

# DESIGN PROCESS & PRODUCT DEVELOPMENT CHALLENGES IN FURNITURE BASED ON RECLAIMED WOOD IN CENTRAL JAVA

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**Abstract:** Wood in Indonesia has been used as the main raw material in making various kinds of human needs for long time, especially in furniture making. With the support of an adequate wood resources, Central Java become the center of wooden furniture industries. Along with it's development, there are environmental issues that accompany the production of wood furniture. The limitation of quality timber push the industry to seek alternative materials, one of which is reclaimed wood. Environmental issues are indirectly causing design trends followed by the furniture industry. Production process and design decision produced by reclaimed wood has a different process than the new wood. Although it has a high value, reclaimed wood use is also a risk to the furniture industry. This study aims to describe the evaluation of the strengths and weaknesses of the former use of wood through the SWOT (Strength, Weakness, Opportunity and Threat) through the production process, prices of materials, wood cycle in industry and product development. The study was conducted using the method of direct observation and depth interview with two case studies furniture industry in Central Java. The results of the study are expected to be constructive suggestions for the development of the former wood furniture design in Central Java.

**Keywords:** *design, evaluation, furniture, reclaimed, wood*

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## 1. INTRODUCTION

The most commonly wood used for furniture in the past is teak wood. Quality, level of strength and the resilience of teak wood give a high value for furniture. When placed inside the room, teak wood furniture will have unlimited endurance time. However, if placed in outdoor direct from the sun, the furniture will last for 20-30 years. Long life cycle which makes the price of furniture made from old teak higher compare to others. Nowadays, the company have difficulty in providing the best price and quality for consumer caused by the high price teak wood. Therefore, the industry continues to look for alternatives in the selection of materials. Now, various types of wood give option of price. Based on its market segment, then there are two kinds of furniture. The first is a lower middle-class furniture using unpopular wood (eg. mango wood) or popular wood with low quality; then the upper middle class furniture with quality popular wood (teak, mahogany, etc.).

Based on the raw material, wood is the main material that dominates Indonesian furniture products as much as 67.02%, according to the Ministry of Industry and Trade of the Republic of Indonesia through Furnicraft Magazine Today. The export value of furniture and handicraft Indonesia in 2013 was 1.8 billion US dollars for furniture, with details of the wooden furniture exports reached 1.2 billion US dollars, rattan furniture 262.5 million US dollars, bamboo furniture 1.8 million US dollars, furniture metal made 43.7 million US dollars, furniture made from plastic 49.7 million US dollars, and other furniture products 311 million US dollars (website International Furniture Expo Indonesia 2015). The high demand for timber affect environmental issues, started by a Earth Summit conference (1992), which confirms that the environment is a major issue on the international political agenda. Slowly, various ideas about the environment more and more included in the design field.

Strong attention to the environmental crisis affecting the human way of thinking, in order to continue to seek alternative wood materials include using scrap wood. The impact is high demand of reclaimed teak furniture for the export market. The high market demand caused a shortages and soaring material prices. Trend changes of material encouraging the industry to adapt, whether it was in the process of material selection, production process, and design concept. The production process uses reclaimed wood requires a different system compared to new wood. The use of reclaimed wood not only provide opportunities, but also risks for the furniture industry. In this study, analysis of opportunities, risks, and design development will be conducted in particular reclaimed wood furniture.

## **2. THEORETICAL BACKGROUND**

### **2.1 S.W.O.T Analysis**

Basic theory used in this study refers to the connection of sustainable design and management design. In analyzing a design, problems and solutions, there are various methods by considering environmental aspects, economic aspects and market. Strategic methods to analyze the opportunities and challenges in the industry is the SWOT (Strength, Weakness, Opportunities and Threats). Through the SWOT method, we will be able to analyze the existing and future situation of product, the market, the company by considering environmental, economic and social dimension as well as technology and legislation (Tischner, 2006: 51). SWOT method is not only used as a marketing strategy, but it can also be used to assess the social and environmental aspects in the industry.

### **2.2 Life Cycle Analysis**

Life cycle analysis evolved through the study of sustainable design. Papanek (1995) link the design and ecology, through Product Life Cycle Assessment which assesses the entire process from raw material selection, production process, assembly, purchasing process, product use and after use. Before becoming a furniture, there are stages that become the life cycle of a wooden material into final product. In an ecological approach, product development is done to minimize the impact on the environment (Le Lan, 1998: 15). The purpose of Life Cycle Assessment (LCA) is to determine the environmental impacts of a product, product group or system as comprehensively as possible and to identify weaknesses, ecological improvements, make a decision, promote environmentally friendly products and methods (Tischner, 2006: 52 ). It is important to know the environmental impacts from each cycle (life cycle) furniture. Planning of the material's cycle become one of the considerations in sustainable design. From continuous cycle, the product or material could be used as reusable products (re-using), processed (recycling) and modified (upgrading). One of sustainable design concepts associated with the cycle is upcycle, who was appointed by McDonough (2013). Sustainable concept not only how to dispose of the product to where it should be, or to make products that can be easily broken down and made waste. But how a product that is no longer used can be turned into products that have better value. In producing the product, designers contribute to give a decision. According Bhamra & Lofthouse (2007), designers have to take further responsibility because of the role they play as the industry's connection with the marketplace, interacting between people and products. There are several important elements in the production process which affects the life cycle of a product, namely; raw materials, manufacturing process, use, end-of-life, recycle or disposal.

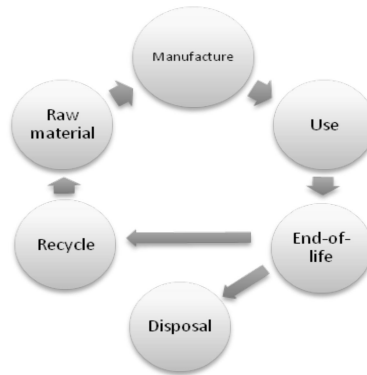


Figure 1 elements affects the life cycle of a product

Source: Bhamra & Lofthouse, 2007

### 3. THE RESEARCH METHOD

#### 3.1. Case Studies

Data collected through in-depth interviews with owner or designer from industries. In addition to conducting interviews, collection of furniture design from industry also needed as secondary data. Observations and interviews analyzed through qualitative descriptions. The object of case studies are two furniture industry, with the category that the industry using reclaimed wood or old furniture as the main material and located in Central Java. The following are profiles of two industries:

1. Industry 1

The industry is located in the city of Semarang, Central Java. Established since 1996 and focus on the export market to many countries, like the Netherlands, Britain, Spain, Belgium and the USA. The industry also has international certificates of FSC (Forest Stewardship Council) and the national certificate SVLK (Verification System of Wood Legality) of Indonesia.

2. Industry 2

The industry is located in Yogyakarta, Central Java. Known as a new industry with an interest in the remnant wood material, and old furniture. His attention to environmental preservation are also publicized through local media. The industry takes craftsmen from Jepara city, which is known as downtown craft of woodcarving. During this time, the market of industry 2 still comes from local market.

#### 3.2. Issue of Observation & The Question of Interview

Observation done by reviewing the types of waste wood for furniture as well as furniture are produced. In addition, the observation was also made in the production process of industrial. The interview process conducted semi-structured question, with four key questions below:

1. What kind of wood do you use, and why did you choose the wood?
2. Where is the source of material come from?
3. Please explained the stages of wooden selection up in the finished product (if you use a waste wood from industry, what conditions should be selected)?
4. With so many competitors, the increasing market demand and raw material resources are limited, please explained the strategy / character design form furniture should be designed by your company, as well as by other industry players in order to maintain the efficiency of wood materials?

## 4. RESULT AND DISCUSSION

### 4.1 Types of Remnant Wood

Before entering the SWOT analysis of the design and production process industry, first will be presented four main types of remnant wood that is widely used by the furniture industry. The following of four kinds of wood are: used wood from demolished houses, remnant of wood chest, remnant of ship, and remnant of railroad tracks. These four types of wood have different characteristics. Remnant wood must be selected again, in accordance with the needs of each industry. Industry first selection process through the level / color grading timber. To determine the age of the wood, there are selection process by the standards of color grading of wood. Avoiding timber wich has white color and choose timber with same color. The main pillars of old houses usually used as reclaimed wood in industry. Standard sizes of selected wooden beam are 16 cm<sup>2</sup>, 14 cm<sup>2</sup> and 12 cm<sup>2</sup>, with the price of one trunk Rp.3000.000 (Puspita, A.A, et.al: 2016). In the past, the beam measuring 20 cm<sup>2</sup>- 40 cm<sup>2</sup> is easily obtained, but now it has been difficult to find and have very high price.

Remnant of wood chest have high demand because it is affordable and easy to obtain. Generally made of pine (or called as *jati belanda* in Indonesia). The wood used for container or chest must have been through the drying process so it has proper light weight. Remnant of wood chest has also been used by Heinz Frick, one environmentalist in the field of architecture in Indonesia. Today's, the remnant of wood chest currently used for furniture in hotels, cafe, and even offices.

It is believed that the resilience of wood chest last up to 5 years, so that it coincides with the periodic changes made by the hotel and cafe to make design improvement in accordance with the trend development. Former timber railway sleepers have become one of the alternatives for using good quality wood. Wood that has been used as a cushion rail is ulin wood or commonly mentioned as *kayu besi* in Indonesia (iron wood). Ulin is a native plant from Sumatra and Borneo, Indonesia, which are included in the category of world protected trade timber (Hidayat.S., 2003). Ulin wood has high quality, resistant to different weather or nature conditions and able to face the invading organism attacks wood (Gusmawalati.D., et.al., 2014).



Figure 2 the types of remnant wood

Source: Personal Documentation

### 4.2. S.W.O.T Analysis

#### A. Strength analysis: production process & life cycle of wood

The main advantages of the use of waste materials is a positive impact on the environment and minimize exploitation (Priyanto, 2008). According Priyanto (2008), the principle of sustainable design is not only minimizes over-exploitation, but also can afford the correct process. The first analysis is the strength of the remnant wood-based industries, assessed through the life cycle of materials, specifically remnant wood. The life cycle can be seen in the production process. There are differences step compared to standard process, which required the selection of size and color of

the wood. Selection by color aiming to standardize timber to estimate it's strength. Unlike the new timber whose age is known, the age of remnant wood is not known. But it was clear that the former wood has high levels of dryness.

Table 1 Analysis from the life cycle of remnant wood and production process

Parameter	Other products	Furniture Industry				Use	Recycle / Disposal
		Processing	Research & Development	Production	Distribution		
Source	Former wood: Remnant of ship, remnant of truck, remnant of railroad& remnant of railroad	Material: Cutting Drying process/ no need drying process	Design: Sanding Measuring Pattern Treatment top coat  Combination with non wood material	Furniture production: Shaping Assembly Raw product Finishing  producing other component	Packing	Customer: Export/ domestic	Repairment/ Disposal/ Burnt
Step	size & color selection	board	component	Final product			
Waste	Waste 1 (large pieces) Used as: mozaic wood board as furniture source for craftman component	Waste 2 (small / medium pieces) Used as:	Waste 3 (small pieces & wood shavings) Used as: Oven fuel		Waste 4 (styrofoam & cardboard)		

Source: Personal Documentation

In addition to using remnant wood resources, industry number 2 has another production process using unused or old furniture. Typically, old furniture used by industry 2 made of teak wood, with high durability. The production process is simpler, and the waste are not as much as previous cycle (figure 3). At the initial stage, the selection made is the selection of the damage, the furniture can still be repaired will be selected. Several material such new wood or tin drum, can be used to support furniture reiparement and product structure.

Table 2 Analysis from the life cycle of unused/ old furniture and production process

Parameter	Other products	Furniture Industry				Use	Recycle / disposal
		Processing	Research & Development	Production	Distribution		
Source	Unused furniture from wood	material: Cleaning	Design: Component replacement Component replenishment	Reiparement Sanding Finishing	Packing	Customer: Domestic	Reiparement /disposal /burnt
Step	Selection of damage	Raw product/ new board	Component / raw product	final product			
Waste	Waste 1: Unused part (disposal/ burnt)	Waste 2 (dust)	Waste 3 (small pieces & wood shaving) Used as: Source for craftman		Waste 4 (styrofoam & cardboard)		

Source: Personal Documentation

### B. Weakness: Limitation of resources

The use of remnant wood in industry, have specific challenges. The disadvantage is the limited material resources at high prices. The industry should have a good strategy in the search for material resources. As mentioned by industry 2: *“Material’s stock will be instantly search to the source at the center point of specific timber producer. Sometimes for the sake of efficiency –new wood or remnant wood - each have their respective suppliers, especially for areas such as Jepara, which always provided complete supplier / store material and material support sharing.”*

With the uncertainty of remnant wood resources, sometimes the industry can not produced the same design with exact material continually. Based on interviews, it is known that the economic value of products made from old wood is quite high. It is also due to the depletion of old wood and increasingly more expensive. The price of one rod bearing rail with length of 2-2,5 meters used to be Rp 120.000. Today, the price rise up to Rp 300,000.

### C. Opportunity on Design Market

In 2010, Indonesia has a population of 237.6 million people (Central Bureau of Statistics), with a predominance of productive age of 15-55 years by 60%. Meanwhile, Indonesia experienced a growth of 1.3 percent annually. It is estimated that in 2034 Indonesia will have a population of 303.9 million people (projections Central Bureau of Statistics). It is the fact that illustrates a very large market opportunity in the country. Besides having the export markets, it is important for the furniture industry to dominate the domestic market. In addition to population number, the opportunity for the furniture industry also emerged restaurants, hotels, up to the office. Thus, the furniture export market orientation can slowly shift to enter the domestic market. Industry 2 specifically focused on using remnant wood and the modification of old furniture. Therefore, most of the design from industry 2 can not be reproduced because the material is limited. The unique design and limited precisely attract local consumers.



Figure 5 products from industry 2

Source: Personal Documentation

### D. Threat: imported furniture

Competition with mass-produced products become major concern of the furniture manufacturers in Indonesia. Currently the products of competitors from the Swedish retail company is in great demand by the people of Indonesia, especially since its emergence in 2014 in Indonesia. The various advantages of Swedish product are; affordable price, lightweight product, assemble design, follow the trend, and so on. It should look out for the furniture industry in Indonesia, so that local markets are still looking for domestic products. Although it has advantages from the aspect of price, design and functionality, the products of competitors from the Swedish retail company also has some drawbacks. Especially, in terms of strength and durability of materials that can not compete with the strength of solid wood. Therefore, retail products from Swedish are usually used for household needs and not to the facility in a restaurant or hotel. Remnant wood provides unique value from other furniture products. the imperfect condition of wood gives unique aesthetic value

and the authenticity of fiber. Durability of wood indirectly give confidence to consumers that products made from remnant wood can also have the strength and resilience.

## 5. CONCLUSION

The emergence of furniture based on remnant wood become more increasing, with the accompaniment of overseas market demand which has an interest in sustainable value. industrial development should also be accompanied by a gradual design evaluation. In addition to the evaluation, the industry needs to manage and produce the design in accordance with the needs of the domestic market and a growing trend, not only to follow the current export market demand. One strategy that can be done to avoid dependence on export markets is creating a trend that is in accordance with the culture, traditions, and the habits of Indonesian society, whether it's using new wood and remnant wood.

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