due to the high-demanding export furniture design based on timber such as rubberwood. It has become a serious matter since the government's introduced kenaf as alternative materials and there are deficiencies of collaboration and networking between scientist and designer to ensure the continuity in supports of research and development in Kenaf between government and manufacturer. Moreover, this conceptual framework study will purpose a guideline, solution and recommendations as potential materials through furniture design application for designer and manufacturer.

Keywords - Kenaf fibre based, design process, material, furniture design, manufacturing

1. Introduction

The demand for essential commodities was closely linked to the population of any country. Impact (Larson-Brelid et al.,2010). Research work on kenaf is being carried out worldwide in USA, Australia, Thailand, India, Japan and followed by Malaysia in 1999. Early research was started in the United States of Increasing market demand create a shortage of raw materials (L. jungberg,2007). Therefore, emerging technologies in a new product have identified durable biocomposite as the best alternative for reducing unnecessary environmental America in 1940 to use kenaf as a substitute for jute due to the supply distribution from the Far East during World War II (Roseburg,1996). Kenaf has many applications including in the production of natural fibre. Kenaf fibre is produced mainly in India and China, followed by Bangladesh. Malaysia. Malaysia discovers kenaf as a new source growth in 1998, with technological nowadays brought many developments to the agricultural industry, especially kenaf. This development further opens another space for kenaf in the country's biocomposite industry and another potential on the variety of area. Subsequently, Malaysia finds the massive potential of kenaf in the sector involving paper and wood and related sectors; a joint effort has been made to study the kenaf plant more deeply. A technical committee of National Economic Action Council (MTEN) consisting of from several research institutions in Malaysia such as Malaysia Agriculture Research Development Institute (MARDI), Universiti Putra Malaysia (UPM), Forest Research Institute Malaysia (FRIM), Universiti Teknologi Malaysia (UTM), Universiti Tun Hussein Onn Malaysia (UTHM) and Fibre Development Centre (FIDEC) have been established in conducting research on kenaf plant. This pure business lead by MARDI is intended to do scientific research so that kenaf can be commercialised in various industrial sectors. On April 2010, Ministry of Kenaf and Tobacco National (LKTN) stand as government organization in line with the National Commodities Policy (DKN), the National Kenaf and Tobacco Board (LKTN) will work to enhance the development of the downstream industry and promote the production of kenaf products to done research widely in Kenaf fibre almost in all scope and direction. However, until now design documentation not been done on the previous researcher by any organization or individual. A lot of past research already mention Kenaf have potential on furniture design in Malaysia and as sustainable materials.

Recently, due to the increasing ease of environmental awareness, the concern of environmental sustainability. The overall purpose of this research is to undertake a theoretical and empirical investigation into kenaf materials and to better understand the process of kenaf and the furniture design in Malaysia.

2. Issue

2.1 Issue on material

Malaysia has an abundance of agro waste material that has not been fully utilised to a maximum extent. Thus, the finding of a new alternative fibre in the non-wood material will be favourable in product design. Depleting forest tree to get wood material (Nazliza.S, Rahinah.I, 2014). According to Chua.C (2017) President Malaysia Furniture Council (MPC) based on National Timber Industry Policy (NATIP), the government’s reduce on rubberwood export was timely and effective to ensure the sustainability of raw materials for the furniture industry. The introduction of Kenaf into the various materials used by timber-based industries would be an instrument in alleviating the shortage of forest-based raw materials. Kenaf as non-wood material is also suitable supplement for wood. As this issue becomes more crucial, alternative fibre non-wood material is seen to give an excellent solution to save our environment (Nazliza.S, Rahinah.I, 2014). As a mention by Angelini et al., (1998); and Ken-ichi et al., (2002) recognizing its immense potential on kenaf fibre potential for the wood-based sector interest has grown in using kenaf as a sustainable material and alternative raw material, because it has the excellent advantages of being renewable, low cost, and easily grown even under severe conditions such as low water supply and little fertilizer, compare to rubberwood.

2.2 Issue on collaboration between scientist and designer

Science and technology are important for human development and wellbeing. It assumed that the design (specifically product/industrial design) could play the important role in the advancement of science and technology (C. Peralta, J. Moultrie,2010). Lord Sainsbury, (2007) mention evidence suggest that the use of design helps scientist to develop the commercial application for their work while it is still at the research stage or the outset of the technology. The Collaboration between scientist and designer is happening, especially in the fields of medical and testing equipment and in the commercial application of biomimicry, but there are lacking on scholarly research between scientist and designer (C. Peralta, J. Moultrie,2010). In Malaysia, there are lacks collaboration and networking between scientist and designer to ensure the continuity in supports of research and development in Kenaf with government and industry. The potential of kenaf on furniture design always is mention in various of past research from a scientist. According to Najib et al. (2006); Akil et al., (2011) Kenaf fibre is a potential raw material for the variety of product such as reinforced composites, fireboard, fabrics, high-quality paper and furniture. Paridah et al. (2007) reported Kenaf had been found to be a potential raw material for wood composites. It was also reported that particleboard made from kenaf core has superior physical and mechanical properties than those of rubberwood.

Table 1: The previous research had been done from scientist.

	SCIENCE	DESIGN
Najib et al (2006)	Potential to furniture	
Akil et al, (2011)	Potential to furniture	
Paridah <i>et al.</i> (2007)	Potential to furniture	
A.Mahmood et al(2018)	Potential to furniture	
Nazlina, Rahinah (2014)		Potential kenaf in product design
S.M Sapuan (2014)	Potential to furniture	

3. Delimitation of research

The study is focusing on kenaf fibre-based in Malaysia. The researcher was looking for the potential of kenaf fibre-based in furniture design. An only 5-6 expert on kenaf will be a participant for the interview session and 50-person layman or student for peer evaluation.

4. Conceptual framework

4.1 Conceptual framework on design

Conceptual design framework is a guideline to this study to identify the basic principle and outline of design flow or design solution. The framework is constructed by refer the phase on designing and activities. The flow of designing separated to several phase such as:

- Idea development
- Idea screening
- Idea development
- Mockup
- Testing

As goes through, the flow of the design phase needs to validate with peer evaluation as user testing on furniture design.

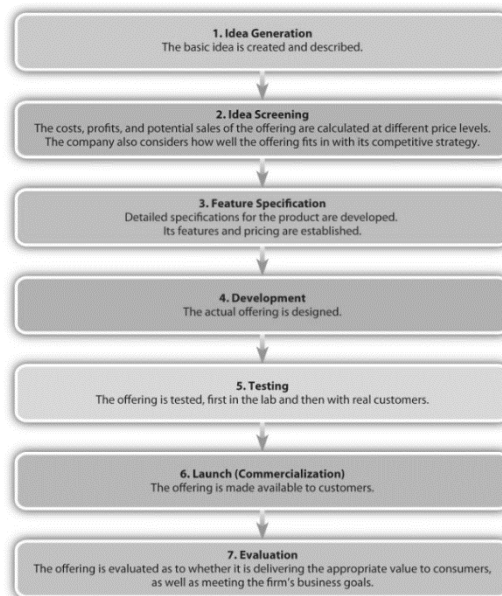


Figure 1: The conceptual framework from NPD (new product development.)

4.2 Conceptual framework on material

On this study material selection (kenaf fibre-based) and design (furniture design) are foremost part of research to integrated terms in the development of any product with a competitive cost. However, it is difficult to select appropriate material for any product design without knowing the importance of material selection in design. This study gives an overview of the new product development activities and some basic features of materials selection the process of kenaf fibre-based.

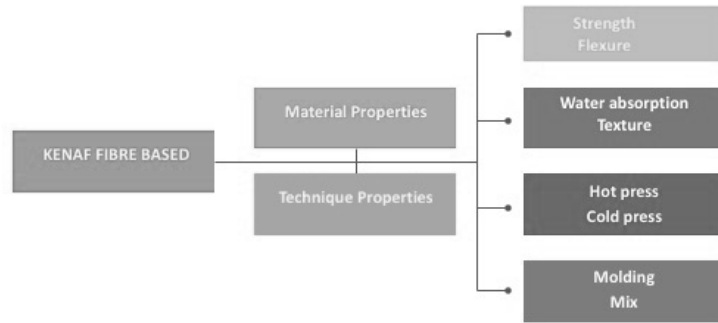


Figure 2: The conceptual framework on Material

5. Methodology

The methodology for this study is the mix method which included qualitative and quantitative — the qualitative research collected from primary and secondary data regarding kenaf fibre based and the development of framework from past research such as journals, articles and books. The data from the literature review will be used for a semi-structured interview session with expert respondent or participant. The next step is to analysis with transcribes or documented the data from the expert. From the data, the researcher transforms all recommendation and response to the design phase and material properties. Peer evaluate from layman and student participant (50 people) for design phase will be cover on attributes such as:

- Aesthetic- form, texture, colour
- Usability- durability, ergonomic and posture and strength
- Technology-jointing, furnishing and finishing.

Several designs, furniture or outcomes will be testing from the peer. Finally, the outcomes as a guideline and the documentation of the design process will contribute to the local furniture manufacturer, the body knowledge and the government ministry LKTN and MTIB.

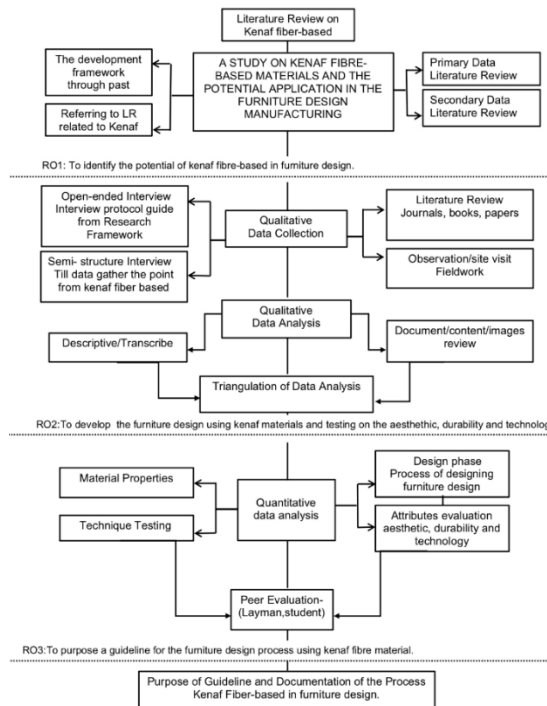


Figure 3: The conceptual framework on research flowchart.

6. Conclusion

This research was concerned with the design and material conceptual framework as the development of kenaf fibre based materials application on furniture design in Malaysia. The conceptual framework as an approach for the process of design. On the other hand, this conceptual framework study will purpose a guideline, solution and recommendations as potential materials through furniture design application for designer and manufacturer.

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