STUDY ON THE DEVELOPMENT OF ENRICHED ASSORTMENT OF WOOD PRODUCTS SOLD IN THE DOMESTIC MARKET

ITTO PD 928/22 Rev.1 (I)
Development Of Sustainable Domestic Market
For Wood Products

Jakarta, February 2025

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

JAPANGOV THE GOVERNMENT OF JAPAN

MAFF Ministry of Agriculture, Forestry and Fisheries

MINISTRY OF FORESTRY REPUBLIC OF INDONESIA

FINAL REPORT ACTIVITY 1.3

STUDY ON THE DEVELOPMENT OF ENRICHED ASSORTMENT OF WOOD PRODUCTS SOLD IN THE DOMESTIC MARKET

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INTERNATIONAL TROPICAL
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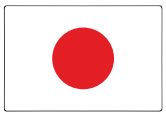

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EXECUTIVE SUMMARY

The development study of enriched wood products sold in the domestic market analyses consumer preferences towards using processed wood products versus subtitled products such as plastic, steel, and aluminium. Consumer interest in using processed wood products can be determined in terms of design, price, quality, and payment method. Besides knowing consumer preferences for using wood products, there is also the development of innovative products. Innovative product development aims to create new products or improve existing wood products, as for the advice given to consumers on improving wood products as well as to the market or producers.

In West Java, Banten, and Jakarta Province, the activity is carried out through a product innovation competition at the "**Green Timber Innovation Challenge** (GTIC): Processed Wood Product Innovation for Sustainable Forestry Business" on December 21, 2024, at the Sylva Pertamina Auditorium, Faculty of Forestry and Environment IPB. The introduction and promotion of engineered wood in Central Java is carried out in **FURNECRAFT**: "Sustainable Furniture for Better Living" held on 16-19 November 2023 at the Oudetrap Building, Kota Lama, Semarang City, Central Java. The "**East Java Wood Product 2023**" event runs for two days on December 13-14, 2023 in Malang Creative Center (MCC) for the East Java locus as the container to introduce new ideas and creative solutions in the wood industry.

The increasing demand for high-quality furniture and the limited types of wood available creates a need for alternative materials that can meet quality, aesthetic, and ecological criteria. Product innovation is very important to maintain the value of product benefits for consumers. Innovation is also a key aspect of a company's success in marketing. Product innovation is not only in design but also in the use or selection of raw materials. The use of environmentally friendly materials is one of the current trends. Products that are innovative, competitive, and have added value must always be developed by companies to be able to adapt and compete with other producers.

Enrichment in wood products sold in the domestic market could be approached by diversifying wood products. Wood product diversification should be developed based on the study of wood consumers, especially their preferences and needs. Then, it should also be combined with the local resources and product introduction strategies. Engineered wood could be one of the best choices in wood product diversification due to its ability to be applied to furniture and construction materials. Engineered wood for furniture and construction materials exhibits some advantages in their performance of strength and earthquake resilience, and also supports environmentally friendly action. It could be developed using local wood species, fast-growing species, including the thinning teak homogeneous or heterogeneous combinations according to consumer preferences.

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I. INTRODUCTION

1.1 Background

Economic development is a continuous planning process carried out by the government to improve people's lives and improve long-term per capita income. Economic development planning in Indonesia, one of which is through the forestry sector. Since the 1970s the Indonesian processed wood industry has developed rapidly. This was triggered, among other things, by the government's policy to increase the exploitation of production forests based on Law No. 5 of 1967, and has increased rapidly since the implementation of the log export ban policy in the late 1970s. These two policies resulted in an increase in the production capacity of the processed wood industry, especially the sawn timber and plywood industries in the 1980s. The COVID-19 pandemic slowed down economic activities in all sectors of the economy due to reduced state funds for development in favour of funding for public health protection and strict enforcement of health protocols by the government authorities that practically restricted the movement of people hence economic activities. As reported by the ITTO, domestic consumption has proven to be a stabilizer for tropical timber production in previous economic crises. Amidst the outbreak of the COVID-19 pandemic, the government and the wood industry are attempting to invigorate the sluggish development of domestic consumption of wood products. In its report titled "Impact of the COVID-19 Pandemic on Tropical Timber Production", ITTO points out three critical conclusions:

- Exports of primary wood products are highly vulnerable to economic shocks.
- The focus and strong dependency on unprocessed wood products should be reconsidered to chance forest sector resilience in the future.
- Domestic consumption has proven to be a stabilizer for tropical timber production in previous economic crises.

Domestic consumption may become a stabilizer for timber production reduced consumption in Indonesia should be overcome by all means. The sluggish development of consumption observed in recent years has to be addressed with the main purpose of promoting a strong and resilient domestic consumption of wood products such that the increasing consumption will serve as a stabilizer of economic shock in the sector. The domestic market for wood products will be strengthened through the improvement of advantages of using wood products relative to substitutes, more diversified wood products offered to consumers, and weakened penetration of wood substitutes which in turn will yield a larger contribution to the national economy. The community's need for wood products is increasing along with the current increase in population. Most of these wood products are used as building construction

materials, raw materials for pulp and paper, fuel and charcoal, as well as materials for making furniture.

From the preliminary survey, it is concluded that most of the wood products consumed at the domestic scale to support daily life in Java Islands consist of furniture, construction, and woodcraft products. From the producer's aspects, to increase sales of their products, wood product industry actors (producers, intermediaries, and sellers) must pay attention to consumer behavior trends toward the products being marketed. By paying attention to consumer behavior, it is expected that business actors can determine the level of consumer satisfaction with the products being marketed so that in the end business actors can implement appropriate marketing strategies including product characteristics and prices to determine consumers' interest in wood products. Project PD 928/22 Rev.1 (I) "Development of Sustainable Domestic Market for Wood Products", conducted by the Directorate of Forest Product Processing and Marketing Development, Directorate General of Sustainable Forest Management, Ministry of Environment and Forestry, aims to promote the development of domestic consumption for wood products, in anticipation of population and economic growth, through increased resilience of consumption, enhanced supply chains, and improved government policies. The project will be implemented in a participatory, collaborative manner, for which partners will be selected based on competence. Risks will be managed by putting in place the relevant mitigating measures since the onset of project operations. Its specific objective is to promote a strong and resilient domestic consumption of wood products, to be achieved through the delivery of two outputs, namely: i) increased capacity of the domestic market to satisfy consumers' need for wood products, and ii) enhanced institutional arrangement for steadily rising domestic consumption of wood products. To support the achievement of the outputs, the study of the development of enriched assortments of wood products sold in the domestic market is developed.

1.2 Objective

The objective of this activity is to develop an enriched assortment of wood products sold in the domestic market and to conduct the exhibition/promotion of enriched/new wood products desired by the targeted consumer.

1.3 Output

The study covers updated information on an enriched assortment of wood products sold in the domestic market in the project locus. The expected proposed activity to achieve the output of Activity 1.3 consists of:

- To select relevant targeted consumer groups at the national scale in general and particularly in the locus of the project consisting of West Java, Central Java, East Java, Banten, and DKI Jakarta Province;
- To conduct the study by collecting information on the preferred wood products that are most demanded by consumers, products that are available in the markets, and new products that are desired by consumers;
- To conduct the exhibition/promotion of enriched/new wood products desired by the targeted consumer at the national scale in general and particularly in the project area;

- To integrate the results of the analysis with the Timber Legality Information System.

The study was conducted by the universities consisting of the Faculty of Forestry and Environment IPB University for the locus of West Java, Banten, and DKI Jakarta Province, the Faculty of Forestry Gadjah Mada University for the locus of Central Java, and the Faculty of Agriculture of Brawijaya University. The output of the study consists of 1 package of analysis results (1 activity report).

II. METHODOLOGY

2.1. Time and location

Activity 1.3 was carried out from November 2023 to January 2024. The study on salient features of substitute products has been conducted with the locus of West Java, Central Java, and East Java Province with the additional locus of Banten Province.

2.2. Methodology

2.2.1. Data Collection

The study focuses on the development of enriched assortments of wood products for the commodities of furniture (indoor and outdoor), wood for construction, and woodcraft desired by the targeted consumer groups and wood industries in the project area. The logical framework of the study is summarized in the diagram below.

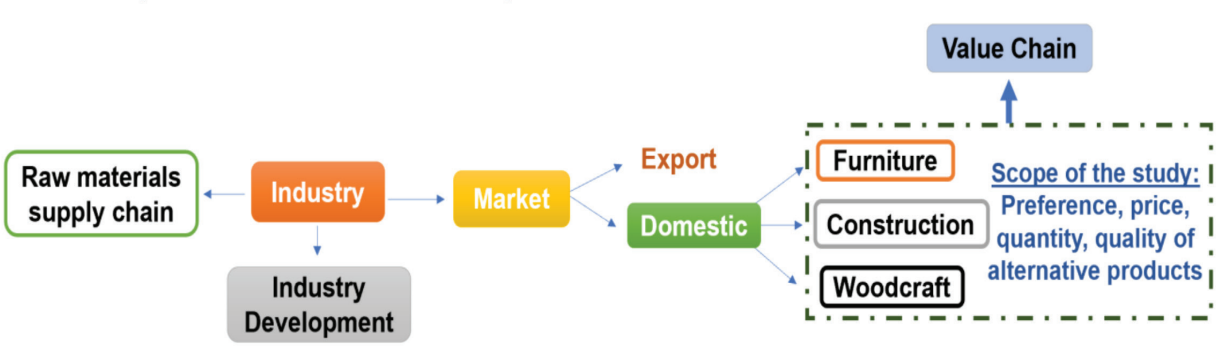


Figure 1 Logical Framework of the study

2.2.2. Data Analysis

Enrichment of wood product types is carried out by identifying relevant consumer groups and understanding market characteristics and consumer characteristics through the literature study, such as collecting supporting data. The consumer surveys are conducted to identify and understand consumer preferences for wood products in more detail. Market analysis is performed comprehensively to analyze existing wood products and assess the availability and demand of such products. In this research, there is the development of innovative products aimed at creating new products or improving existing products; it can be done as follows:

1. Identification of purpose, i.e., defining the main objective, including the problem to be solved or what kind of product to be developed.
2. Selection of research team, i.e., selecting a research team with relevant expertise in the field of products to be developed.
3. Budgeting is setting the budget necessary for research and product development.
4. Market studies are used to identify consumer needs, preferences, and trends related to the developing product.
5. Product ideation means developing ideas with the research team to produce innovative product concepts with detailed and specific development.
6. Prototyping, i.e., making a product based on a design that has been developed. The prototype can be physically shaped or simulated. At this stage, improvements and refinements are required to obtain satisfaction from the products produced.
7. Product launch, i.e., introducing a product to the market with a defined marketing strategy.

In developing enriched wood products, collaboration between industry and universities is required, this is achieved by forming a joint team to study the development of innovative wood products and then test the products to ensure their quality and durability. The development of such products is further displayed in the exhibition carried out alongside the workshop activities. The findings of the product are disseminated to the general public through workshops, seminars, and draft journals. It will be published through the Executing Agency's information system portals and the university information system portal to be accessible by the public widely.

III. RESULTS

3.1. Development of enriched assortment of wood products in West Java

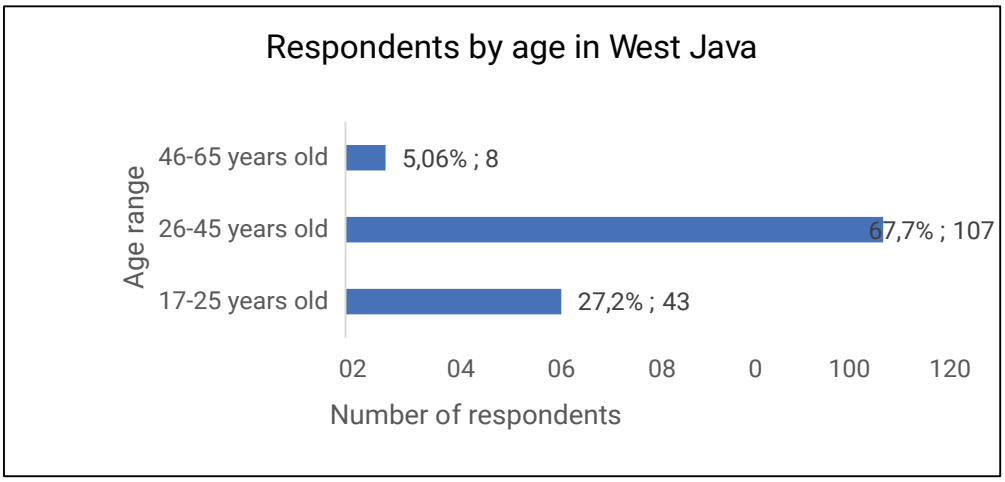
a. Characteristics and type of consumers

The survey was conducted in 19 cities/captains of 28 towns and districts in West Java province. These are: Bandung, Bogor, Bekasi, Cianjur, Cimahi, Ciamis, Cirebon, Garut, Kuningan, Karawang, Majalengka, Depok, Indramayu, Purwakarta, Subang, Sumedang, and Sukabumi. The total number of respondents in the West Java Province is 158 responded. Here is a description of the characteristics of respondents in the West Java Province.

1. Age, gender, and education

Most respondents were in the age group of 26 to 45 years (67.72%). The age group over 45 years is less interested in completing the questionnaire. (Figure 2a). The female respondents are more predominant in completing the questionnaire as in the West Java Province; the women respondent was 70,25% (figure 2b). In West Java, the high school education level respondents are the most dominant, with 61.39%, followed by the college respondents with 32.9% (Figure 2c).

(a)



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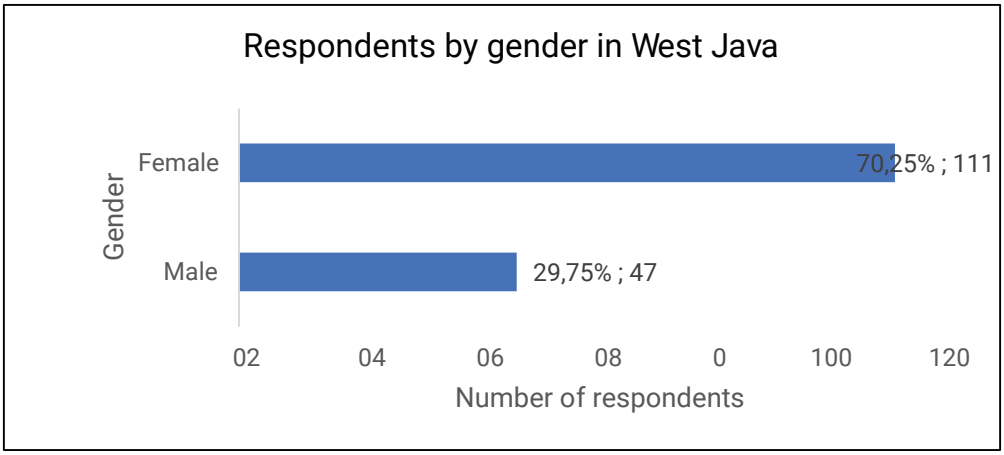

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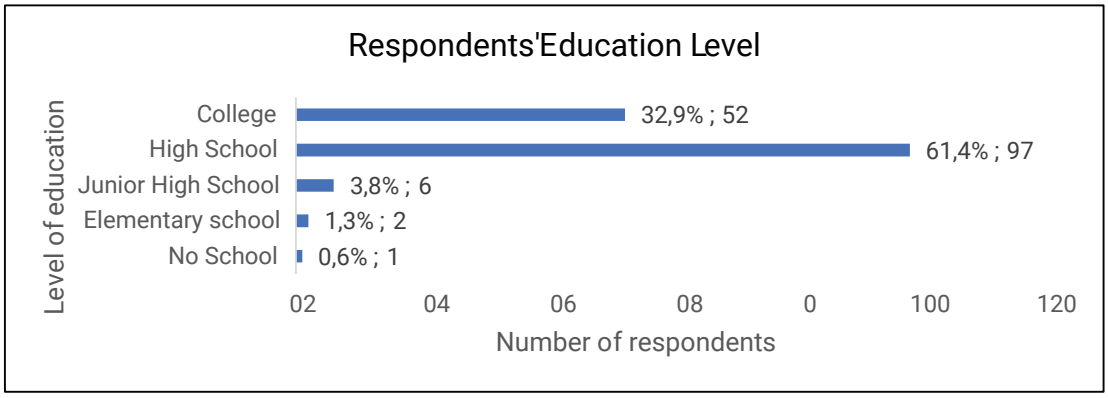
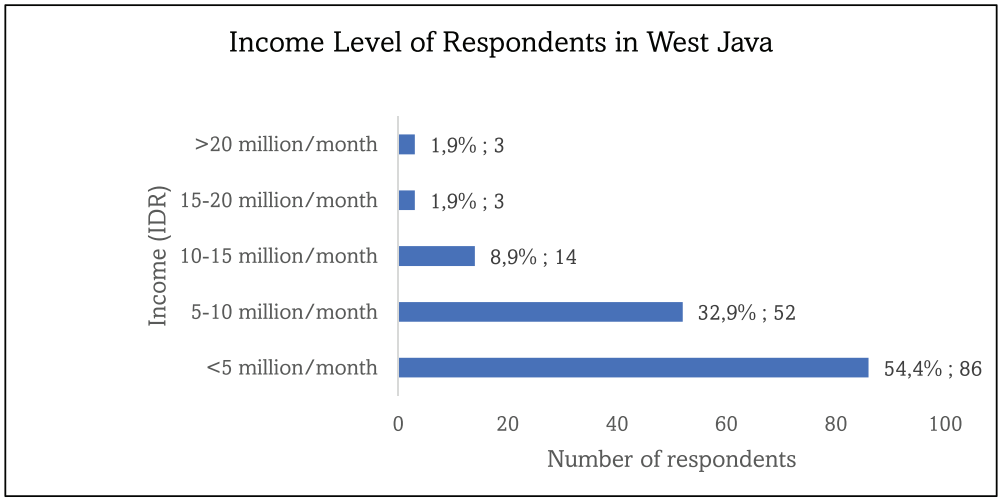


Figure 2 (a) Respondents based on age in West Java; (b) Responds based on gender in West Jawa; (c) The level of education of respondents in West Java

2. Income level and type of occupation

Figure 3a shows that the domination of respondents in the West Java Province has an income of less than IDR 5 million/month, which is as much as 54.4%, followed by respondents with an income of IDR 5-10 million /month of 32.9%. Twelve types of job respondents are part of filling the questionnaire: cashers, private employees, entrepreneurs/private officers, housekeepers, farmers, peasants, laborers, freelance, graduate, developers, BUMN, ASN, and academicians. Figure 3b shows that private employees are the most respondents in the West Java Province respondents (53.16%).

(a)



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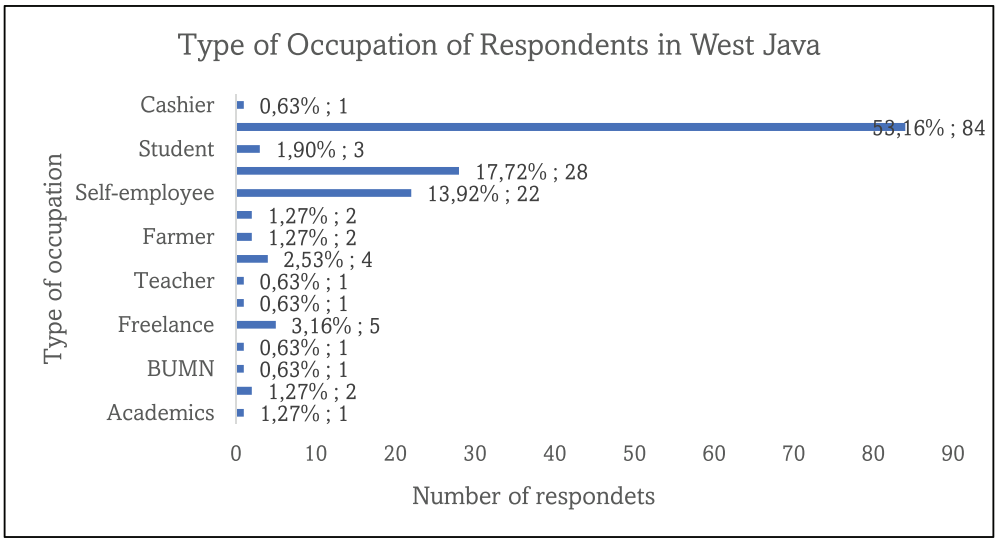


Figure 3 (a) Income level of respondents; (b) Types of occupation in West Java

b. Consumers' preference for the product by type of consumers

The survey was conducted to determine consumer preferences regarding using processed wood products and their substitute products, such as wood products, for furniture, crafts, and construction purposes. Consumer preferences for the various wood-processed products are explained in the section below.

1. Respondent's interest in furniture products

The survey showed that respondents still had a high interest in using furniture made of wood. Interested respondents (Likert scale 4) were very curious (Likert scale 5) about furniture products made of wood 96% and replacement products only 57% (Figure 4). This indicates that furniture products made of wood are still in demand by most of the West Java community.

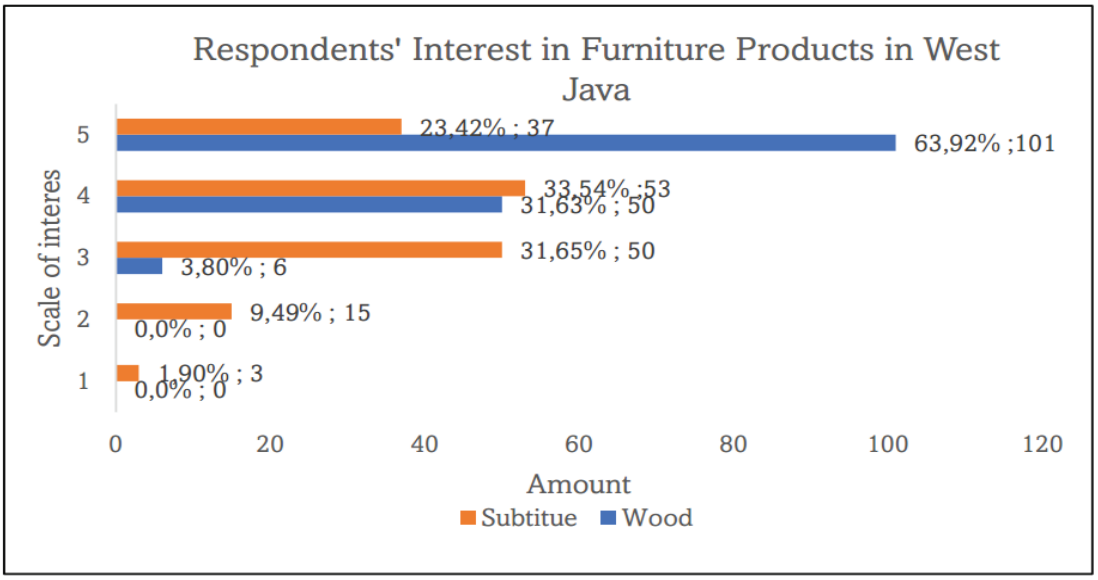


Figure 4 Respondent's interest in furniture products in West Java

As with the use of furniture, respondents in the West Java Province still have an interest in using wood as a construction option. The survey showed that interested respondents (Likert scale 4) were very curious (Likert scale 5) about construction

materials made of wood as much as 84% and for substitutes 60% (Figure 5). This indicates that most of the West Java community still demands construction materials made of wood, but replacement products are also not few of its fans. When the efficiency of production and innovation of construction material products from wood is not immediately fertilized, the replacement product will be a heavy competitor later.

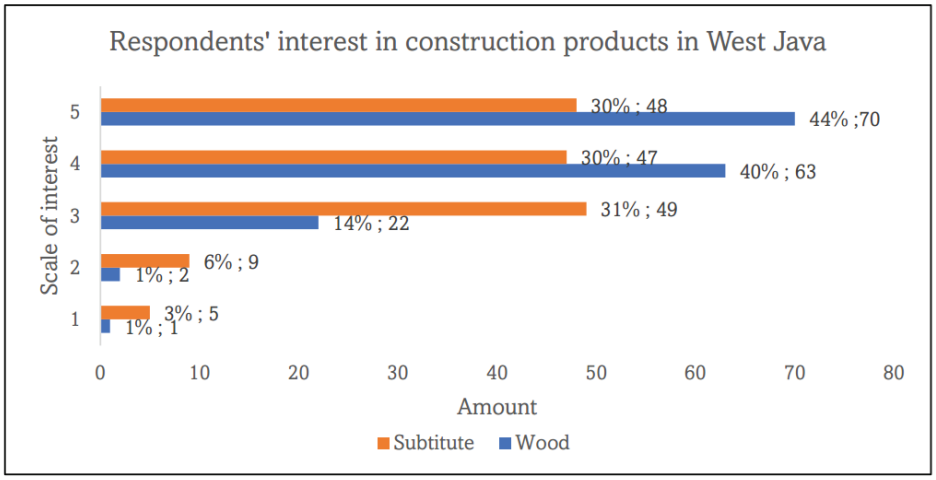


Figure 5 Respondent's interest in construction products in West Java

2. Respondents' interest in wooden craft products

Craft products are also still in demand. Based on the results of a survey regarding respondents' interest in using wooden crafts, it shows that 88% of respondents were interested (Likert scale 4) to very interested (Likert scale 5) in wooden craft products and only 42% for substitute products (Figure 6). As with wooden furniture products, wooden craft products are still in demand by most people in West Java.

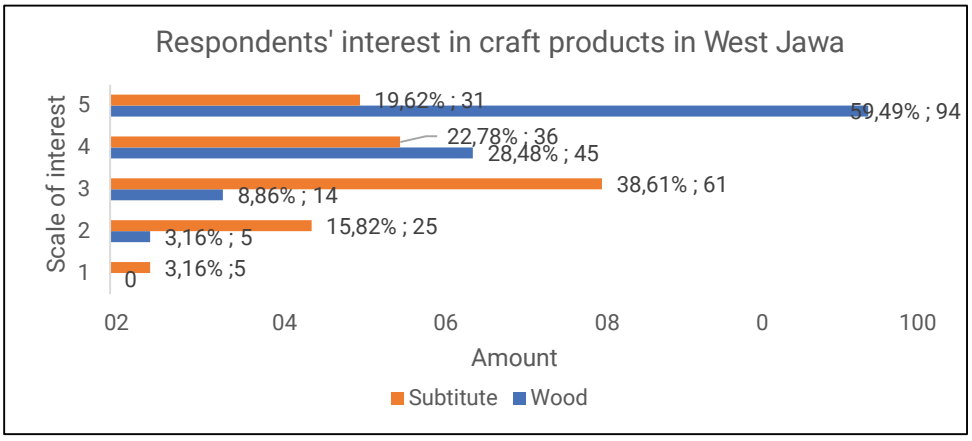


Figure 6 Respondent's interest in craft products in West Java

3. Consumer assessment of wood compared to substitute goods

Respondents' assessment of the level of interest when faced with the choice of using wood or substitute goods has been carried out using a rating scale of 1-10. The higher the value, the more interested the respondent is in wood products. The assessment results show that respondents are more interested in choosing to use wood when compared to choosing to use substitute goods. As shown in Figure 6, 75% of respondents gave a score of 8 (27%), a score of 9 (15%) and a score of 10 (33%). This indicates that wood products are currently in demand by the public.

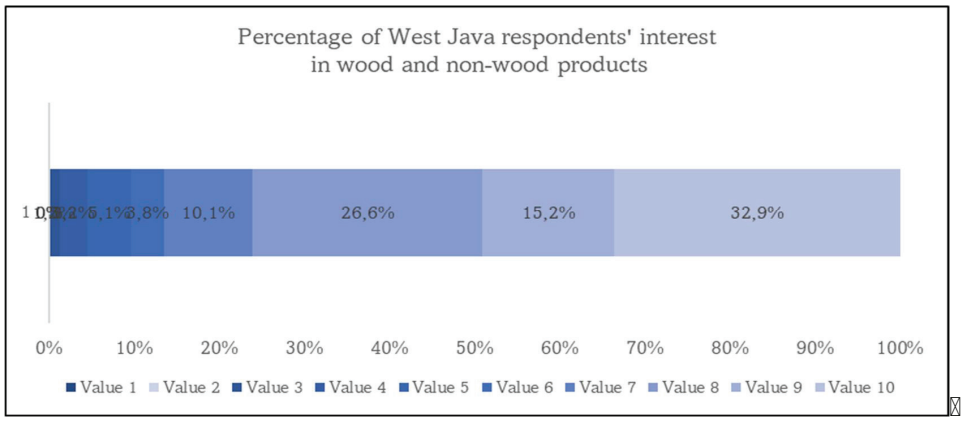


Figure 7 West Java respondents' interest in wood products and their substitutes

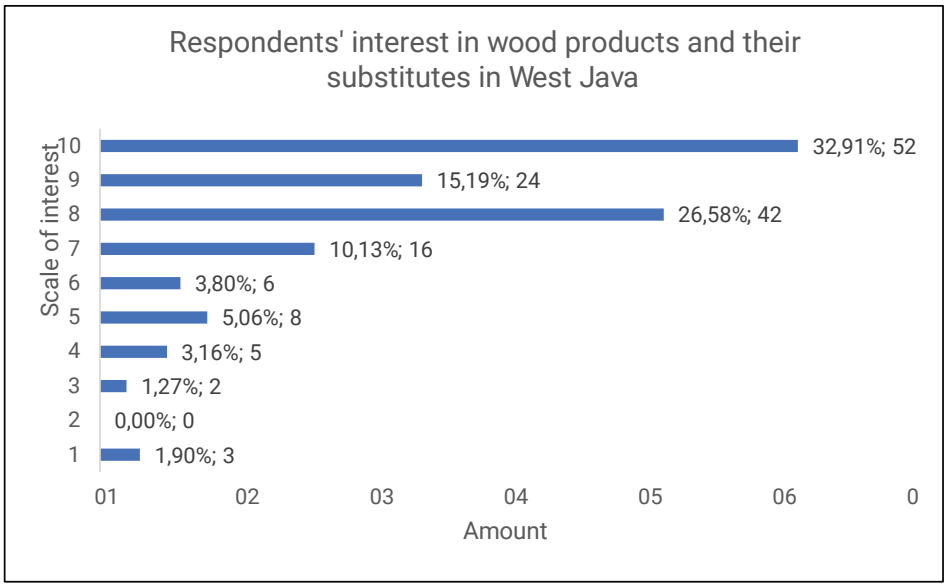


Figure 8 Respondent's interest in wood products and their substitutes in West Jawa

4. Interest in types of wood products and substitute goods

Apart from respondents' interest in wood products, respondents also chose different types of goods. Based on the survey, it is known that cheap and easy-to-find goods are popular among respondents, with wood products being 46.84% and substitute products 58.23%. Not only that, respondents also chose types of products with discounts and negotiable prices for wood products of 19.62% and substitute goods of 22.78%. The survey results on types of goods with other classifications are presented in Figure 9.

It seems that price and ease of obtaining the product are the main considerations for respondents. Cheaper prices can be achieved if efficiency in processed wood production can be achieved. The ease of obtaining products is related to the sustainability of forests as wood producers. As a renewable resource, sustainable forest management is a necessity. Without sustainable management, renewable resources will be the same as non-renewable resources; the more they are used, the faster they will run out.

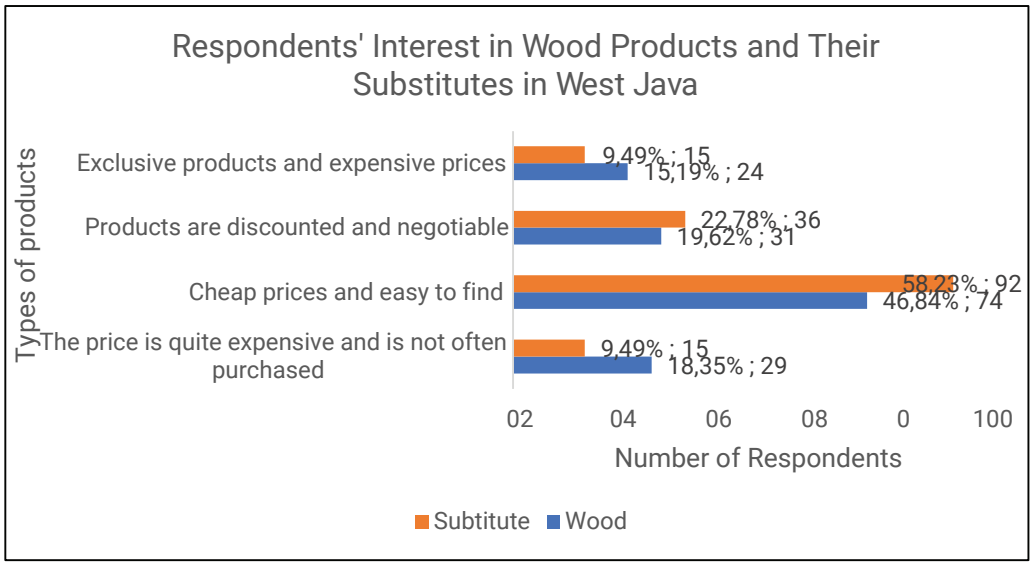


Figure 9 Respondents' interests regarding types of wood products and their substitutes in West Java

5. Preference for wood furniture product design and substitute goods

Regarding design, the survey results show that the wooden furniture product designs that respondents are interested in are complete furniture, 35.4%, then built-in furniture, 25.3%, and multifunctional furniture, 20.3%. Meanwhile, the design choices that are in demand for substitute products are installed furniture, amounting to 26.6%, and furniture with wheels, amounting to 22.8%. The survey results of design choices that are of interest to respondents are presented in Figure 10.

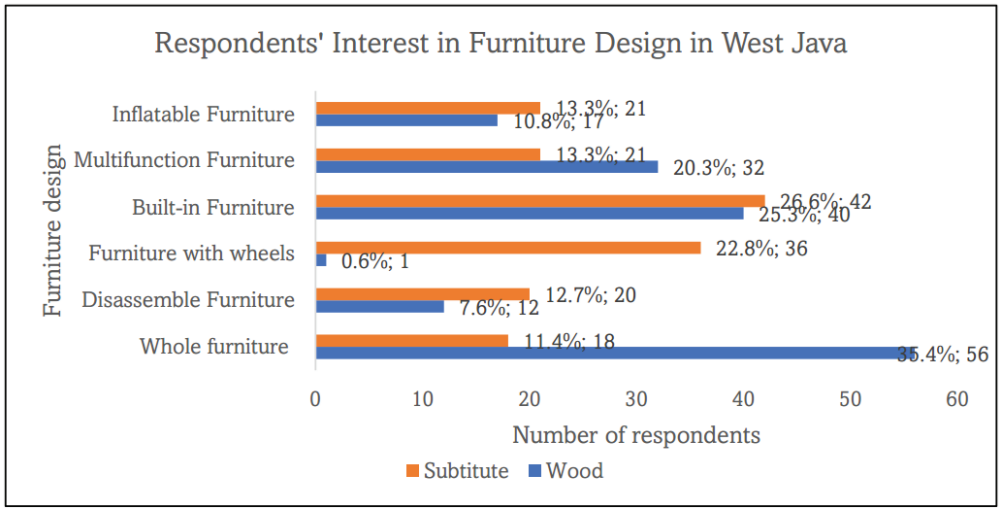


Figure 10 Respondent's interest in furniture design in West Java

The information in Figure 10 shows that the wood-based furniture products that are more popular are whole and multifunctional furniture, while for other types (inflatable, wheeled, and disassembled furniture), respondents tend to prefer products made from wood substitutes (aluminum, plastic, iron, etc.). In contrast to built-in furniture, consumer preferences for wooden products and their substitutes are almost the same. This shows intense competition between wood products and substitutes.

6. Preferences for wooden craft product designs and substitute goods

The various craft designs that respondents are interested in are craft designs for fashion and lifestyle, art crafts, home decorations, and toys. Overall, the most popular design choices for wooden crafts and substitute goods can be seen in Figure 11.

The survey showed that wooden home decoration crafts were the most popular among respondents, namely 48.10%, followed by artistic crafts (39%) and children's toys (6%). For home decoration, there seems to be no difference in preference between wood products or their substitutes, both of which are preferred by 48.10% of respondents. Meanwhile, for fashion and lifestyle, substitute products are more popular, at 39.24%.

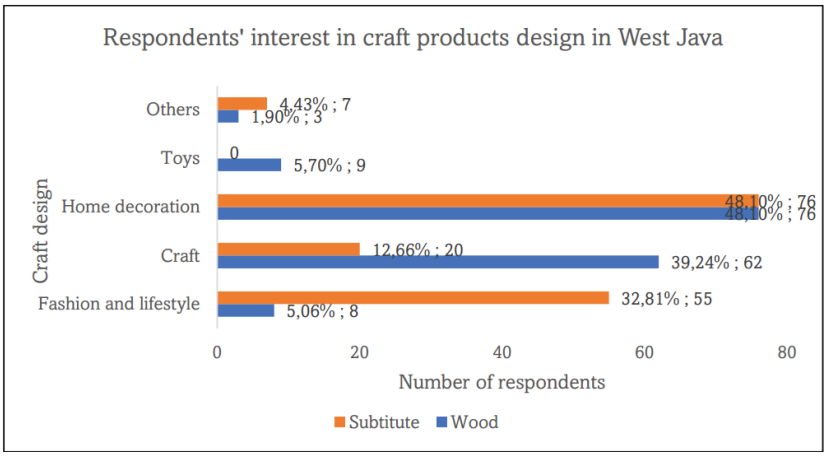


Figure 11 Respondent's interest in craft product design in West Java

7. Price preferences for wooden furniture and craft products

7.1 Furniture

The survey shows that for purchasing wooden furniture products, the costs that consumers are willing to spend (WTP) are dominated by the price range of IDR 1,000,000 – 3,000,000 (38%) and IDR 3,000,000 – 6,000,000 (30%). However, for furniture products with a price range of IDR 1,000,000 – 3,000,000, respondents were more interested in buying products made from wood substitutes (47%). It seems that for expensive products (> IDR 3,000,000), respondents are more interested in buying wood-based products (43%), as shown in Figure 12.

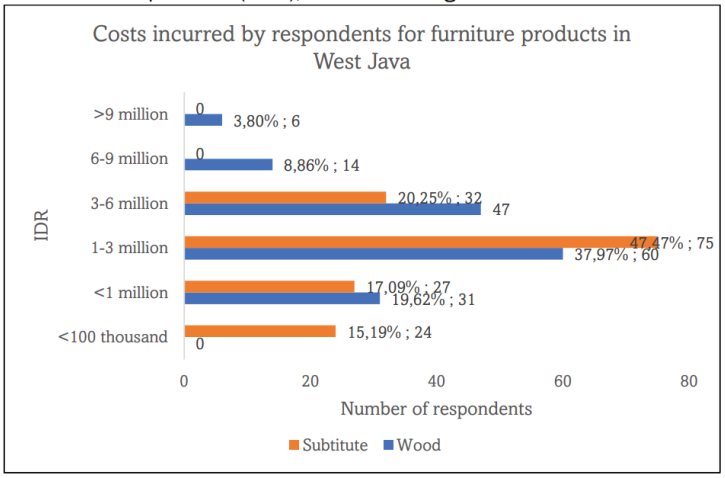


Figure 12 Costs incurred by respondents for furniture products in West Java

7.2 Woodcrafts

Figure 13 shows that the majority of respondents (42%) are willing to pay to buy wooden craft products in the price range of IDR 1,000,000 –3,000,000. Meanwhile, for substitute goods, most respondents (49%) were more interested in buying products priced at less than IDR 1,000,000, although there were also respondents (4%) who were willing to spend more than IDR 9,000,000.

Wooden craft products with prices of less than IDR 6,000,000 are more popular with consumers, while substitute craft products are more popular at prices of more than IDR 1,000,000. It appears that in the price range between IDR 1,000,000 to 6,000,000, there is intense competition between wooden craft products and their substitutes.

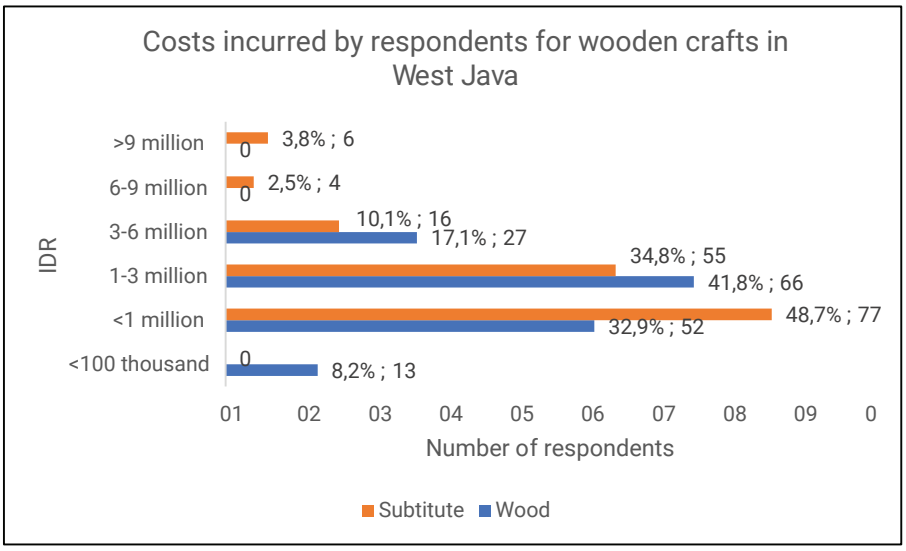
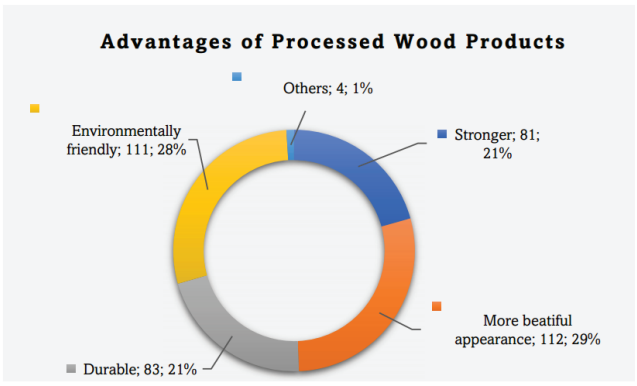


Figure 13 Costs incurred by respondents for furniture products in West Java

8. Preference for the quality of processed wood products

The reason respondents use processed wood products is also determined by their knowledge of the quality of the product. How do product advantages determine respondents' choices in using wood products or substitute goods? Respondents in West Java chose processed wood products because of their advantages in the form of a more beautiful appearance (29%) and environmental friendliness (28%), Figure 14(a). Apart from processed wood products, respondents also chose substitute products. The survey shows that respondents who dominate choose substitute products with superior water resistance at 25.9%, followed by easy maintenance at 23.3% Figure 14(b).

(a)



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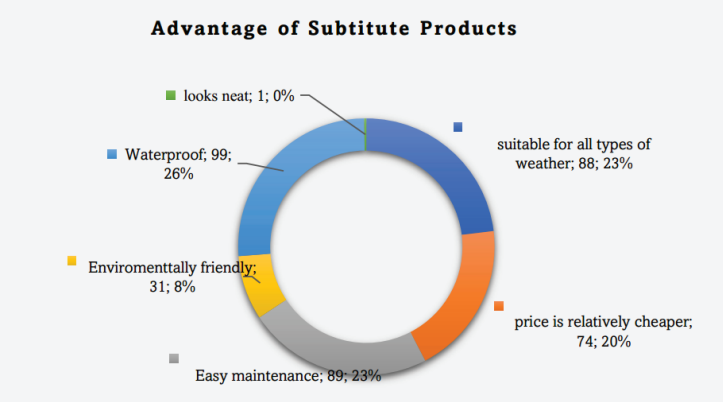
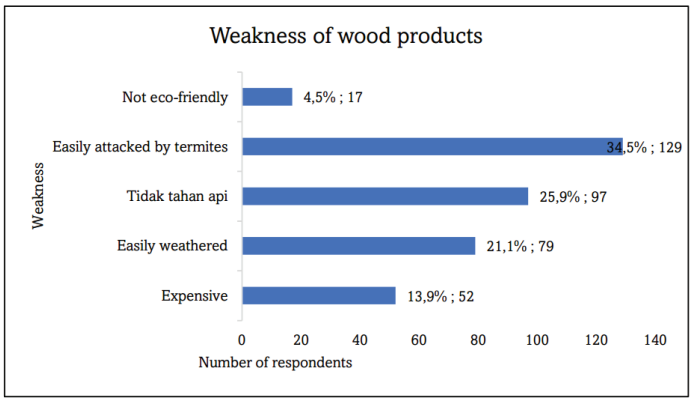


Figure 14 (a) Advantages of processed wood products according to respondents in West Java; (b) Advantages of substitute products according to respondents in West Jawa

The most prominent disadvantages of using processed wood products are that they are easily attacked by termites 34.5%, not fire resistant 25.9% and not environmentally friendly 4.7% (Figure 15a). Various negative campaigns accusing that using wood products is not environmentally friendly is something that needs to be straightened out through education to consumers. Some weaknesses regarding product strengths should be answered through product innovation created by research institutions. Even substitute goods have weaknesses. Respondents in West Java Province considered that limited design at 50.8% was the most dominant weakness, followed by less strong materials at 33.7% (Figure 15b).

(a)



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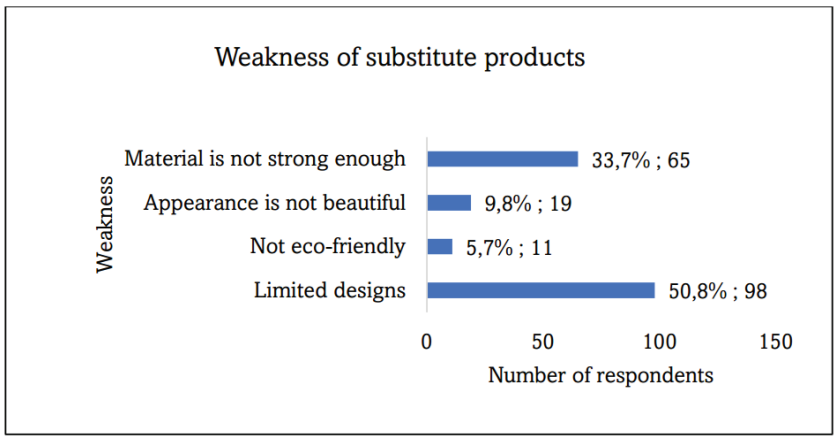


Figure 15 (a) Weaknesses of wood products based on respondents in West Java; (b) Weaknesses of substitute products based on respondents in West Java

8. Payment type preference

The payment method chosen by respondents in transactions to purchase wood products and their substitutes is dominated by the payment method in cash (88%) for wood products and 84.4% for substitute products. The public's interest in buying wood products in cash will be very profitable in terms of marketing efficiency and maintaining business liquidity, in addition to saving entrepreneurs on the cost of borrowing money (cost of money). Apart from the cash method, there are also other methods such as payment by debit/e-money, online, contract, and credit (Figure 16).

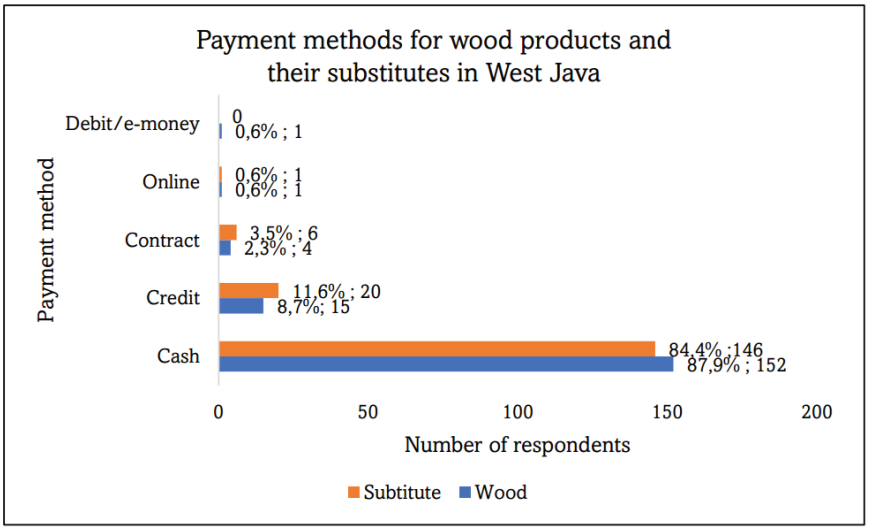


Figure 16 Payment methods for wood products and their substitutes in West Java

c. Enriched assortment of wood products sold in the West Java market

Innovative product development aims to create new products or improve existing timber products. One form of activity is carried out through a product innovation competition at the "Green Timber Innovation Challenge (GTIC): Processed Wood Product Innovation for Sustainable Forestry Business". The competition combines creativity, innovation, and education to realize positive changes in the use of processed wood products in a sustainable forestry industry. The target of the product innovation competition involves students in West Java and Banten to design wood product innovations that are unique, creative, functional, and affordable.

The innovation competition products were shown at the workshop and exhibition held on Thursday, December 21, 2024, at the Sylva Pertamina Auditorium, Faculty of Forestry and Environment IPB. During the exhibition, all competition participants displayed and presented their innovative work to the jury, and all participants were present.

The assessment criteria for the Green Timber Innovation Challenge (GTIC) processed wood innovation products are:

1. Product uniqueness: Product uniqueness is something that identifies certain goods or services that can cause a person's perception of these goods or services. Other experts say that product uniqueness is an added value that makes a product stand out compared to other competitors.
2. Creativity: A creative product is a product that is new so that there is no equal whether it is a model, shape, or texture.

3. Functionality or benefits: Products with standard configurations and long-life cycles. Usually has little variation. Customer needs over time remain relatively unchanged.
4. Price affordability: A product whose price can be reached according to consumer expectations
5. Handiness: Ease of use of the product
6. Novelty: The creation of a product that is completely new and has not existed before or a modification of something that has existed before.

The total number of participants who participated in the competition was 13 participants consisting of 11 groups. The following are the products developed at the GTIC innovation competition:

1. Wood Pellet: Sengon Wood Waste and Coconut Shell
   This product is a pellet made from biomass that functions as an alternative fuel, a material for smoking food and wood, and becomes a litter for pets.
   Wood Pellets have a small size design and are easy to carry anywhere (portable). This product can be a new lifestyle as an alternative fuel that is environmentally friendly and easily accessible at a low price (Figure 17).

Figure 17 Innovation; Wood Pellet

2. Educational Box Games

   This product is a wooden box produced from processed Dutch teak or pine wood waste. This product combines several board games such as snakes and Ladders, XOX and memory games as educational and entertainment media that can support sensory and motor skills and improve soft skills. This product is an innovation developed for the wider community (all groups) to increase the processing of wood waste which can become a product with high economic value. Educational box games have a flexible, all-in-one design and are easy to carry anywhere (portable). This type of product is not specifically for minors but can be utilized by all ages so that it can become a new trend (lifestyle) that applies in society at a low price and is easily found (Figure 18).

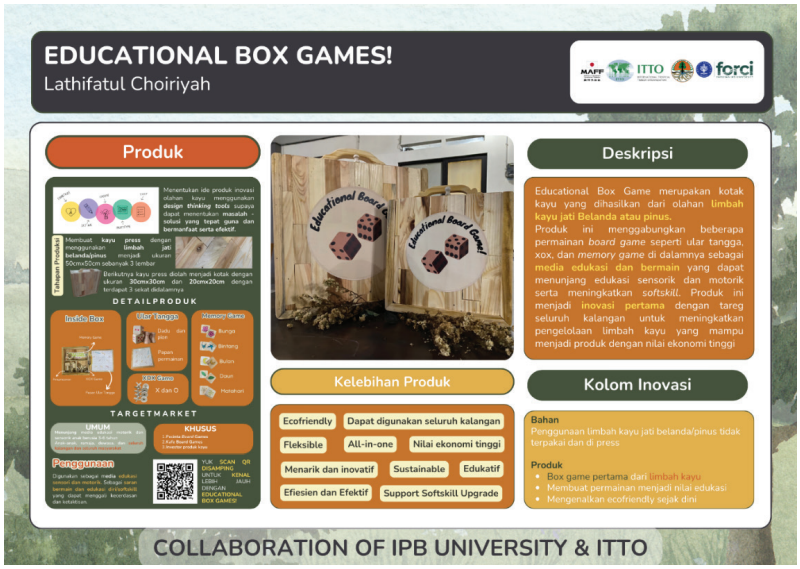


Figure 18 Innovation; Educational Box Games

3. Laminated Wooden Chopsticks

This product is used to pinch and move food from one container or plate to another and is also a frequently used cutlery. Laminated wooden chopsticks have an attractive design combined with two different types of wood, namely teak and pine wood using the lamination method. This product can be a prevailing lifestyle in the community by introducing chopsticks that are different from the usual at a low price and easy to find (Figure 19).

Figure 19 Innovation; Laminated Wooden Chopsticks

4. Laminated Cutting Board

This product is a cooking utensil that has an aesthetic value that enlivens a product by revealing elegant teak fibers. The laminated cutting board has a design that emphasizes the aesthetics and beauty of the product and has a size of 40 x 20 cm so as to provide comfort when cutting ingredients. This type of product can be a lifestyle that applies in society at a low price and is easy to find (Figure 20).

Figure 20 Innovation; Laminated Cutting Board

5. Laminated Wooden Tray
   This product is an innovative laminated product for household needs. This product is a tray of mahogany and white teak laminated to create beauty and improve product quality. The laminated wooden tray has an attractive design by prioritizes aesthetics. This type of product can be an option for a tray that has a laminated wood motif and can be a growing trend (lifestyle) in society at a low price and is easy to find (Figure 21).

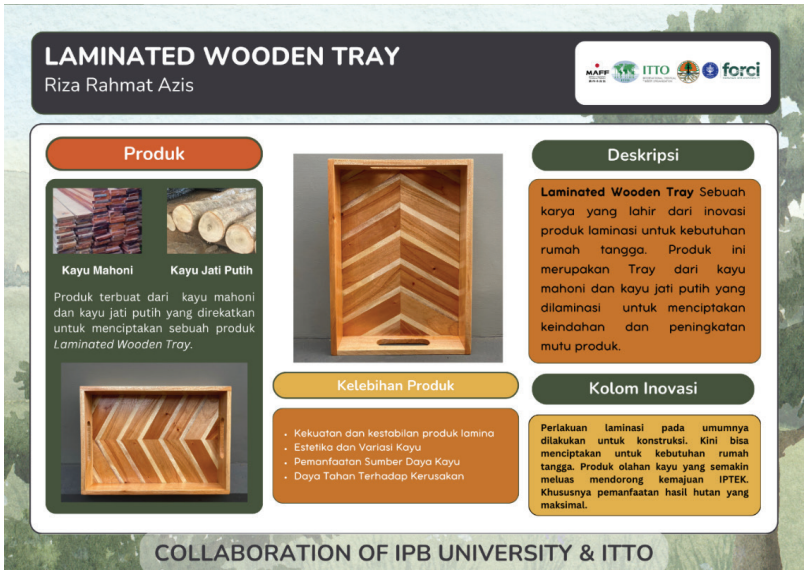


Figure 21 Innovation; Laminated Wooden Tray

6. GS Bamboe: Hidgrogel Slow-Release Fertilizer

   This product is a slow-release fertilizer (SRF) based on bamboo wood fiber cellulose (Bambusoideae) with maggot fertilizer as a technology to overcome the problem of low fertilizer efficiency. GS Bamboe is packaged as 250 g/pcs. In the production stage, GS Bamboe uses natural ingredients by considering the availability of raw

materials, sustainability, and through a cleaner production approach. GS Bamboe is a low-cost and easy-to-find product.

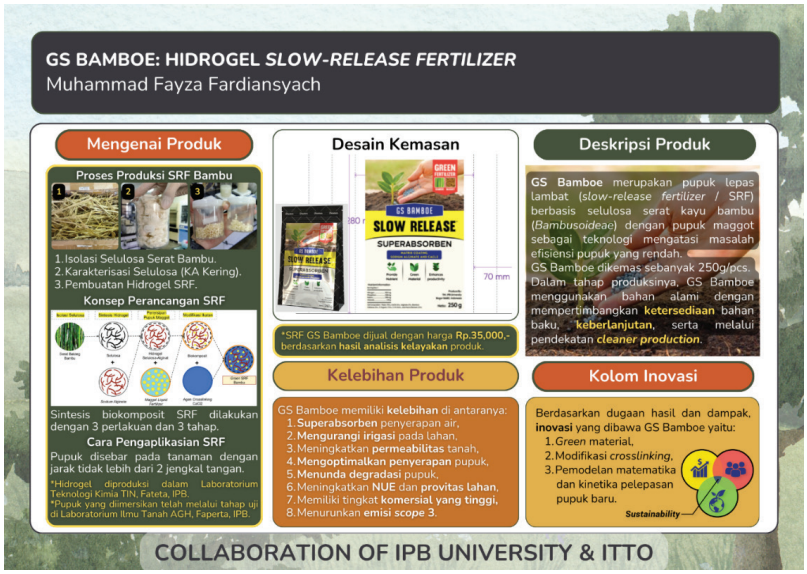


Figure 22 Innovation; GS Bamboe

7. Sofa Bed
This product brings a revolutionary concept in wooden furniture design, changing the traditional role of the chair function into a multifunctional space that transforms into a comfortable and minimalist bed, so that it can save space and has its aesthetic value. The sofa bed has a unique design, minimalist, multifunctional, and aesthetic value. This type of product can be an option for consumers who choose products at low prices and are easy to find (Figure 23).

Figure 23 Innovation; Sofa Bed

8. Wowafa
This product serves as an insect-repellent solution made from efficient wood waste. With the soothing aroma of lemongrass, clove, and cinnamon, Wowafa is not only useful as an insect repellent but also as an aromatherapy. The cellulose

residue produced after burning can be used as fertilizer for plants. With the right composition, Wowafa is environmentally friendly. Wowafa has a minimalist and efficient design, easy to carry anywhere. This type of product can be an option for consumers who choose products with low prices and are easy to find (Figure 24).

Figure 24 Innovation; Wowafa

9. Eksia Liquid

This product is an iron corrosion prevention liquid based on tannin extract from acacia bark *(Acacia mangium).* Packaged in cans with a height of 7 cm and a diameter of 7.5 cm. Can reduce the corrosion rate by 79.2% so that it can prevent corrosion of iron. Eksia liquid is a product that has a minimalist and efficient design. This type of product can be found at low prices and is easy to find (Figure 25).

Figure 25 Innovation; Esia Liquid

10. Wood Sieve

This product is one of the wood craft products as a container for placing dried flower

sticker ornaments. Wood Sieve has a high aesthetic value so it has the potential to become a new developing lifestyle. This type of product is cheap and easy to find (Figure 26).

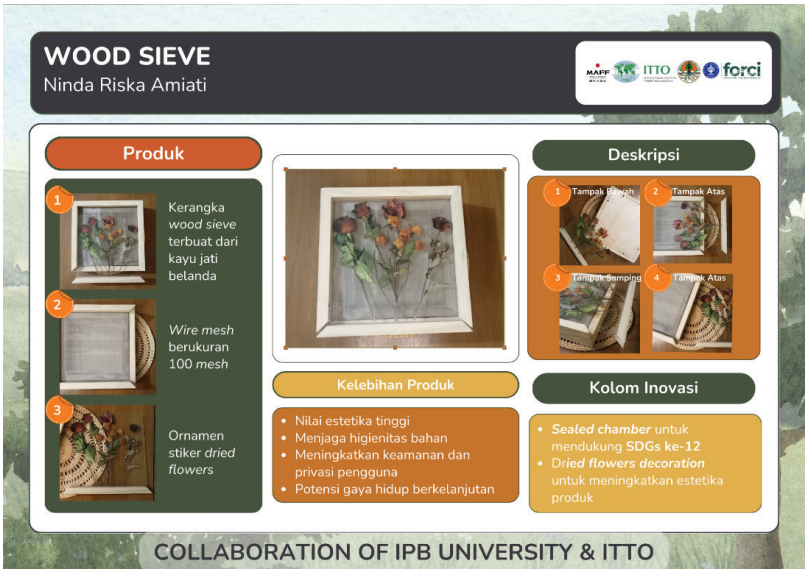


Figure 26 Innovation; Wood Sieve

11. Afloat: Authentic Art Float

This product is a fishing float made from sengon wood (*Paraserianthes falcataria)* which is usually used as a marker of fishing bait so that it does not sink far into the seabed and detects fish movement when it touches the river.

Afloat is a unique keychain product with batik motifs of the archipelago as one of Indonesia's cultures. This type of product is cheap and easy to find (Figure 27).

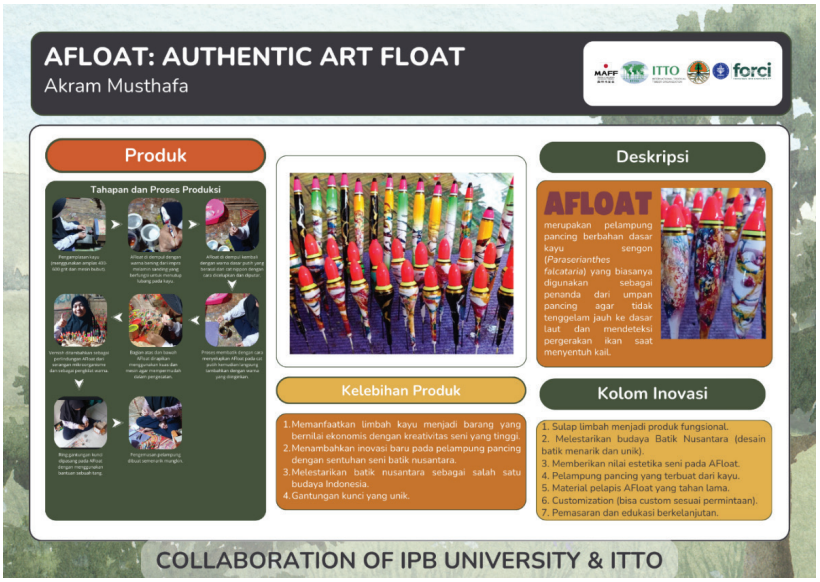


Figure 27 Innovation; Afloat

Based on the product innovations produced at the GTIC Competition, the types of products with low prices and easy to find, minimalist designs, prioritizing aesthetics, multifunctionality with environmentally friendly quality, and affordable prices will enrich processed wood products with high consumer interest. It is also necessary to have a means of media promotion for processed wood products.

In addition to the competitive innovations, some researchers explore product innovations from processed wood. The general characteristics of wood are that it is a renewable resource, a material that is easy to produce, has specific properties such as strength, elasticity, and ductility with distinctive patterns and colors, is hygroscopic and anisotropic, and can burn and be attacked by wood-destroying organisms. The advantages of the properties of wood are that it has high strength and low weight (strength to weight ratio), has high resistance to chemical and electrical influences, sound and heat insulation, is easy to shape and work with, is easy to obtain in a short time and is relatively cheap and environmentally friendly. However, there are also weaknesses of wood, namely that it is less homogeneous and has defects such as the direction of the grain, knots, etc., some types of wood are less durable in certain circumstances, wood can expand and contract with changes in humidity and wood is a source of food and shelter for organisms. Wood destroyer.

The wood used as material for furniture, crafts, and construction is made of logs (round), solid wood (sawn), and derivative wood products (engineered wood). Artificial wood products such as plywood, laminated wood (glulam), particle board, Oriented strand board (OBS), board (hardboard, insulation board, MDF), Laminated Veneer Lumber (LVL), Parallam/OSL, Laminated Strand Lumber/LSL, scrimber, I-Joist, and Cross Laminated Timber. Derivatives of wood products are described in Figure 28.

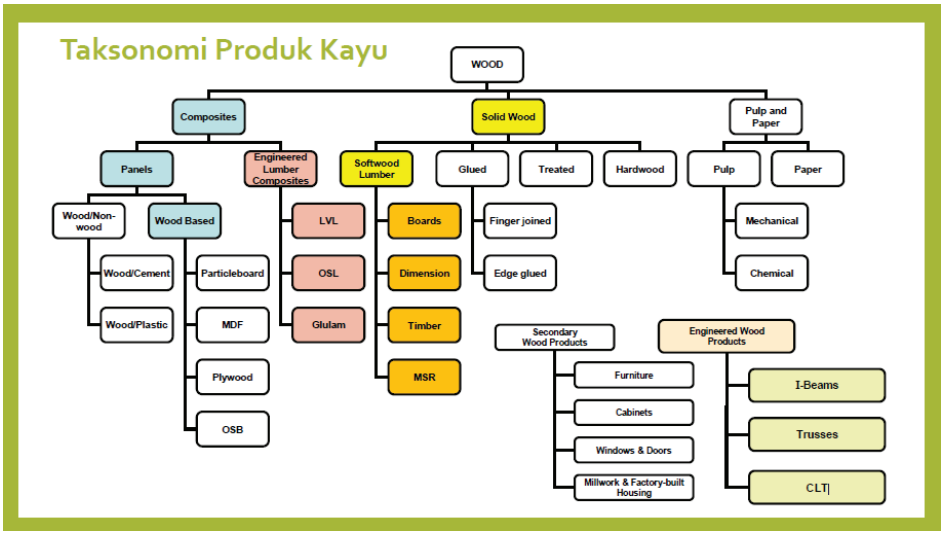


Figure 28 Taxonomy of wood products

The use of solid wood and engineered wood can potentially develop the wood industry. Construction wood must generally have a sturdy, robust, comfortable, and safe structure. Apart from that, the useful life of the wood must also reach the planned useful life. Construction wood must be accessible to the general public and be economical and functional. Construction wood generally also has aesthetic value or an attractive appearance.

Indonesia has sawn timber, which has around 4,000 types of wood, of which 200 are commercial wood. This wood has a high durability class of 15 – 20%, such as balau wood, ironwood, and teak wood. The wood alternative is mixed wood (70% high strength class), known as the "Borneo wood" group, which consists of various types of wood (multiple strengths). Due to the nature of wood, which has shape defects and attacks by destructive organisms, it is necessary to dry and preserve it properly to maintain its quality.

Even though Indonesia has a variety of sawn wood, high-quality wood is increasingly rare, and the price is expensive and unaffordable. Affordable wood is wood with a low strength class that comes from fast-growing species produced from Industrial Plantation Forests (HTI) or Community Forests (HR). So, it is necessary to make efforts to efficiently use construction wood to save raw materials by sorting it.

Structural wood is used as a raw construction material for various wood classes and wood species. Wood is used as a construction material because it has strength, durability, and aesthetic value. However, the decreasing supply of wood from natural forests, the increasing price of high-quality sawn wood, and the increasing number of residential houses and furniture have caused lightwood to be in demand with its minimalist and modern properties. The role of fast-growing lightwood trees, or light wood that grows quickly and has a small diameter can play a key role in stabilizing the availability of wood in the world. Figure 29 shows engineered wood products from Fast Growing Lightwood Trees.

Figure 29 Engineered wood products

Apart from engineered wood products, there are also mass timber products or engineered wood panels that increase their strength through lamination between layers. Various types of laminates include Cross Laminated Timber (CLT), Dowell Laminated Timber (DLT), Nail Laminated Timber (NTL), and Glued Laminated Timber (GLT). The following is an overview of research on laminated wood, especially the CLT type (30).

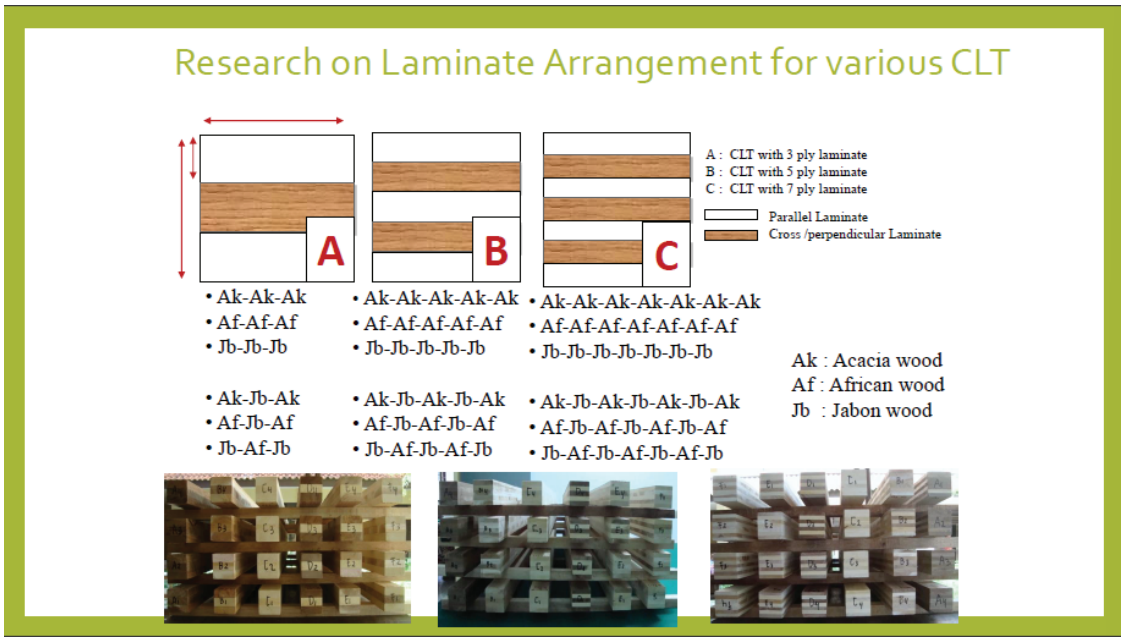


Figure 30 Lamination on CLT wood

Improving the wood industry needs to be accompanied by innovation and renewable technology. Currently, wood-based nanomaterials or wood with a small material base can be developed for computer chips, flexible computer screens, car panels, replacement tendons for humans, and coatings for fresh food. There is also Engineered Wood such as Cross-laminated timber (CLT), Plywood, OSB, Glulam, Parallel Strand Lumber (PSL), LVL, and I-Joists. Next are Wood Cellulose Derivatives, such as 3-D printing, pharmaceuticals, medical devices, food additives, building materials, and clothing. Modern Furniture is made from CNC routers, Laser cutting, AI Processing, and other mixed materials. Some of the processed wood product innovations that we have developed include:

1. Jabon Magnetic Wood

This product is the result of research from Istie Rahayu, Wayan Darmayan, Lina Karlinasari, Akhiruddin Maddu, Irma Wahyuningtyas, Esti Prihatimi, Rohmat Ismail and Gilang Dwi Laksono. Magnetic wood is multifunctional wood which has several advantages, such as:

a. Heat conductor due to the presence of Fe3O4 nanoparticles, which can increase the thermal conductivity of wood

b. Absorbs electromagnetic wave radiation emitted by cell phones, Local Area Networks (LAN), and other household equipment.
c. Reduces health risks due to wave radiation

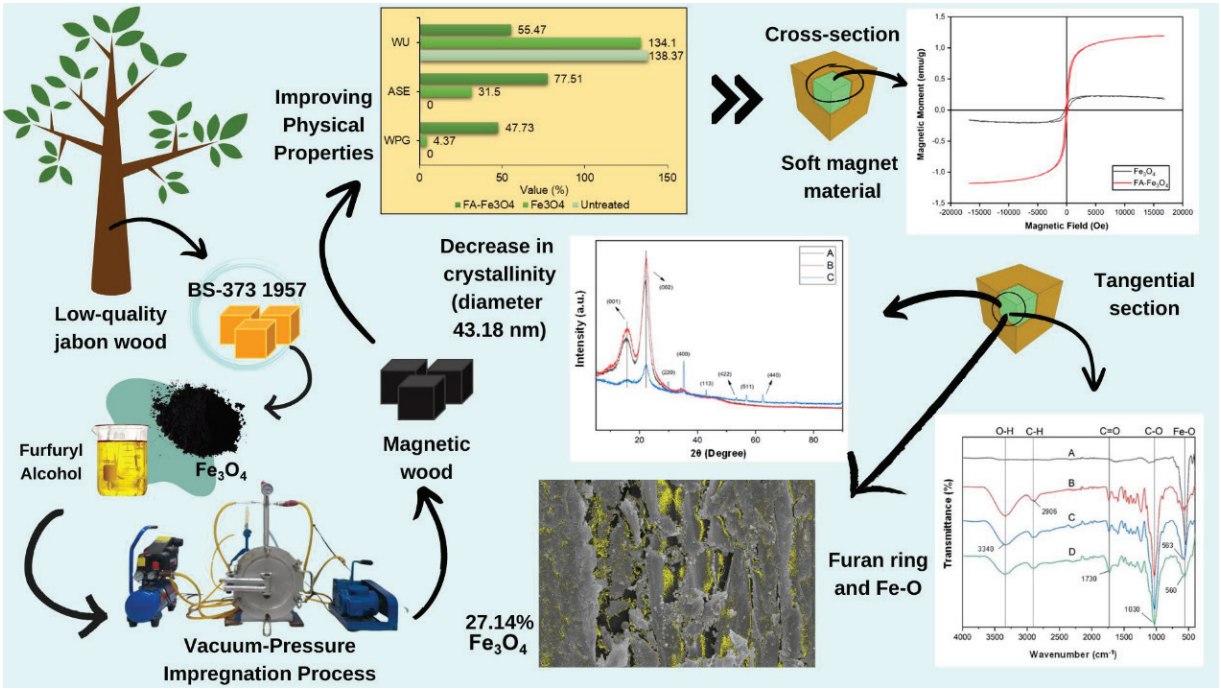


Figure 31 Jabon magnetic wood

2. Foamed Insulation Panels (Made of Palm Trunk)

Research results were obtained from Lukmanul Hakim Zaini, who developed environmentally friendly products for insulation materials using sick coconut stem waste. The advantages of this innovative product are:

a. Increased building energy efficiency
b. Creating added value for BKS
c. Support bioeconomic strategies
d. This product has the potential to produce building energy efficiency of up to 50%

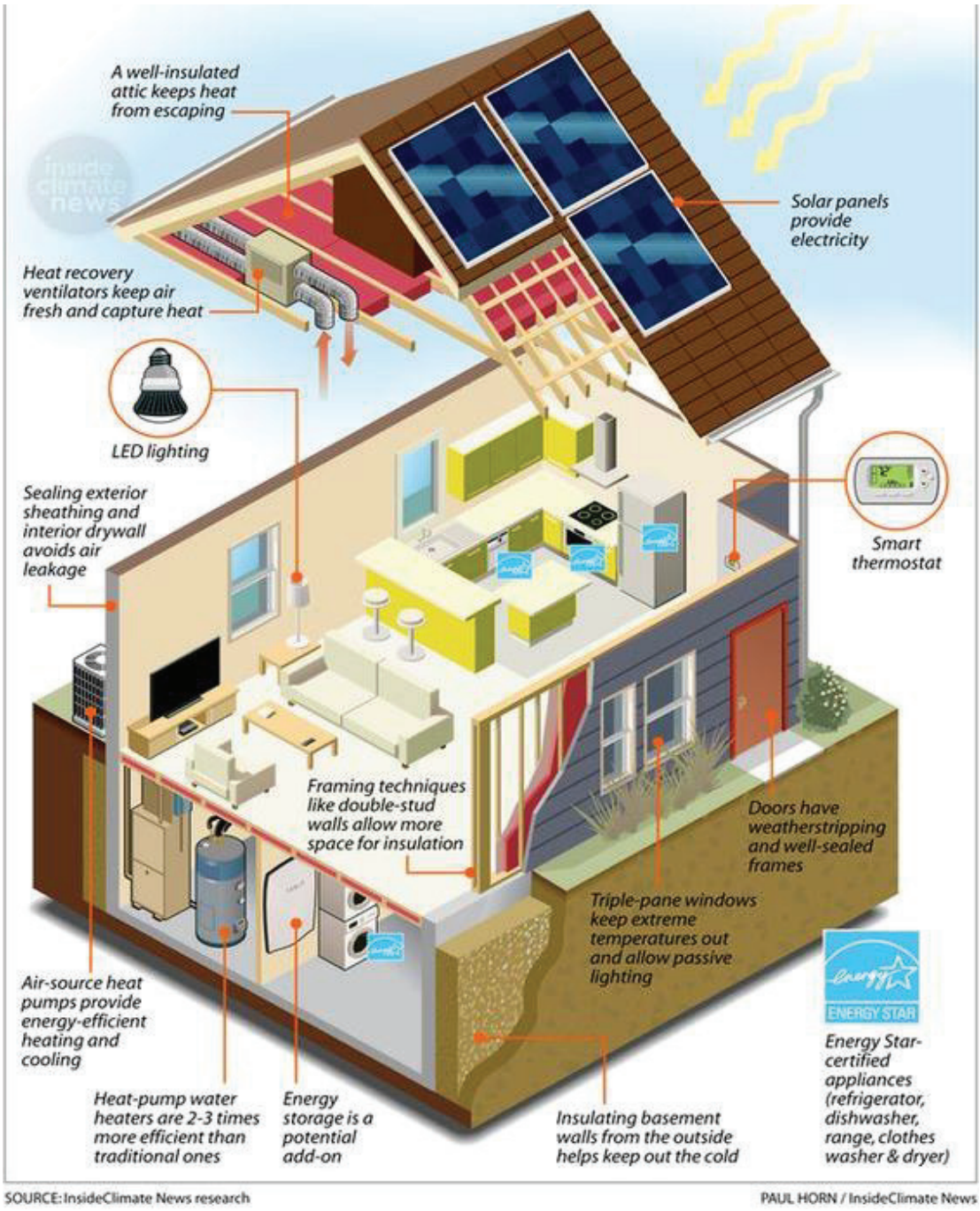


Figure 32 Foamed insulation panels

2. Bamboo Sandwich Panels

This product is the result of Naresworo Nugroho's research. The light and strong panels harness the potential of bamboo in its reed form and thin cuts. The advantages of this product are:

a. Multifunctional application for room divider partitions, walls, ceilings, and floors (flooring)
b. The results of the racking test as a wall component were proven to be an earthquake-resistant material
c. Functions for sound or sound insulation (tightness) and good heat

Figure 33 Bamboo Sandwich Panels

Using wood products with developing technology to develop the wood industry can help increase carbon storage, which is expanded by CO_2 capture. So, education regarding the use of wood products needs to be improved. Wood products do not damage the environment but increase available carbon reserves.

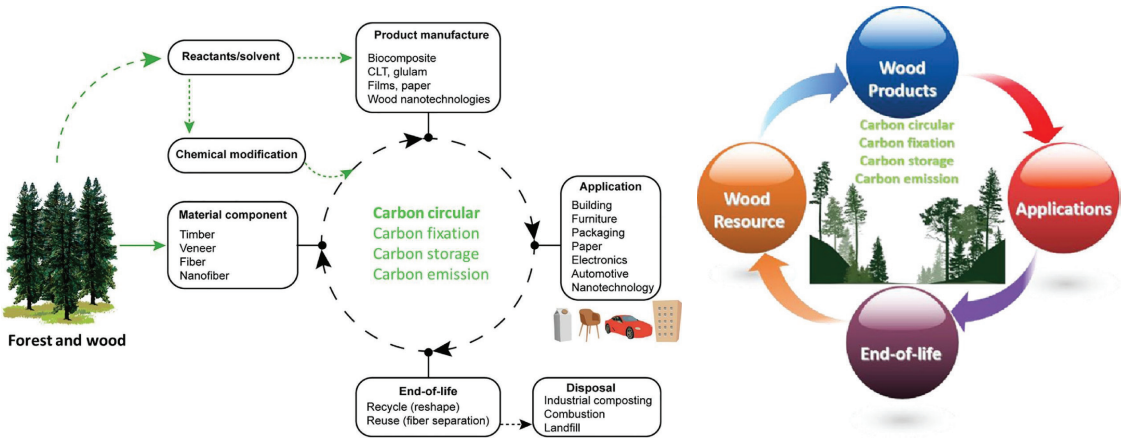


Figure 34 Wood products as an increase in carbon reserves

d. Recommendation for the development of the enriched assortment of wood products sold in the West Java market

Apart from the promotional media suggested by respondents, there are also recommendations to increase the consumption of processed wood products, such as furniture, crafts, and construction wood. Respondents recommend wooden furniture such as:

1. Use raw materials from quality types of wood so that they have a long service life,
2. Increased product durability and environmental friendliness,
3. Affordable prices for middle-class people,

4. The model design is attractive, functional, easy to maintain, and continues to innovate products
5. Educate the public to eliminate the negative stigma regarding using wood products.

Meanwhile, to improve wooden crafts, several recommendations made by respondents are more or less the same as for wooden furniture, such as:

1. Affordable prices,
2. Improved product quality and durability,
3. Unique, creative, and artistic designs, functional products, increased innovation, and varied products
4. Location affordability (market access) for purchasing products like e-commerce and strategic store locations.

As for what is recommended for improving construction wood products. Not much different from the recommendations given for furniture and craft products, such as:

1. Quality and extended durability,
2. Environmentally friendly,
3. Affordable prices,
4. Various product designs that prioritize neatness, beauty, and uniqueness and are easy to maintain,
5. Know market conditions,
6. Increased wood supply,
7. Business collaboration with housing development
8. Strategic sales location

3.2. Development of enriched assortment of wood products in Banten Province and DKI Jakarta Province

a. Characteristics and type of consumers

The survey was conducted in 6 cities/regencies out of 8 cities/regencies in Banten province and five administrative cities of DKI Jakarta. These areas include Cilegon City, Serang City, Serang Regency, Tangerang Regency, Tangerang City, South Tangerang City, Central Jakarta Municipality, North Jakarta, South Jakarta, East Jakarta, and West Jakarta. The total number of respondents in Banten and DKI Jakarta was 116 respondents. The following is a description of the characteristics of respondents in Banten Province and DKI Jakarta.

1. Age, gender, and education

Most of the Banten and DKI Jakarta respondents were in the 26-45-year age group. 77.8% in Banten Province (Figure 35a) and 83% in DKI Jakarta Province (Figure 35b). The age group above 45 years is less interested in filling out the questionnaire. Female respondents dominated in filling out the questionnaire, as in Banten Province, female respondents were 53.3% (Figure 35c), and DKI Jakarta

was 56% (Figure 35d). In Banten Province, respondents from high school education level dominate, namely 51.1%, followed by respondents from tertiary institutions at 42.2% (Figure 35e). Meanwhile, in DKI Jakarta Province, high school respondents reached 52%, followed by respondents from tertiary institutions at 41% (Figure 35f).

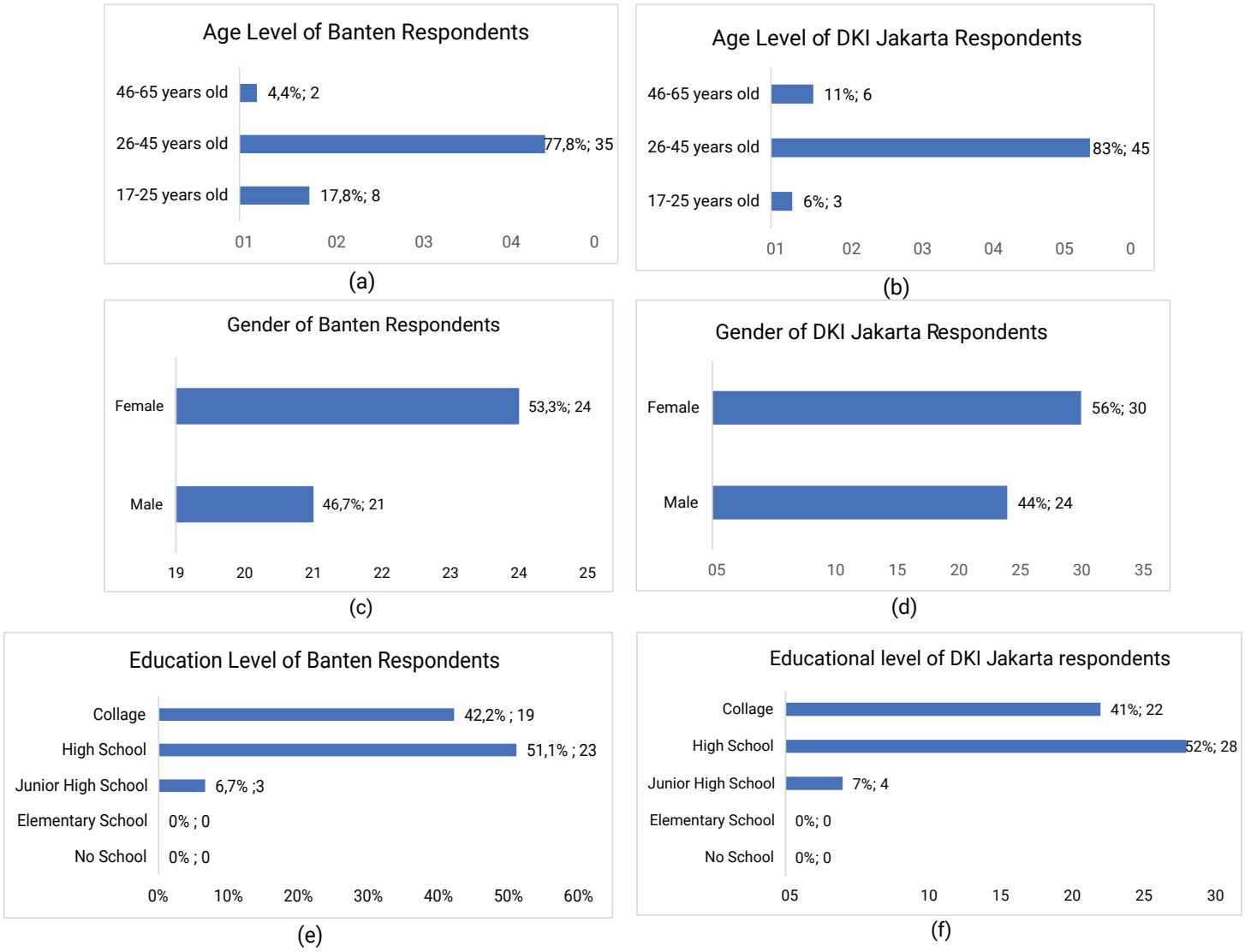
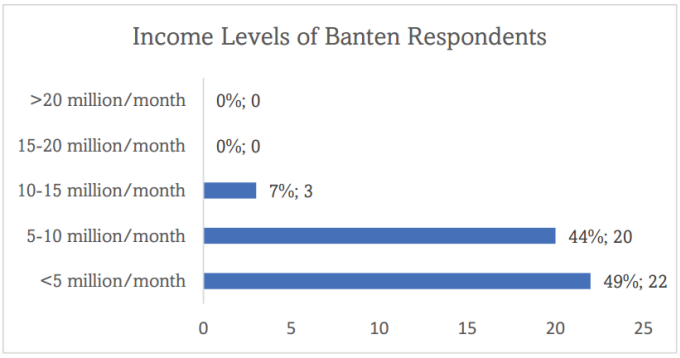


Figure 35 (a) Respondents based on age in the Banten; (b) Respondents based on age in DKI Jakarta ; (c) Respondents based on gender in Banten ; (d) Respondents based on gender in DKI Jakarta respondent; (e) Respondents based on education level in Banten; (f) Respondents based on education level in DKI Jakarta

2. Income level and employment type

Figure 36a shows that the majority of respondents in Banten Province have an income of less than IDR 5 million/month, namely 48.9%, followed by respondents with an income of IDR 5-10 million/month, 44.4% (Figure 24a). Meanwhile, 56% of respondents in DKI Jakarta Province had an income of 5-10 million/month, followed by 35% with an income of less than 5 million/ month (Figure 36b). 12 types of respondents' jobs are part of filling out the questionnaire: cashier, private employee, entrepreneur/entrepreneur, housewife, farmer, trader, laborer, freelancer, fresh graduate, developer,

BUMN, ASN, and academic. The provinces of Banten and DKI Jakarta show the dominance of respondents as private employees at 62.2% (Figure 35c) and 65% (Figure 35d), respectively.



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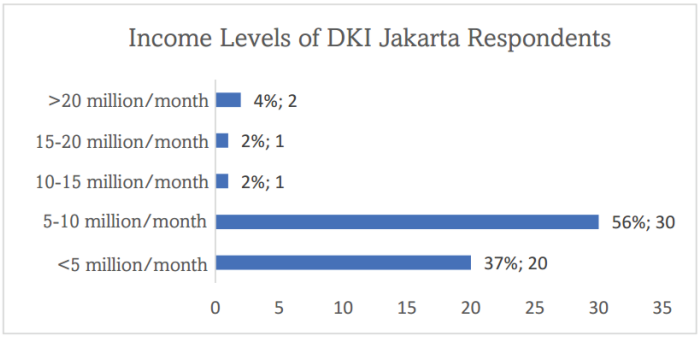

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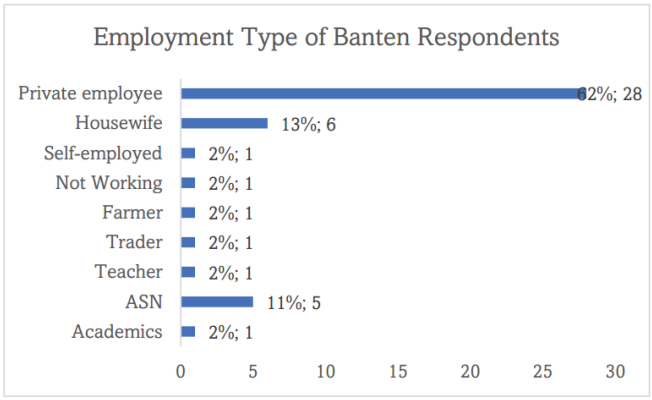

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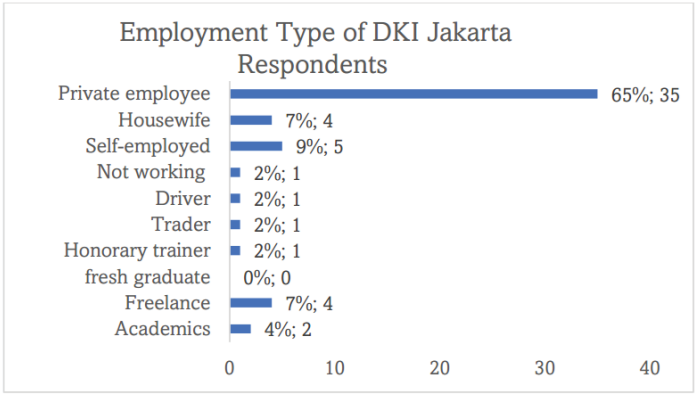


(d)

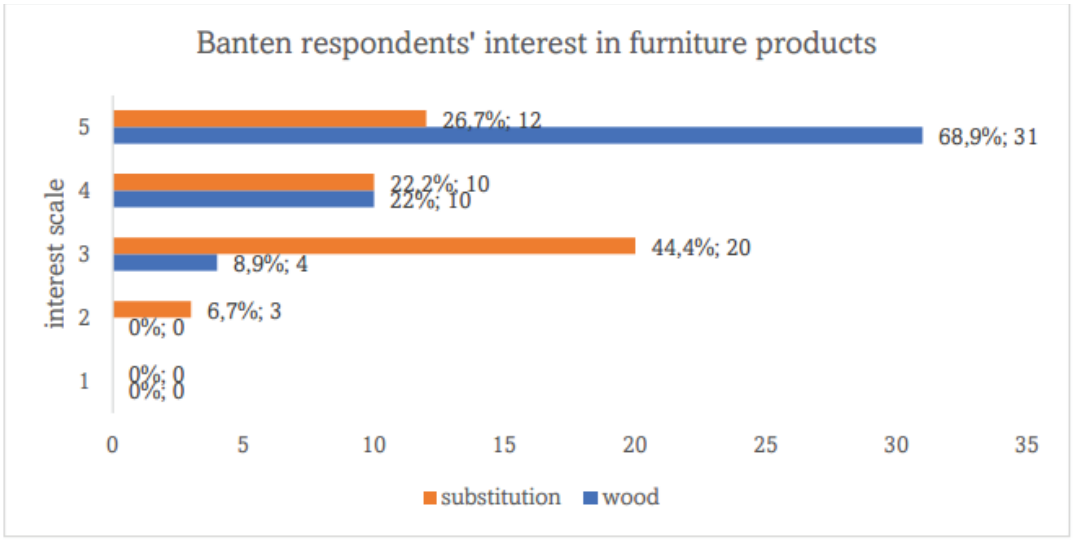
Figure 36 (a) Income level of respondents in Banten; (b)) Income level of respondents in DKI Jakarta; (c) Employment type of respondents in Banten; (d) Employment type of respondents in DKI Jakarta

b. Consumers' preference for the product by type of consumers

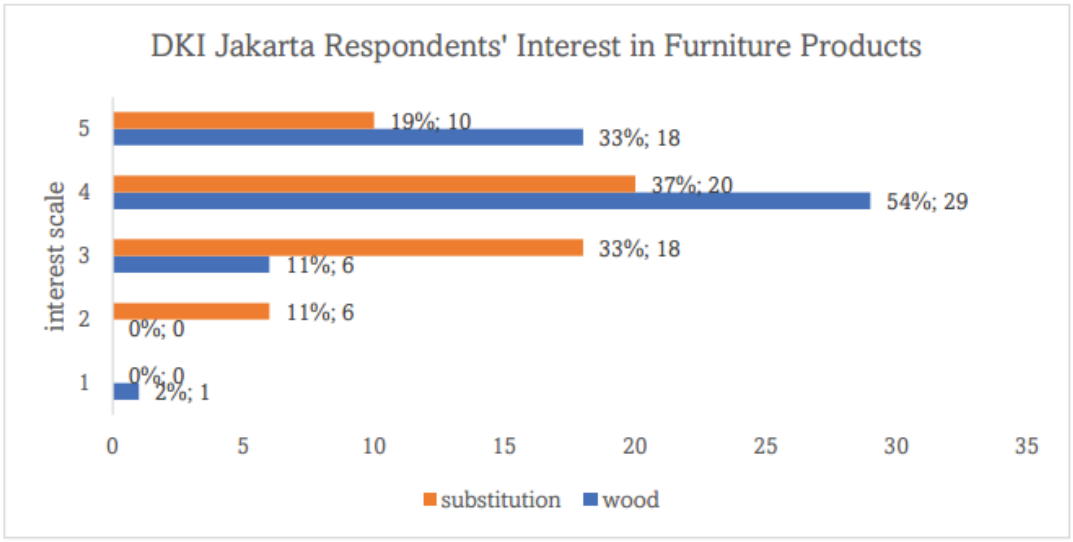
The survey was conducted to determine consumer choices regarding using processed wood products and substitute products. The use of processed wood products includes furniture, construction, and crafts. A description of consumer preferences for various processed wood products is outlined in the section below.

1. Respondents' Interest in Furniture Products

The survey shows that respondents are still highly interested in using wooden furniture. Interested respondents (Likert scale 4) to very interested (Likert scale 5) in wooden furniture products were 91% and for substitute products only 49% (Figure 37a). That indicates that wooden furniture products are still in demand by the majority of Banten people. Similar to Banten, the people of DKI Jakarta also suggest that most people still demand wooden furniture products because 87% of respondents are interested (Likert scale 4) to very interested (Likert scale 5) in wooden furniture products and only substitute products—56% (Figure 37b).



(a)



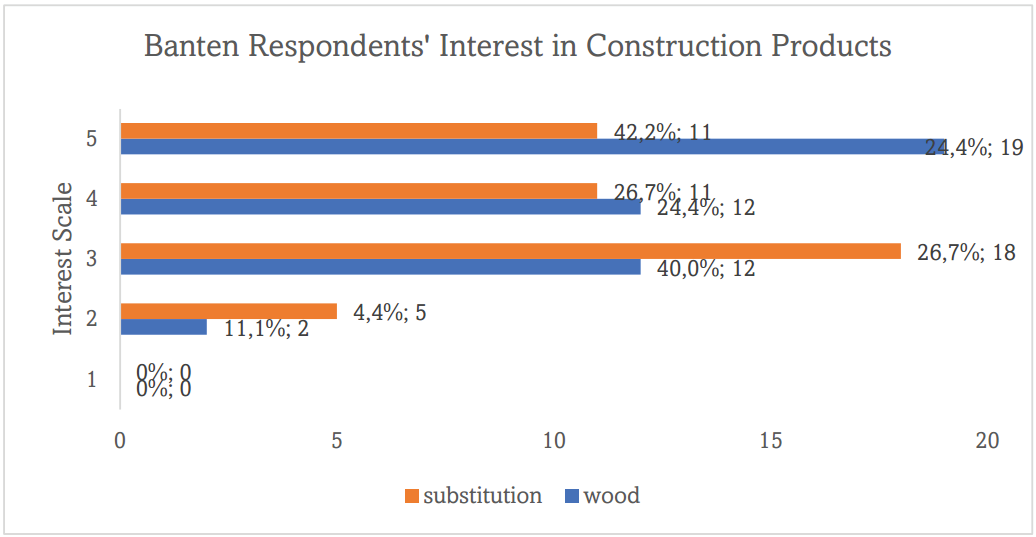
(b)

Figure 37 (a) Banten respondent's interest in furniture products; (b) DKI Jakarta respondent's interest in furniture products

2. Respondents' interest in construction products

As with the use of furniture, respondents in Banten Province and DKI Jakarta are still interested in using wood as a construction option. The survey showed that 69% of Banten respondents were interested (Likert scale 4) to very interested (Likert scale 5) in wooden construction materials and 48% for substitute products (Figure 38a). Meanwhile, the DKI Jakarta survey showed that 78% of respondents were interested (Likert scale 4) to very interested (Likert scale 5) in wooden construction materials and 70% for substitute products (Figure 38b). That indicates that most of the people of Banten and DKI Jakarta still demand wooden construction materials, but substitute products are also in high demand. Substitute products will likely become tough competitors if production efficiency and innovation in wooden construction material products are not immediately improved.

(a)



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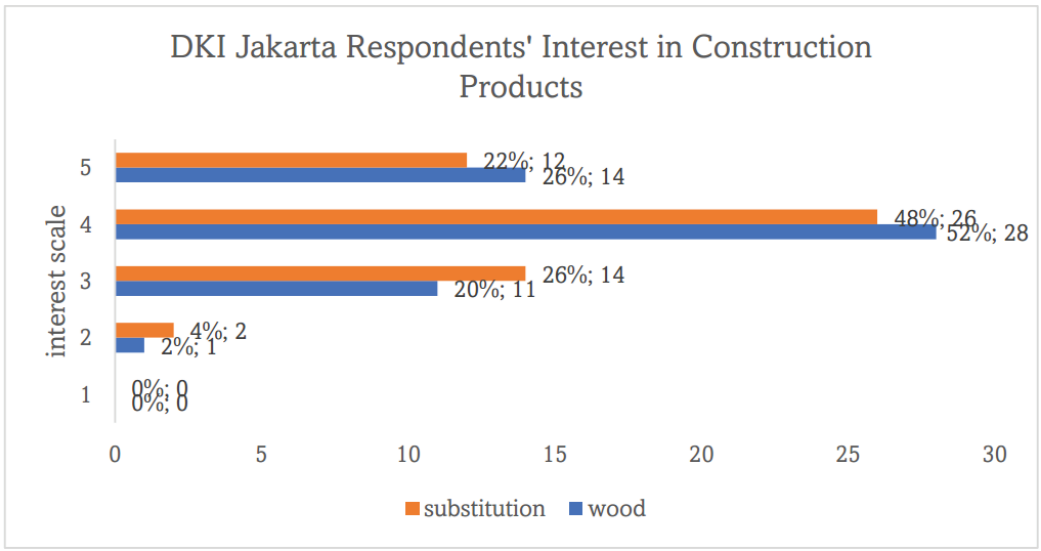
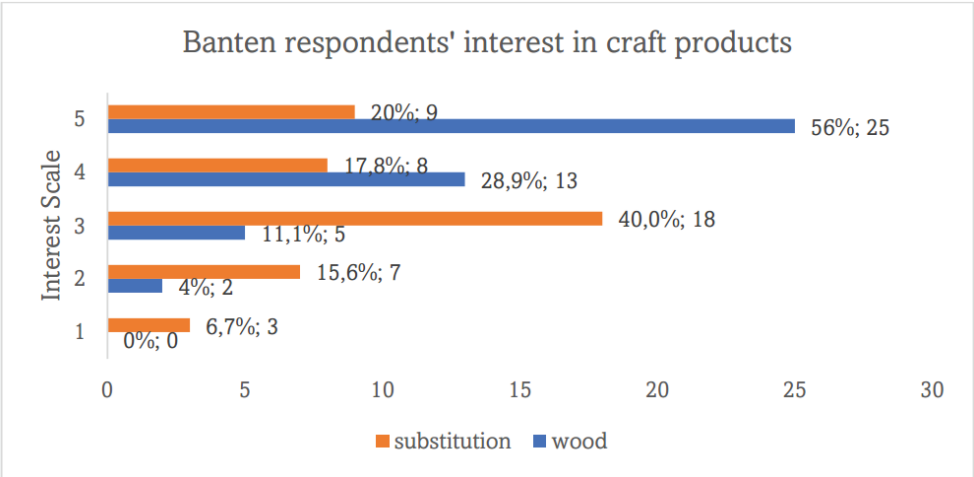


Figure 38 (a) Banten respondents' interest in construction products; (b) DKI Jakarta respondents' interest in construction products

3. Respondents' interest in wooden craft products

Craft products are also still in demand. Based on the survey results regarding respondents' interest in the use of wooden crafts, it shows that 88% of respondents are interested (Likert scale 4) to very interested (Likert scale 5) in wooden craft products, and only 85% for substitute products (Figure 39a) as with wooden furniture, wooden craft products are still in demand by most Banten people. DKI Jakarta respondents also indicated the same thing. Based on the survey results regarding respondents' interest in the use of wooden crafts, it shows that 88% of respondents are interested (Likert scale 4) to very interested (Likert scale 5) in wooden craft products and only 82% for substitute products (Figure 39b) as with wooden furniture, wooden craft products are still in demand by most of the people of DKI Jakarta.

(a)



(b)

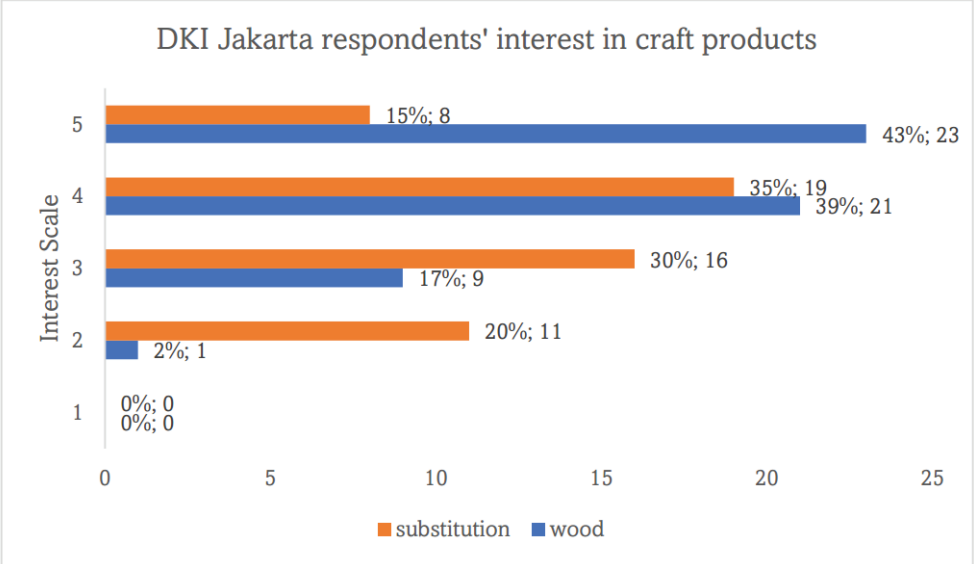
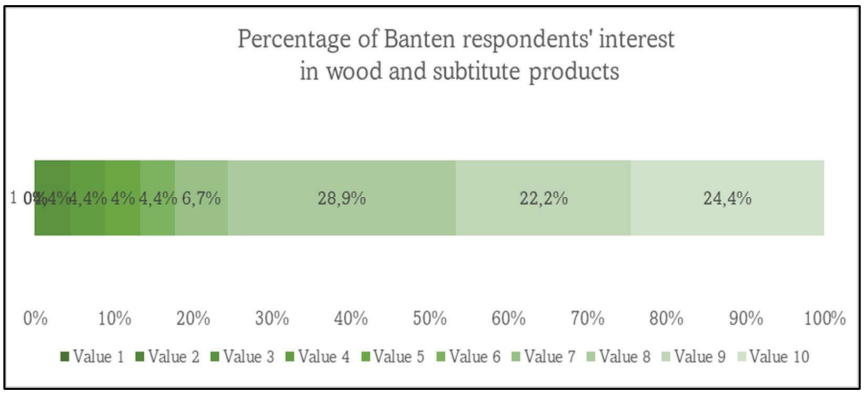


Figure 39 (a) Banten respondents' interest in craft products;
(b) DKI Jakarta respondents' interest in craft products

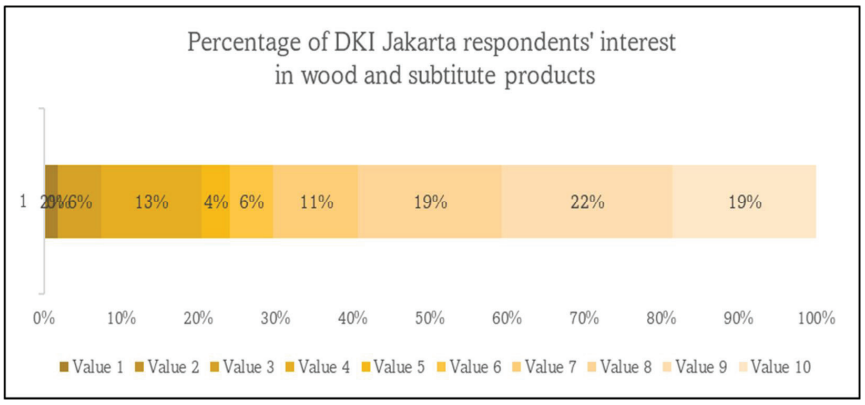
4. Consumer assessment of wood compared to substitute goods

To assess respondents' level of interest when choosing wood or substitute goods, an assessment was carried out using a rating scale of 1-10. The higher the value, the more interested the respondent is in wood products. The assessment results show that Banten respondents are more interested in using wood than in using substitute goods. As shown in Figure 40a, 76% of respondents scored above 8. That indicates that wood products are currently in demand by the people of Banten.

The assessment of respondents' interest in DKI Jakarta Province also showed that respondents were more interested in using wood than substitute goods. As shown in Figure 40b, 60% of respondents gave a score above 8. That indicates that currently, wood products are still in demand by the people of DKI Jakarta.



(a)



(b)

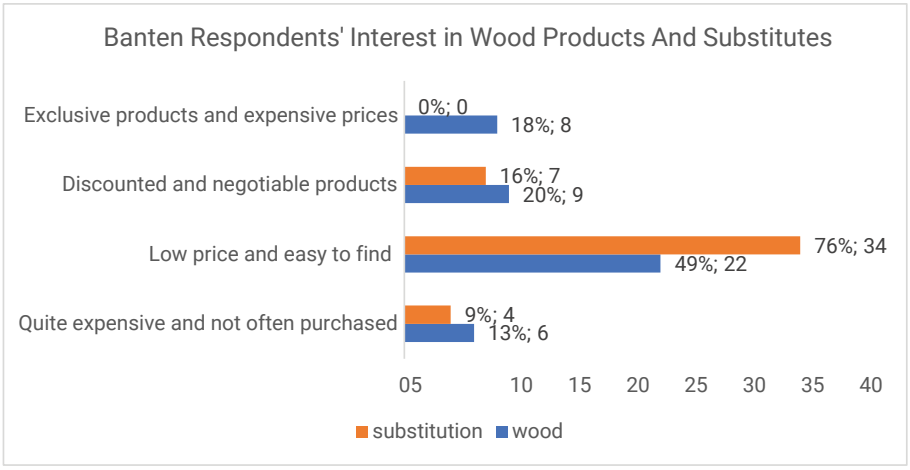
Figure 40 (a) Banten respondents' interest in wood products and their substitutes; (b) DKI Jakarta respondents' interest in wood products and their substitutes

5. Interest in types of wood products and substitute goods

Apart from respondents' interest in wood products, respondents also chose different types of goods. Based on the survey, it is known that cheap and easy-to-find goods are popular with Banten respondents, both for wood products 49% and substitute products 76%. Not only that, respondents also chose types of products with discounts, which could be negotiated for wood products at 20% and substitute goods at 16%. The results of the survey of Banten respondents regarding types of goods with other classifications are presented in Figure 41a.

The same thing can also be seen in the survey results in DKI Jakarta Province. Types of goods that are cheap and easy to find are more popular with respondents, both for wood products and substitute products. For wood products, the percentage of respondents who chose this type of product reached 57%, while for substitute products, it reached 56%. In contrast to Banten respondents, DKI Jakarta respondents prefer products that are pretty expensive and not often purchased for wood products by 22% and with substitutes by 26%. The survey results on types of goods with other classifications are presented in Figure 41b.

(a)



(b)

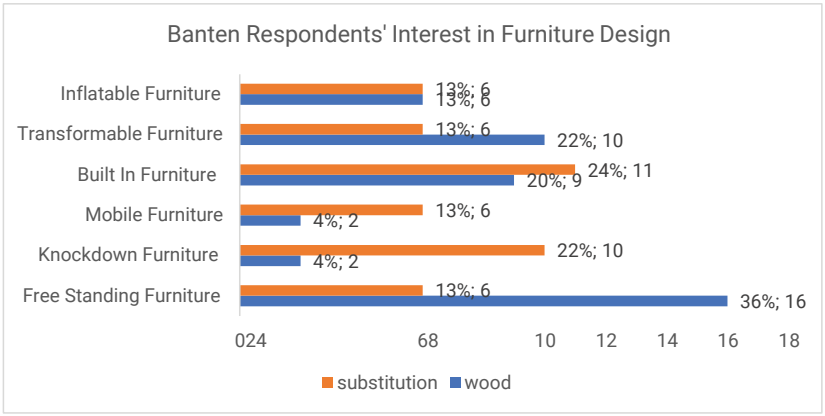
Figure 41 (a) Banten respondents' interest in wood products and substitutes; (b) DKI Jakarta respondents' interest in wood products and substitutes

6. Preference for wood furniture product design and substitute goods

Regarding design, survey results in Banten Province show that the furniture designs that respondents are most interested in are complete furniture at 35.6%, followed by multifunctional furniture at 22.2%, and installed furniture at 20%. Meanwhile, the most famous furniture design for substitute products is installed furniture at 24.4%, followed by disassembled furniture at 22%. The survey results are presented in Figure 42a.

Survey results in DKI Jakarta Province show similar results. The furniture design respondents are most interested in is complete furniture at 28%, followed by disassembled furniture and installed furniture at 20%. Meanwhile, the most famous furniture design for substitute products is installed furniture at 35%, followed by disassembled furniture and furniture on wheels at 17% each. The survey results are presented in Figure 42b.

(a)



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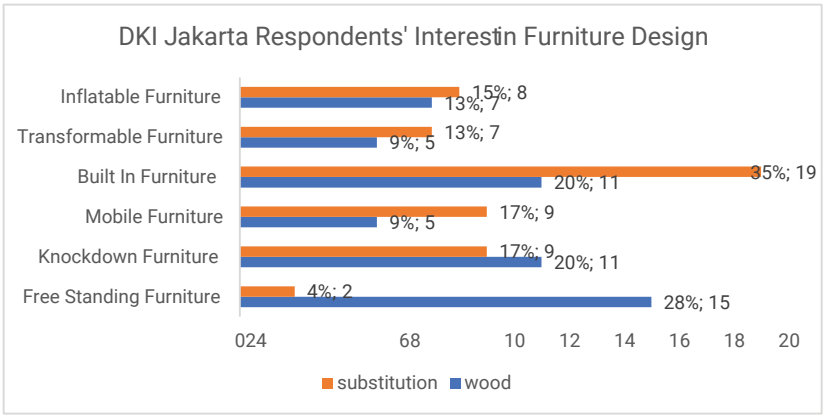


Figure 42 (a) Banten respondents' interest in furniture design; (b) DKI Jakarta respondents' interest in furniture design

That shows that the wood-based furniture products that are more popular are furniture designs that are complete, installed, and multifunctional. For respondents in both regions, consumer preferences for wood products and their substitutes are almost the same. That shows intense competition between wood products and substitutes.

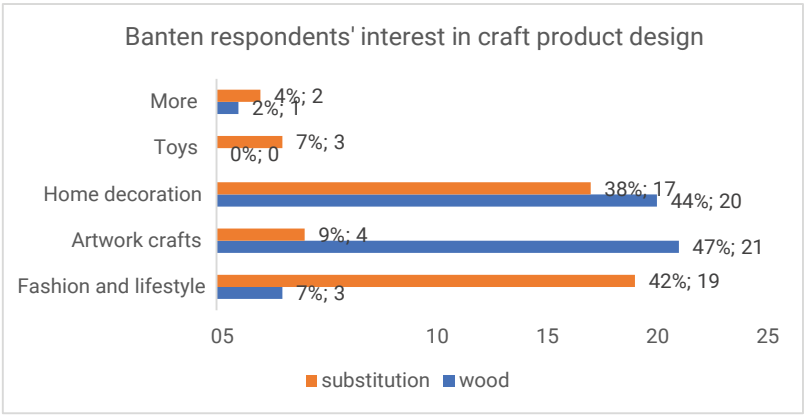
7. Preferences for wooden craft product designs and substitute goods

The various craft designs that respondents are interested in are craft designs for fashion and lifestyle, arts and crafts, home decorations, and toys. Overall, the design choices for wooden crafts and substitute goods that are most popular are home decorations and art crafts, which can be seen in Figures 43a and 43b.

The results of a survey on the preferences of Banten respondents showed that wooden crafts as works of art were the most popular among respondents, namely 46.7%, followed by home decoration (44.4%) and fashion and lifestyle (6.7%). The survey results are presented in Figure 43a.

The survey results on respondents' preferences in DKI Jakarta Province for wooden craft products and substitute goods are similar. Based on the survey results in DKI Jakarta Province, 41% of respondents liked wooden products as home decoration, followed by art crafts at 37% and other products at 22%. The survey results are presented in Figure 43b.

(a)



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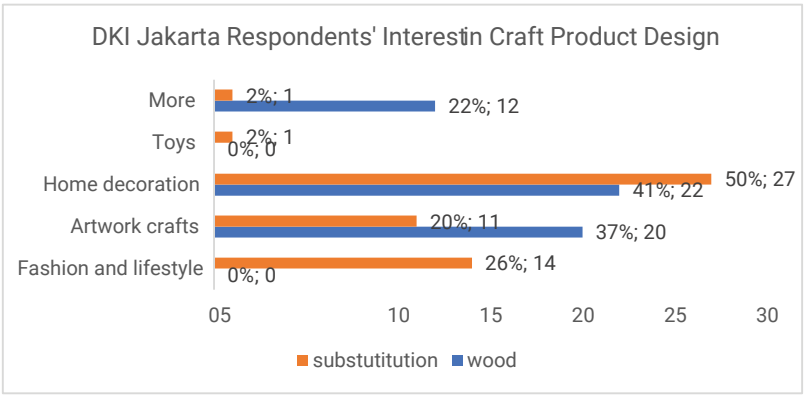


Figure 43 (a) Banten respondents' interest in craft product design;
(b) DKI Jakarta respondents' interest in craft product design

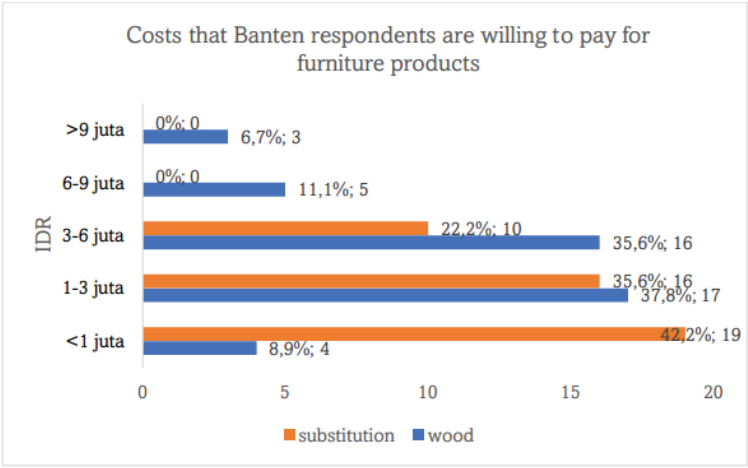
8. Price preferences for wooden furniture and craft products

8.1 Furniture

The results of the Banten respondent survey show that for purchasing wooden furniture products, the costs that consumers are willing to spend (WTP) are dominated by the price range of IDR 1,000,000 – 3,000,000 (37.8%) and IDR 3,000,000 – 6,000,000 (35.6%). However, for furniture products with a price range of less than IDR 1,000,000, respondents were more interested in buying products made from wood substitutes (42.2%). It seems that for expensive products (> IDR 3,000,000), respondents are more interested in purchasing wood-based products (33%), as shown in Figure 44a.

The survey results of DKI Jakarta respondents showed something slightly different: that for purchasing wooden furniture products, the costs that consumers were willing to spend (WTP) were dominated by the price range of less than IDR 1,000,000 (39%) and IDR 3,000,000 –6,000,000 (35%). However, for furniture products with a price range of less than IDR 1,000,000 and IDR 1,000,000 – 3,000,000, respondents were more interested in buying products made from wood substitutes by 39% and 22%, respectively. It seems that for expensive products (> IDR 3,000,000), respondents are more interested in buying wood-based products (50%), as shown in Figure 44b.

(a)



(b)

Figure 44 (a) Costs that Banten respondents are willing to pay for furniture products; (b) Costs that DKI Jakarta respondents are willing to pay for furniture products

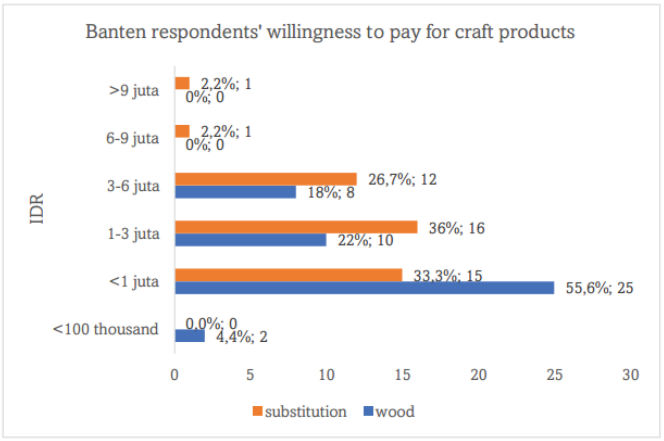
8.2 Wood crafts

Figure 45a shows that most Banten respondents (55.6%) are willing to pay to buy wooden craft products at a price of less than Rp. 1,000,000. Meanwhile, for substitute goods, most respondents (36%) were more interested in buying products with a price range of IDR 1,000,000 – 3,000,000.

In contrast to the survey results of DKI Jakarta respondents (Figure 45b), some respondents (52%) were willing to pay IDR 1,000,000 – 3,000,000 to buy wooden craft products, while for substitute goods, the majority of respondents (43%) were more interested in purchasing products priced less than IDR 1,000,000.

Wooden craft products priced at less than IDR 6,000,000 are more popular with consumers. In the price range between IDR 1,000,000 – 6,000,000, there is intense competition between wooden craft products and their substitutes.

(a)



(b)

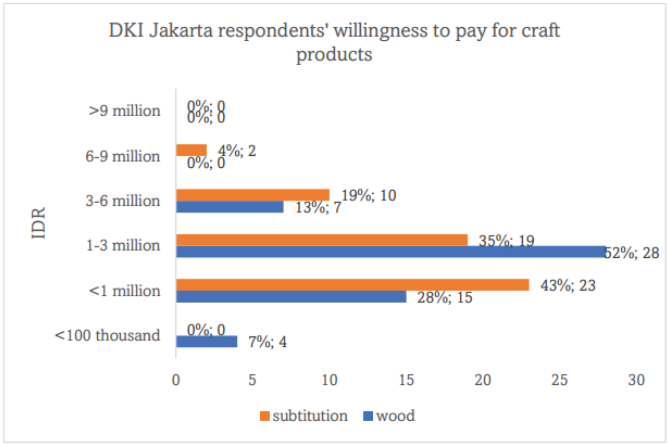


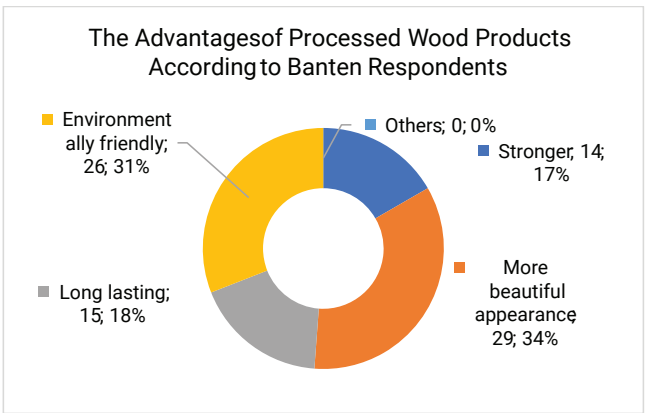
Figure 45 (a) Banten respondents' willingness to pay for craft products; (b) DKI Jakarta respondents' willingness to pay for craft products

9. Preference for the quality of processed wood products

The reason respondents use processed wood products is also determined by their knowledge of the quality of the product. How do product advantages determine respondents' choice of wood products or substitute goods?

Respondents in Banten chose processed wood products because of their advantages, which include a more beautiful appearance (34.5%) and being environmentally friendly (31%) (Figure 46a). Respondents also chose the advantages of substitute products besides processed wood products. The survey shows that dominant respondents choose substitute products with the advantage of relatively cheap prices (30.1%), followed by water resistance (25.8%).

(a)



(b)

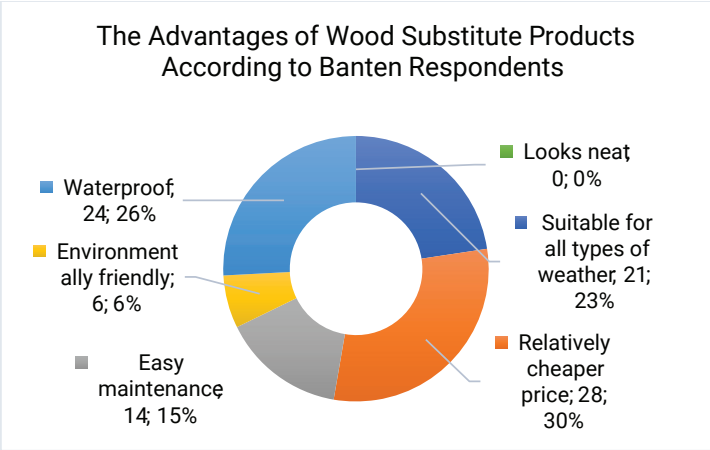
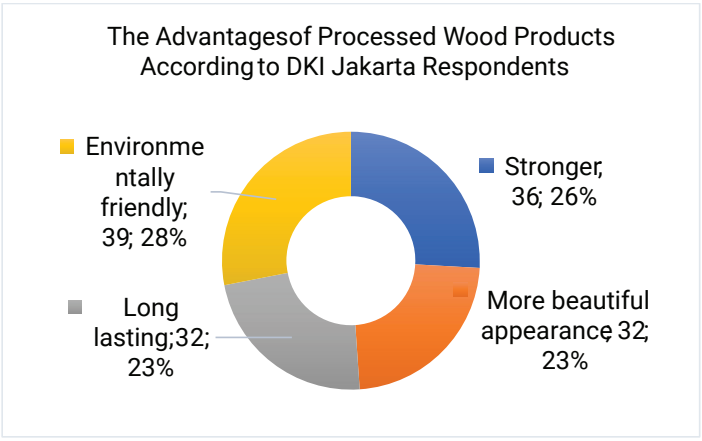
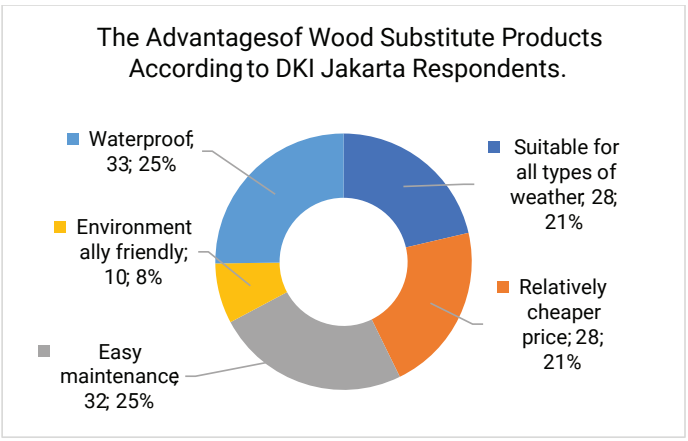


Figure 46 (a) The advantages of processed wood products according to Banten respondents; (b) The advantages of wood substitute products according to Banten respondents

In contrast to Banten Province, survey results showed that respondents in DKI Jakarta chose processed wood products because of their superior environmental friendliness (28%) and more robust (26%) Figure 47a. Apart from processed wood products, respondents also chose substitute products. The survey shows that dominant respondents choose substitute products with water resistance (25%) advantage, followed by easy maintenance (24%) Figure 47b.



(a)



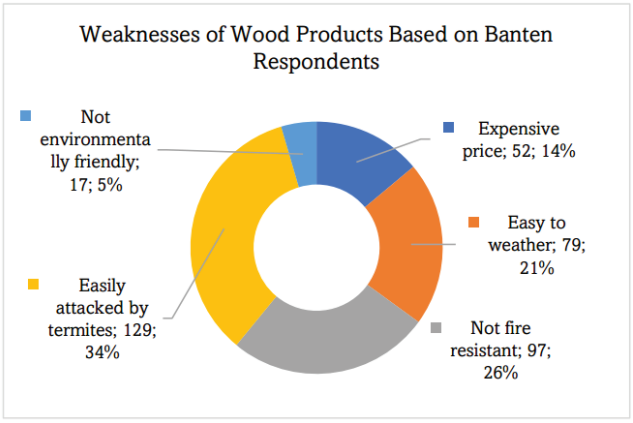
(b)

Figure 47 (a) The advantages of processed wood products according to DKI Jakarta respondents; (b) The advantages of wood substitute products according to DKI Jakarta respondents

Meanwhile, according to respondents in Banten, the most prominent weaknesses of wood are that it is easily attacked by termites (29.1%), is not fire resistant (27.9%), and is not environmentally friendly (4.7%). It can be seen that the results of the Banten respondents' perspective regarding the disadvantages of using wood products are presented in Figure 48a.

Similar to Banten, according to DKI Jakarta respondents, the most prominent weaknesses are being easily attacked by termites (31%), not being fire resistant (26%), and not being environmentally friendly (3%). The results of respondents' perspectives regarding the disadvantages of using wood products are presented in Figure 48b.

(a)



(b)

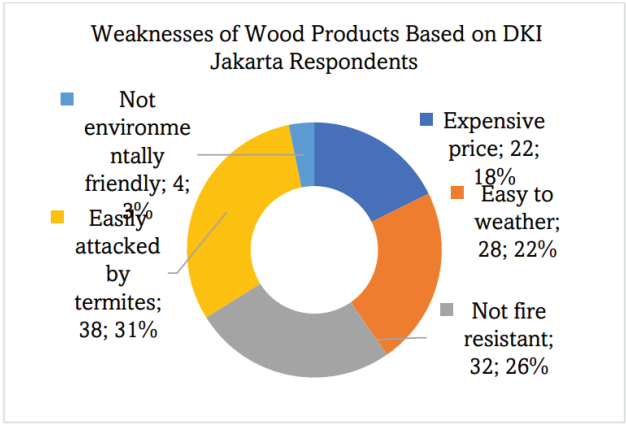
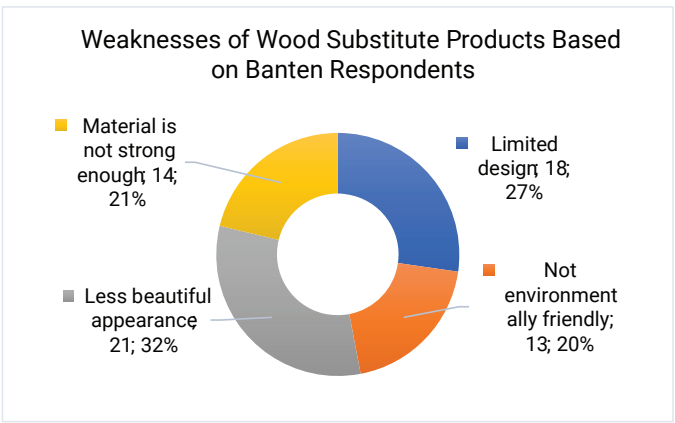


Figure 48 (a) Weaknesses of wood products based on Banten respondents; (b) Weaknesses of wood products based on DKI Jakarta respondents

Various negative campaigns accuse using wood products of not being environmentally friendly and need to be straightened out through consumer education. For example, reducing the use of paper, reducing the use of tissues, and reducing various other products derived from trees, can give negative meanings or connotations to trees (Irwan, 2024). Some weaknesses regarding product strengths should be answered through product innovation created by research institutions. Even substitute goods have weaknesses. Respondents in Banten Province considered the less-beautiful appearance at 31.8% the most dominant weakness, followed by limited design at 27.3% Figure 49a. A survey of DKI Jakarta respondents showed the opposite results. Respondents considered that limited design was the most dominant weakness namely 36%, followed by a less-beautiful appearance of 31%. Figure 49b.

(a)



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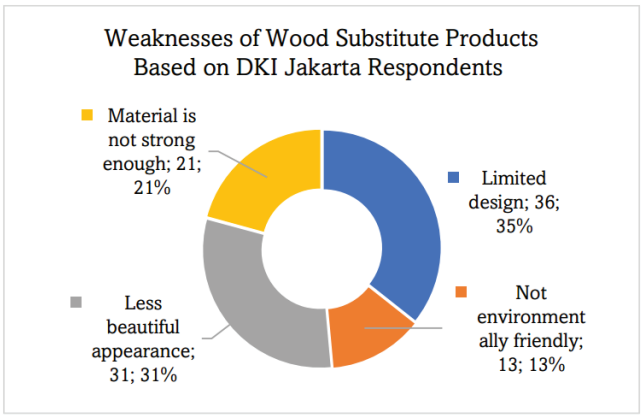
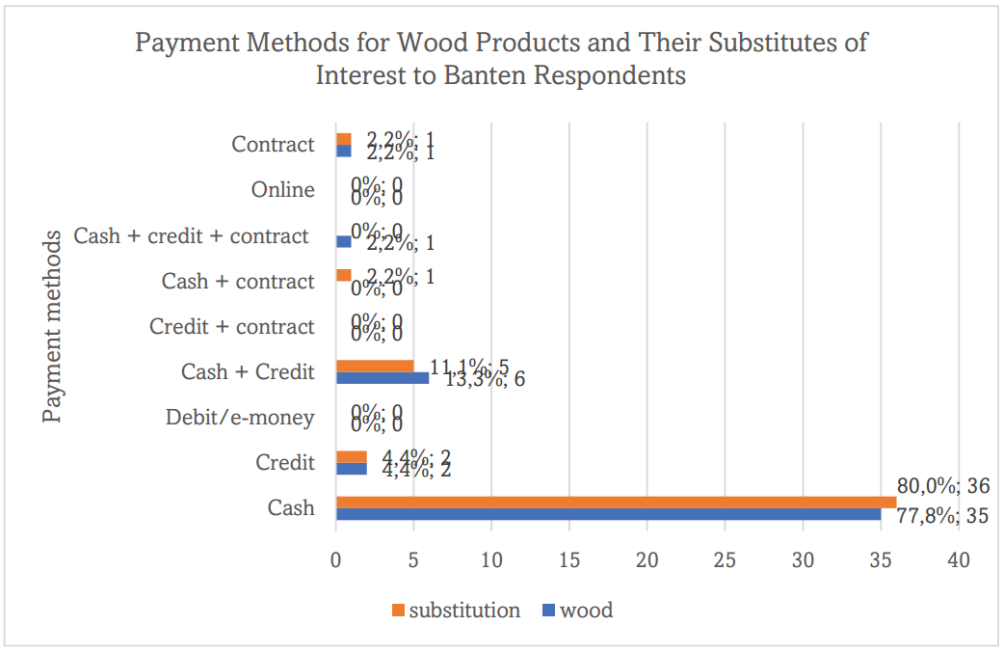


Figure 49 (a) Weaknesses of wood substitute products based on Banten respondents; (b) Weaknesses of wood substitute products based on DKI Jakarta respondents

10. Payment type preference

The payment method chosen by Banten respondents (Figure 50a) in transactions to purchase wood products and their substitutes is dominated by cash or cash payment methods, 79.2% for wood products and 82.4% for substitute products. DKI Jakarta Province (Figure 50b) also gets 74% for cash payments for wood products and 69% for substitute products. The public's interest in buying wood products in cash will be very profitable in terms of marketing efficiency and maintaining business liquidity, in addition to saving entrepreneurs on the cost of borrowing money (cost of funds). Apart from the cash method, there are other methods such as payment by debit/e-money, online, contract, and credit.

(a)



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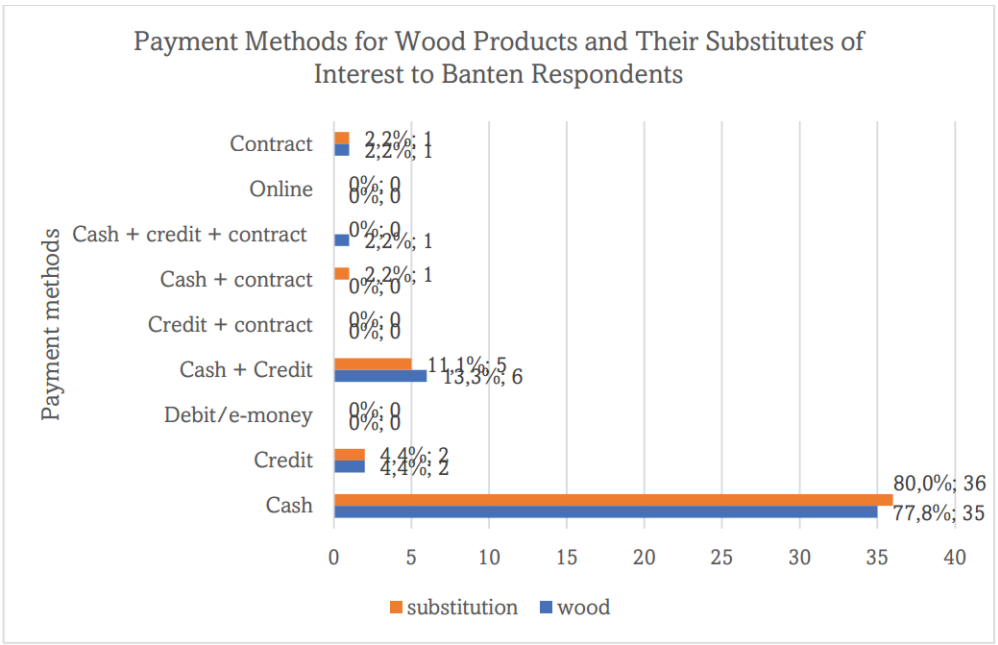

Figure 50 (a) Payment methods for wood products and their substitutes of interest to Banten respondents; (b) Payment methods for wood products and their substitutes of interest to DKI Jakarta respondents

c. Enriched assortment of wood products sold in the Banten Province and DKI Jakarta Province market

Just like in West Java, product innovation in Banten and DKI Jakarta was also carried out through the "Green Timber Innovation Challenge (GTIC): Processed Wood Product Innovation for Sustainable Forestry Business" competition, where the competitive innovative products were exhibited at the Workshop and Exhibition event which took place on Thursday, December 21, 2024, at the Sylva Pertamina Auditorium, Faculty of Forestry and Environment IPB. In addition, there is also research conducted in developing innovations in processed wood products as previously described (explanations are in West Java innovations).

d. Recommendation for the development of the enriched assortment of wood products sold in the Banten Province and DKI Jakarta Province

Apart from the promotional media suggested by respondents, there are also recommendations to increase the consumption of processed wood products, such as furniture, crafts, and construction wood. Respondents recommend wooden furniture such as:

1. Use raw materials from quality types of wood so that they have a long service life,
2. Increased product durability and environmental friendliness,
3. Affordable prices for middle-class people,
4. The model design is attractive, functional, easy to maintain, and continues to innovate products
5. Educate the public to eliminate the negative stigma regarding using wood products.

Meanwhile, to improve wooden crafts, several recommendations made by respondents are more or less the same as for wooden furniture, such as:

1. Affordable prices,
2. Improved product quality and durability,
3. Unique, creative, and artistic designs, functional products, increased innovation, and varied products
4. Location affordability (market access) for purchasing products like e-commerce and strategic store locations.

As for what is recommended for improving construction wood products. Not much different from the recommendations given for furniture and craft products, such as:

1. Quality and extended durability,
2. Environmentally friendly,
3. Affordable prices,
4. Various product designs that prioritize neatness, beauty, and uniqueness, and are easy to maintain,
5. Know market conditions,
6. Increased wood supply,
7. Business collaboration with housing development
8. Strategic sales location.

3.3.Development of enriched assortment of wood products in Central Java

a. Characteristics and type of consumers

This survey was conducted through offline and online mechanisms to study the preferences of consumers for products. The samples included respondents from 16 districts in Central Java Province, with 10-25 respondents/districts. Characteristics were selected based on gender, age, education level, and occupation. Figure 51 shows the percentage of 230 respondents based on gender, comprising 78.7% males and 21.3% females.

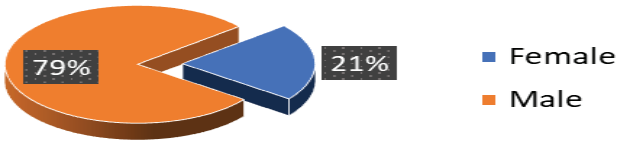

Figure 51 Characteristics of consumers based on gender

Based on the age, 55.7% of respondents were in the age range of 41 – 65, 32.2% were in 25 – 40, 9% were below 25, and 3% were above 65. This implied that the majority of the consumers were in the pre-elderly age, including the baby boomer generation, then followed by the productive age represented by the millennial and Z generations. These two age groups have been predicted previously to actively consume wood products due to their needs and/or capabilities after earning some income.

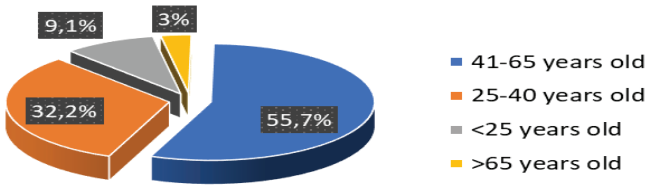

Figure 52 Characteristics of consumers based on age distribution

The educational background of the consumers varied, ranging from primary education including elementary, junior, and senior high school to higher education graduates, such as diploma, bachelor, master, and doctoral degrees. Primary school graduates dominated the education background of wood product consumers in Central Java with 45% (Figure 53). Higher education graduates with a diploma and bachelor degree were estimated at 38%, then master's and doctoral degree backgrounds were 17%. This showed that this study was participated by consumers with some levels of education background that were quite evenly distributed.

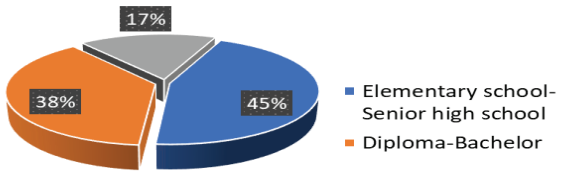

Figure 53 Consumers education background

For the occupation background, the respondent had various jobs, varying from agroforestry farmers, entrepreneurs, company employees, academic-related employees (civil and non-civil servants), and non-academic-related work. Consumers with entrepreneur backgrounds dominantly participated in the study at 46.5%, then followed by those with company employee jobs at 20.9%, academic-related jobs at 13.5%, non-academic related civil servants at 11.3%, and agroforestry farmers at 8.7% (Figure 54). The occupation background correlated with the income of the consumers and the cost-related preference for wood products. Based on the occupation background, the consumers' respondents might have middle-high income mainly, meanwhile, a few have a low income.

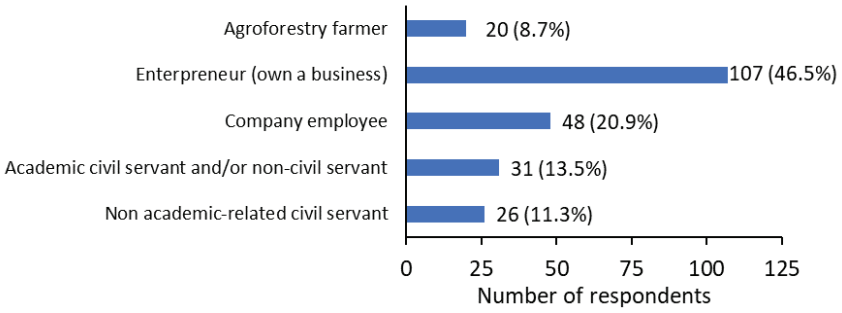

Figure 54 Consumer occupation background

b. Consumers' preference for the product by type of consumers

The preferred product types among consumers in Central Java were classified into solid wood and composite. Specifically, wood composite is a panel or a beam produced by gluing small-size wood including veneer, chip, flake, particle, and fiber at a certain pressure. Various types were produced and developed globally, such as cross-laminated timber, glue-laminated timber, plywood, particle board, fibreboard, and wood plastic composite. Among these types, consumers in Central Java were familiar with plywood (triplex, multiplex), particleboard, oriented strand board (OSB), and medium-density fibreboard (MDF) as the material for construction, furniture, and musical instruments. This was due to the availability in the local market, either from local or import products. The wood composite was consumed mainly due to its cheaper price compared to solid wood.

Solid wood, generally used for building construction, furniture, craft, toys, and household appliances purposes varied in size and shape (log, lumber, and beam), as well as in wood species depending on its specific use. Building parts that held or supported a high load, such as walls, floors, and columns required a big size of beam and lumber. The wood composite was mainly used for furniture, but plywood was also used as a wall partition for cheap or government-subsidized housing.

The Central Java market was more focused on furniture, and the consumption of wood products type showed the same results. The study showed that the highest purchased wood products were furniture including tables, chairs, and cupboards (Figure 55). This was followed by house construction components namely the house roof, Joglo traditional building, beam, and door, then home accessories, crafts, and decoration including beds, shelves, wall hanging, as well as various types of toys. Approximately 90% of consumers were into solid wood (Figure 56). One district, Jepara, had special features, namely carvings, on the furniture well known domestically and internationally, but it was especially for furniture made of teak solid wood.

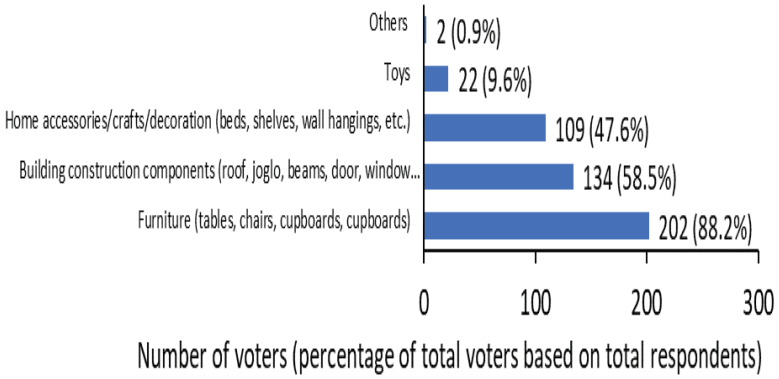

Figure 55 Wood product type purchased by consumers in Central Java

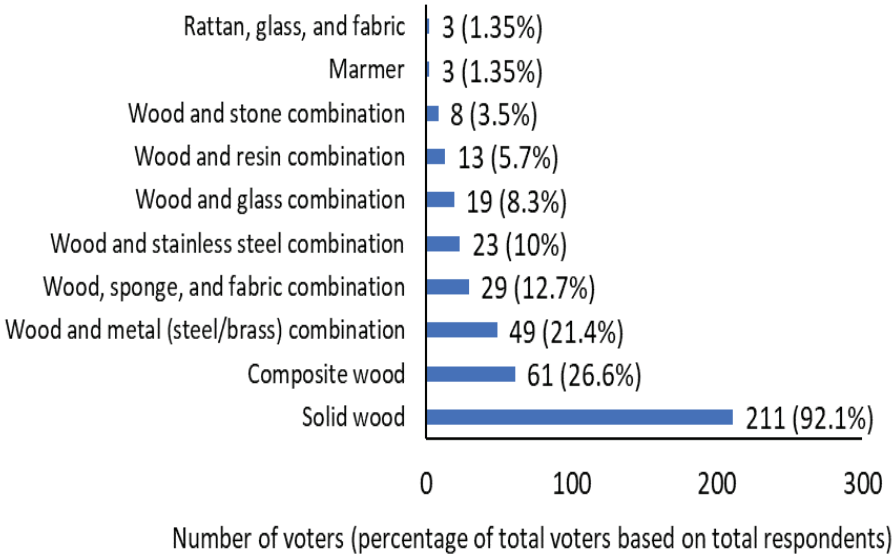

Figure 56 Material types that the consumers in Central Java were interested

b.2 Products Design

The design of wood products in Central Java was focused on furniture and craft. Design are essential factor in adding functional and aesthetic value, delivering a nuance of the room, and supporting the ergonomic as well as safety aspects. Furthermore, design (style) was the second aspect that consumers considered in buying wood products, followed by aesthetics (Figure 57).

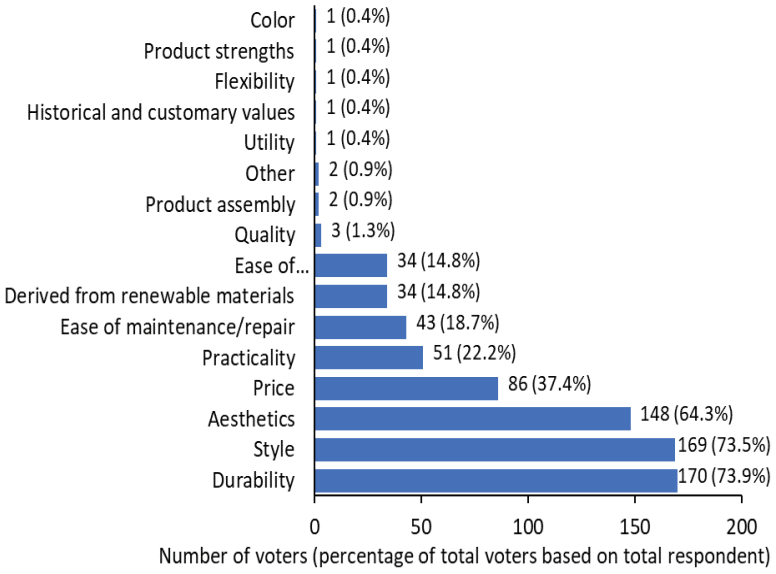

Figure 57 Consumer consideration in selecting the wood product

Design is a complex combination of shape (style), proportion, balance aspects, size, material and its constructions, fitting, ergonomic and safety science, character, as well as color. For model/style, consumer preference design was classified as classic/traditional and modern. Modern style points out minimalist design, while the classic/traditional design is culturally influenced, including both European classic and Indonesian traditional customs. Based on the results, the wood product consumers in Central Java preferred minimalist furniture design at 59.5%, over a partial or slight carving at 26.4%, fully traditional carving design at 12.3%, and others including rustic, industrial, seasonal, outdoor minimalist, and others, amounting to 1.8% (Figure 58). For the materials, consumers preferred solid wood, followed by wood composite (particle board, plywood, medium density fiberboard, finger-joint lamination), wood and metal (steel and brass), wood, sponge, and fabric, wood and stainless steel, wood and glass combination, as well as others. A few manufacturers developed the unique combination of wood and resin, wood and stone, as well as wood and marble. For the construction of the materials, most customers opted for built-in (customized), followed by manufacturer-developed (permanently assembled product), and knockdown (Figure 59).

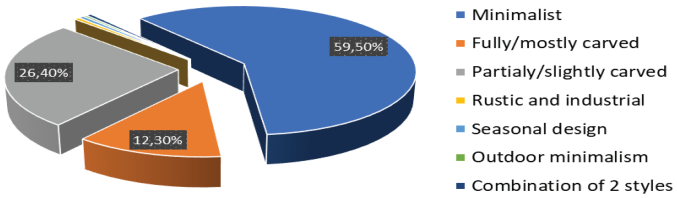

Figure 58 Wood product style preferred by consumers

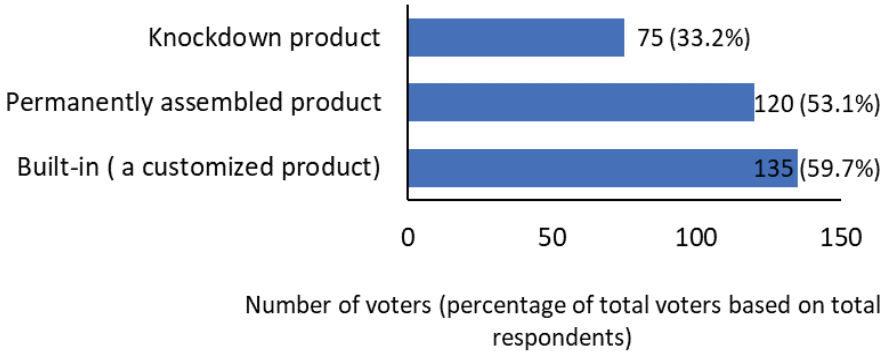

Figure 59 Wood material construction preferred by consumers

b.3 Type of Wood

The type of wood preferred and most consumed in Central Java was teak (Figure 60), primarily due to its high durability against termites and weathering, high strength, and beautiful pattern. Martawijaya et al. (1989) classified teak wood in the durability class 1, with the ability to be resistant for 8 years in a moist soil-contacted area, 15 years in a non-water-submerged area, or unlimited years under roof and non-water-submerged area. Durability was the highest aspect of consumer consideration on wood and product selection, while aesthetics was the third aspect (Figure 57).

The second most preferred wood species is mahogany, which also has high strength and belongs to class 2 according to Martawijaya (1989), with a specific red color. Furthermore, the third most preferred was light wood, such as sengon (*Falcataria moluccana*), jabon (*Anthocephalus cadamba*), and balsa (*Ochroma grandiflorum*). Sonokeling (*Dalbergia latifolia*), kamper (*Cinnamomum camphora*), keruing (*Dipterocarpus acutangulus*), bangkirai (*Shorea laevis*), and merbau (*Intsia bijuga*), were subsequently preferred to be purchased.

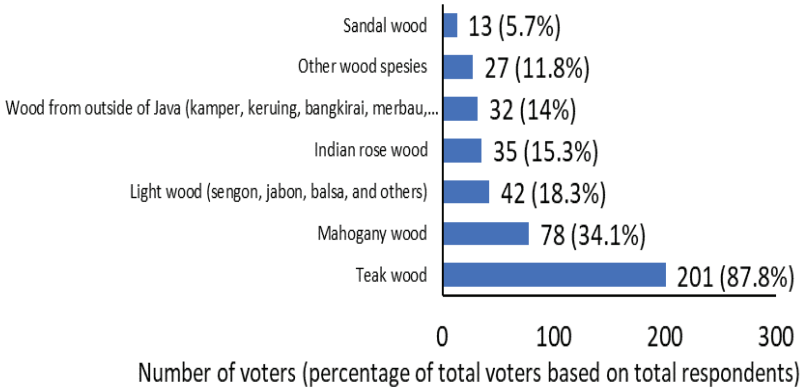

Figure 60 Wood species preferred by consumers

b.4 Price of Products

This study classified the wood product price into five groups, namely cheap (under IDR 1 million), cheap to moderate (IDR 1-5 million), moderate to expensive (5-10 million rupiah), and expensive (IDR more than 10 million). Most consumers (40.1%) preferred the cheap to moderate price (Figure 61). Approximately 26%, 18.1%, and 14.1% of customers choose the expensive, cheap, and moderate to expensive prices, respectively.

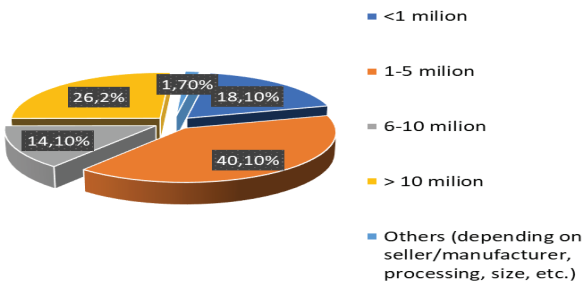

Figure 61 Price list of wood products preferred by consumers

The cheap to moderate price preference on wood product consequence to the wood material selection, namely the wood composite and light wood/low-quality wood usage that has a cheap price. However, these materials typically have a short service life without extra maintenance. This observation was also supported by data on the timing of furniture and house decoration (craft) purchased by consumers in Central Java. More than 50% of respondents purchased the latest furniture within 1 year, while 43.4% purchased the latest home decoration and craft in 1 to 5 years (Figure 62-63). The design tends to be minimal without any carving. Products with moderate and expensive prices use high-quality wood in solid form, and/or a high processing technique (e.g. carving).

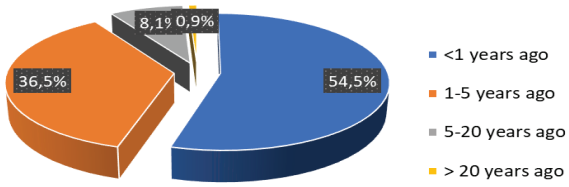

Figure 62 The last time furniture was purchased by consumers

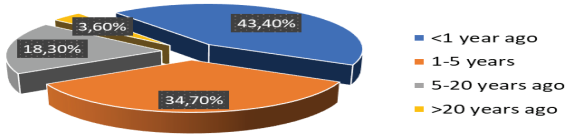

Figure 63 The last time home decorations and crafts purchased by consumers

b.5 Quality of Products

Wood product quality is influenced by several factors, including material selection (solid wood or wood composite), wood species utilization, as well as proper processing and utilization, ultimately affecting the service lifetime. Figure 64 describes the customer opinion towards wood products in Central Java. Approximately 43.5%, 39.6%, 10.4%, and 6.1% of consumers state that domestic wood product has moderate, good, very good, and not good quality respectively. According to some respondents, the quality of domestic wood products can be improved by increasing the durability and the convenient practical assembly in line with international standards, such as IKEA.

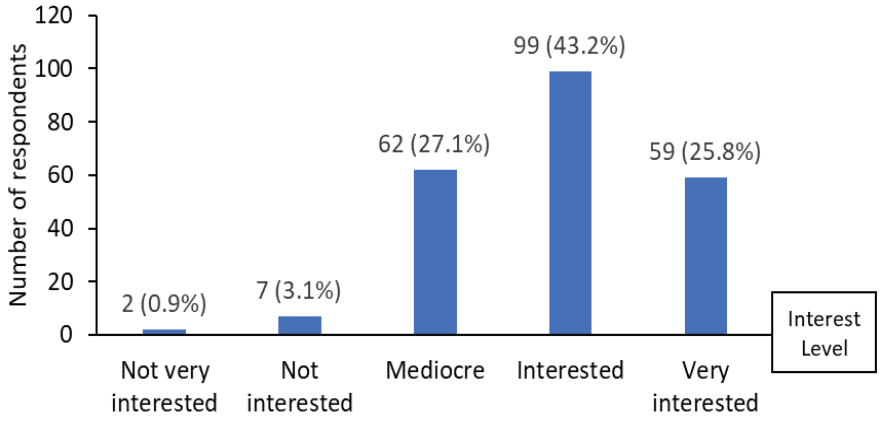

Figure 64 Consumers opinion toward wood products in Central Java

c. Enriched assortment of wood products sold in the Central Java market

Expanding the variety of wood product types begins with an analysis of the wood's potential and the furniture market in Central Java (Activity 1.1 and Activity 1.2). Next, product innovation is determined. The furniture on shelves and benches was selected to strategically satisfy the interior design demands of public areas like parks, libraries, museums, cafes, etc, as well as, houses. The use of cross-laminated timber (CLT) panels as a raw material for furniture instead of solid wood and other panel boards, the composition of CLT panels, and minimalist furniture designs are the innovative furniture designs developed. The design of the furniture was made in detail, including the assembly system. The size and quantity of CLT panel production are determined based on the furniture design that has been created.

CLT panel production was carried out based on our previous research. The CLT's specifications are as follows:

- The three-layer CLT with 17 mm laminae/layer thickness
- The CLT size: 1500 mm x 500 mm x 51 mm
- The composition: Mahogany wood as the face and back layers, and sengon wood as the core layer. The configuration of layers creates a grain direction angle of 90°
- Polyvinyl acetate (PVAc) was used as an adhesive with 244 g/m² glue spread.
- Pressing process was conducted at room temperature and a specific pressure of 0.8 MPa.

The CLT is then tested for physical properties and used as raw material to produce furniture by the developed furniture design. The furniture was later finalized by finishing. Several physical tests were carried out on CLT and furniture such as moisture content, surface roughness, and color. Moisture meter (HM8, Merlin Technology GmbH, Austria), surface roughness meter (SRG4000, Bosworth Instrument, Ohio, USA), and colorimeter (DS-200, Hangzhou CHNSpec Technology Co., Ltd., Hangzhou, China) were used in testing the moisture content, surface roughness, and color, respectively. Production of CLT panels and furniture is carried out at the Faculty of Forestry, Gadjah Mada University. All data is analyzed for further development and scientific paper writing.

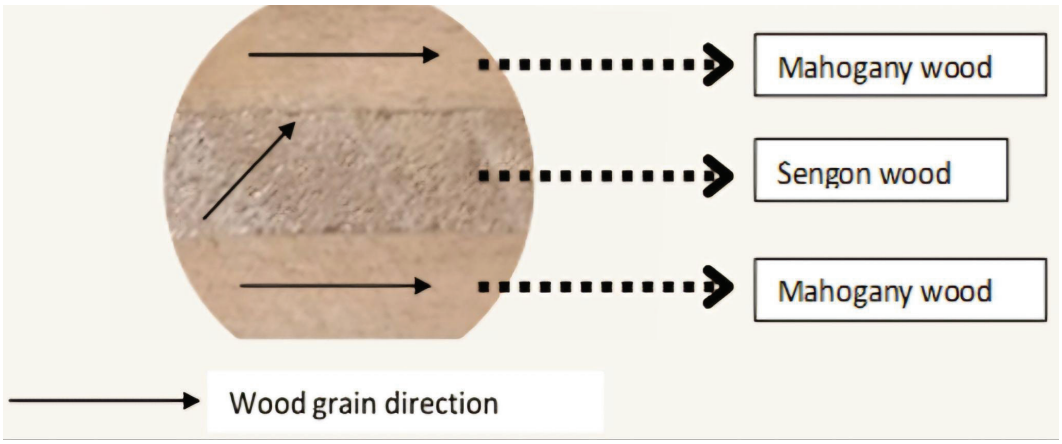

Figure 65 Wood arrangement in CLT manufacturing

The introduction and promotion of CLT products and their application as furniture is carried out in collaboration with the Furniture Industry and Wood Processing Polytechnic, Kendal, Central Java. An exhibition with the "Sustainable Furniture for Better Living" theme held on 16-19 November 2023 at the Oudetrap Building, Kota Lama, Semarang. This exhibition was attended by various wood industries and Micro Small and Medium Enterprises (UMKM) specializing in furniture and crafts from Central Java and surrounding regions, as well as product introductions from the Furniture and Wood Processing Polytechnic students and CLT products introduction from the Faculty of Forestry, Gadjah Mada University. The objective of this exhibition is to expand the market for wooden and furniture crafts in Central Java particularly and in Indonesia generally. The exhibition venue is selected to increase attention from both domestic and international sources.

Based on the results of Activity 1.2, mahogany wood is the second most popular among the Central Java community after teak wood. Teak wood has high strength and durability; however, its long period of harvesting makes its high selling price. Contrastingly, mahogany wood has a relatively shorter harvest period, and relatively high strength, and its selling price is relatively more affordable. Moreover, in terms of supply, sengon (*Falcataria moluccana*) wood is abundant and easy to find in Central Java but has relatively low strength. To enhance the use of wood, the diverse and domestic consumption of wood products, furniture made from CLT using mahogany and sengon woods as raw materials was developed and introduced to the public.

c.1 Cross-laminated timber (CLT)

The CLT products made in this activity were using mahogany and sengon woods. Applications for this product include furniture and construction. The end usage of the product is determined by the type and quality of wood used. Figure 66 shows CLT products made from mahogany wood (surface layer) and sengon wood (core layer), with product properties displayed in Table 1.

Figure 66 C*ross-laminated timber* (CLT) mahogany-sengon-mahogany

Table 1. The properties of mahogany-sengon-mahogany CLT

Moisture content	14.1±0.5%
Surface roughness	6.18±0.22μm (parallel to grain); 8.44±1.11μm (perpendicular to grain)
Color	Bright red with yellowish tinge dominantly, L (brightness): 103.08 a (an indicator from green (x<0) to red (x>0)): 0.19 b (an indicator from blue (x<0) to yellow (x>0)): 0.28

The water content of the CLT met the requirement of British Standard European Norm 386 and JAS (Japanese Agricultural Standard) 234-2007 for CLT which require moisture content of 8-15% and a maximum of 15%, respectively. Therefore, it was potentially exported to Europe and Japan. As compared to *Larix kaempferi* CLT that had been sanded with 60 and 80-grit sandpaper, or 7.55 and 6.68 μm, the surface roughness of CLT parallel to the grain in this study was even lower (Li et al., 2021).

c.2 Furniture

Two types of furniture were produced in this activity; a shelf and a bench.

c.2.1 Shelf

The shelf designs and shelf products made from mahogany - sengon - mahogany CLT are displayed in Figures 67 and 68. Table 2 shows the product specifications, meanwhile, Table 3 shows the product properties.

Table 2. The shelf specification

Dimension	75 cm x 50 cm x 75 cm
Material composition	Mahogany-sengon-mahogany CLT The inner shelf uses commercial plywood
Finishing	Sanding with 120, 200, and 400 grit sandpaper subsequently, filler applying, 400 grit sanding, and then clear matte melamine coating
Model	Permanent with polyurethane adhesive. The outer corners were shaped in the lathe machine
Utilization	Suitable for storing a variety of goods. TV, big plant, or other heavy object can be placed on the top. Books, accessories, shoes, and other items can be placed on the inner shelf

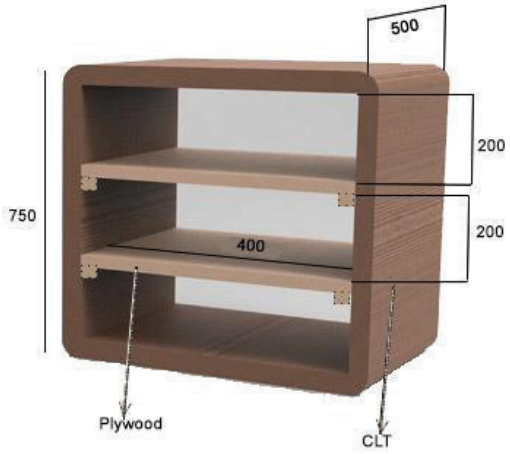

Figure 67 The design of the CLT shelf (all dimensions were in mm; illustrated by Gilang Diasmara)

Figure 68 Shelf made from mahogany-sengon-mahogany CLT

Table 3. The properties of shelf made from mahogany - sengon - mahogany CLT

Moisture content	14.14±2.22%
Surface roughness in parallel to grain direction	6.18±0.22µm (before the sanding process) 3.84±1.74µm (after sanding process) 0.79±0.17µm (after finishing process)
Surface roughness in perpendicular to grain direction	8.44±1.11µm (before the sanding process) 4.94±0.83µm (after sanding process) 1.64±0.40µm (after finishing process)
Color	Prior to the finishing process L (brightness): 105.77 a (an indicator from green (x<0) to red (x>0)): 0.15 b (an indicator from blue (x<0) to yellow (x>0)): 0.36 After the finishing process L (brightness): 97.22 a (an indicator from green (x<0) to red (x>0)): 1.25 b (an indicator from blue (x<0) to yellow (x>0)): 0.11

c.2.2. Bench

Figure 69 and 79 show the design of bench and bench products made from mahogany-sengon-mahogany CLT. Bench specifications can be seen in Table 4 and bench properties in Table 5.

Table 4. Specification of the bench made from mahogany-sengon-mahogany CLT

Dimension	130 cm x 40 cm x 42 cm
Material composition	Mahogany-sengon-mahogany CLT
Finishing	Sanding with 120, 200 and 400 grit sandpaper subsequently, filler applying, 400 grit sanding, and then clear matte melamine coating.
Model	non-permanent (*knock-down* system with steel screw)
Utilization	Suitable as indoor seats in cafes, boarding houses, residences, and public spaces such as libraries, museums and others. The bench capacity is occupied by 2-3 people with a body weight of ± 60 kg. The bench can be equipped with foam as a seat cushion to increase the comfort of the bench user.

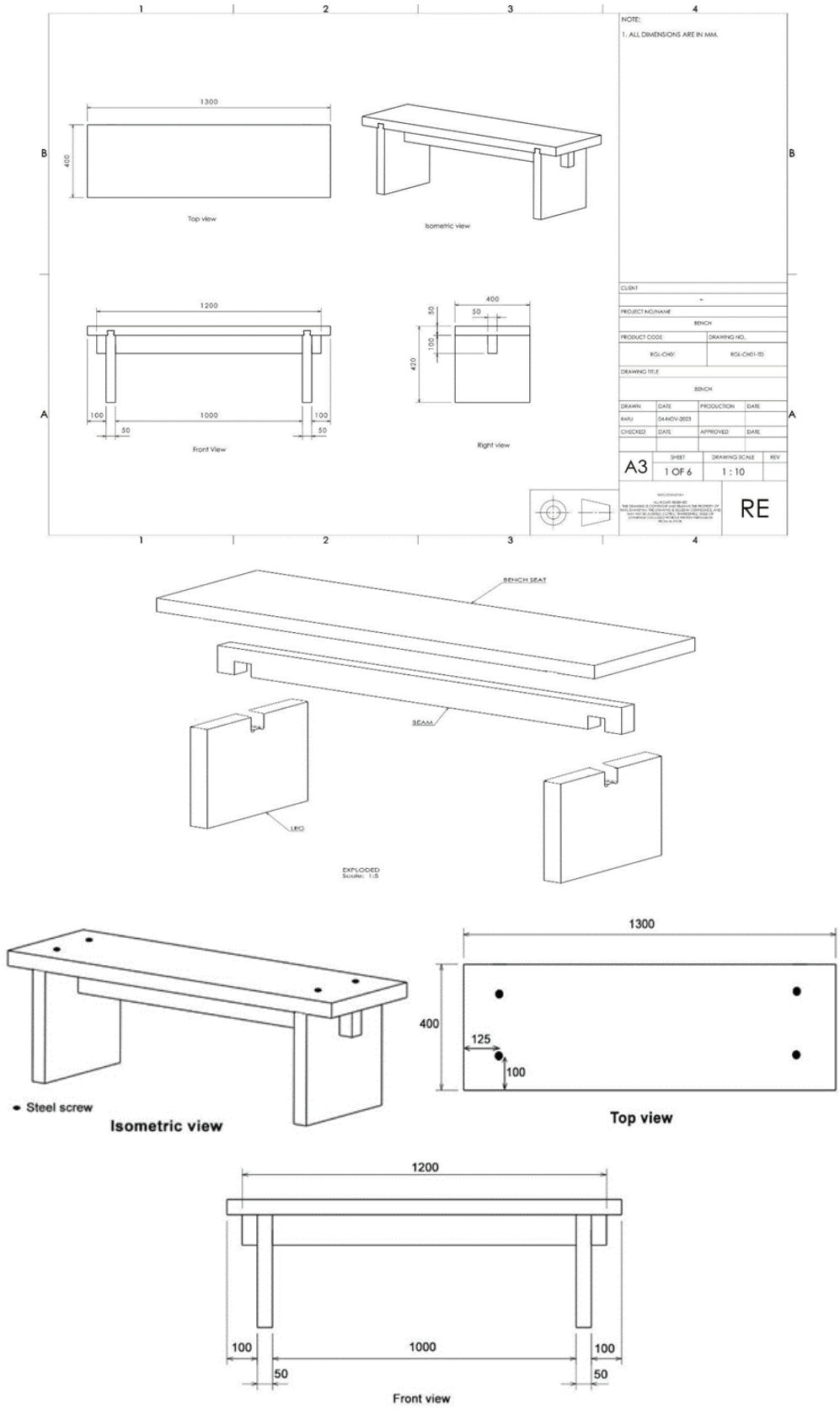

Figure 69 The CLT bench design (all dimensions were in mm) (illustrated by Rafli Evansyah and Greitta Kusuma Dewi)

Figure 70 Bench made from mahogany-sengon-mahogany CLT

Table 5. The properties mahogany-sengon-mahogany CLT bench

Moisture content	14.21±2.22%
Surface roughness in parallel to grain direction	6.18±0.22µm (before sanding process) 2.59±0.47 µm (after sanding process) 0.77±0.23 µm (after finishing process)
Surface roughness in perpendicular to grain direction	8.44±1.11µm (before the sanding process) 4.31±1.08 µm (after sanding process) 1.33±0.20 µm (after finishing process)
Color	Before the finishing process L (brightness): 100.38 a (an indicator from green (x<0) to red (x>0)): 0.24 b (an indicator from blue (x<0) to yellow (x>0)): 0.20 After the finishing process L (brightness): 95.26 a (an indicator from green (x<0) to red (x>0)): 0.15 b (an indicator from blue (x<0) to yellow (x>0)): 1.77

The moisture content of the shelves and benches is around 14%, so it is the same as the moisture content of CLT. In all types of furniture, the surface roughness parallel to the grain is lower than the surface roughness perpendicular to the grain. Surface roughness decreased after the sanding process and decreased further after the finishing process. This is because the cell cavities are filled during filler application and clear matte melamine coating, so the surface becomes smoother. The colour before finishing tends to be bright red with a yellowish tinge, meanwhile, after finishing the colour tends to be darker red with a tinge of yellowish colour but not significant. This is due to the finishing material used being clear matte melamine, it does not change the colour drastically.

CLT products have great potential and can be competitive compared to other materials. This is because they can be used as furniture products that require quite high strength. On the other hand, the cross combination on the sides of CLT can be an added value. The use of different types of wood, the arrangement of board surfaces, and more ergonomic and artistic furniture designs can add value to the product. Due to the different mechanical properties for furniture and construction applications, CLT can be developed according to their needs by using a combination of fast-growing wood and thinned wood with other wood species. CLT can be produced from small-diameter, fast-growing trees, into large-diameter wood that has excellent strength and dimensional stability.

d. Dissemination of enriched assortment of wood products sold in Central Java Market

The introduction and promotion of CLT products and their application as furniture products was carried out in collaboration with the Furniture and Wood Processing Industry Polytechnic, Kendal, Central Java. The collaboration exhibition was held with the theme “Sustainable Furniture for Better Living”. The exhibition has been held for 4 days (16 - 19 November 2023) at the Oudetrap Building, Kota Lama, Semarang. This exhibition aims to expand the furniture market in Central Java by disseminating the results of research/final assignments on furniture and crafts from students of the Furniture Industry and Wood Processing Polytechnic, as well as furniture and craft products from other industries and universities.

The exhibition was opened by the Head of the BPSDMI Industrial Vocational Education Development Center, Emmy Suryandari, ST.,MTM. and Director of the Furniture & Wood Processing Industry Polytechnic, Dr. Peni Soffiyanti. Committee also invited various agencies and industrial circles such as the Director of BPPHH KLH, Director General of Argo Ministry of Industry, General Chair of HIMKI, HIMKI Expert Council, Head of HIMKI Semarang, Asmindo Jogja, Asmindo Semarang, Head of the Semarang City Industrial Service, Chair of CDC FB UI, and Head of KOMINFO Semarang City. The exhibition presents the wood products of students from the Furniture and Wood Processing Industry Polytechnic, industrial incubators, and furniture, and woodcraft products industries. This event also presents CLT products developed by the UGM Faculty of Forestry. Meanwhile, the total number of participating industries is 7 industries, namely Fureko, Zith Living, Oemah Kursi, For You, CV Vina Arya, Lem Fox, and PT. Kim. The government agency, Semarang Industry and Trade Service, also participated as an exhibitor. The total number of visitors to the exhibition reached 1,260 people from the general public and foreign countries (America, Canada, England, Germany, and South Korea). Several online mass media covered this activity, namely

TVRI news, Tribun Jateng news, Suara Merdeka, ayosemarang.com, Warta Jogja, and Liputan 6 SCTV.

The 2023 Furnecraft Exhibition is an event to introduce new products for shelving and bench furniture from cross-laminated timber (CLT) mahogany-sengon-mahogany wood. This is an important thing because people did not know about CLT-based furniture. The decreasing trend in the presence of solid wood has caused furniture manufacturers to look for alternative raw materials. The high level of interest from exhibition visitors shows good prospects for this CLT product. The potential for processing CLT products from various types of wood is very interesting, especially supported by activity data 1.1 and 1.2. CLT products can also be made with a variety of wood species and properties to obtain the desired product quality. The choice of wood species for each layer can also be considered to obtain the best results. This CLT product has quite high bending strength, so it can be applied to furniture products that require high strength. Therefore, this CLT product has great potential for further development, both in terms of raw materials, processing, finishing, and various types of products so it is hoped that it can strengthen both export and domestic markets.

e. Recommendation for the development of the enriched assortment of wood products sold in the Central Java market

Products that are innovative, competitive, and have added value must always be developed by companies to be able to adapt and compete with other companies. The increasing demand for high-quality furniture and the limited types of wood available creates a need for alternative materials that can meet quality, aesthetic, and ecological criteria. One of the alternative materials is Cross-Laminated Timber (CLT). This material can be produced from small-diameter, fast-growing trees, into large-diameter wood that has excellent strength and dimensional stability. In addition, CLT is visually interesting on its own. Increasing the variety of CLT product types can be done by exploring and studying the use of other wood species and fast-growing species, including thinned teak products. This fast-growing wood and thinned teak wood can be also combined with other wood species and modified through coating to improve product quality.

3.4. Development of the enriched assortment of wood products in East Java

a. Characteristics and type of consumers

The characteristics of respondents in the study on “Developing a variety of enriched timber products sold in the domestic market” were selected based on gender variations, educational levels, generations, and income levels. The study included respondents from various districts/cities in East Java Province, and the respondent data was collected using randomly distributed questionnaires in these regions. The results showed that the study’s respondents’ characteristics covered a wide range of sexes, from male to female. In addition, some respondents had varying levels of education, ranging from elementary school graduates to undergraduates. The research also involved different generations, including the baby boomers and Generation Z. Besides, respondents also came from different income levels, from low to very high income. The study covered a wide range of respondents in terms of gender, with both males and females participating. Figure 71 shows the percentage of 112 respondents based on gender, comprising 55% male of respondents and 45% of females.

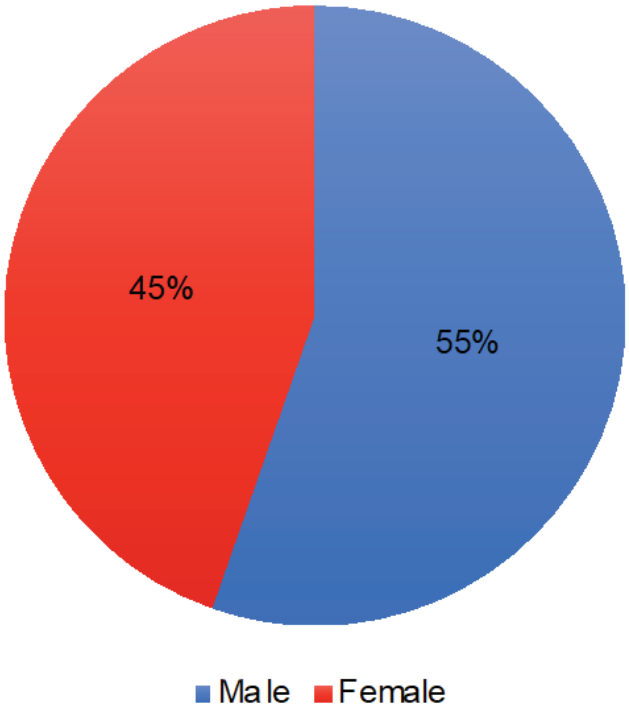

Figure 71 Profile of respondents by gender

The research involved individuals with different levels of education, ranging from high school graduates to undergraduates. In Figure 72, the results show that respondents have an educational background that includes 84% of college, 14% of Senior High Schools (SMA), 1% of Junior High Schools (SMP), and 1% of Elementary Schools (SD). This shows that the majority of respondents had a higher level of education, with about 84% of the respondents having a bachelor's degree. It shows that higher education plays an important role in the participation in this study. Moreover, a low percentage of those with a background in high school, secondary school, and SD indicates that the study is more focused on populations with higher levels of education.

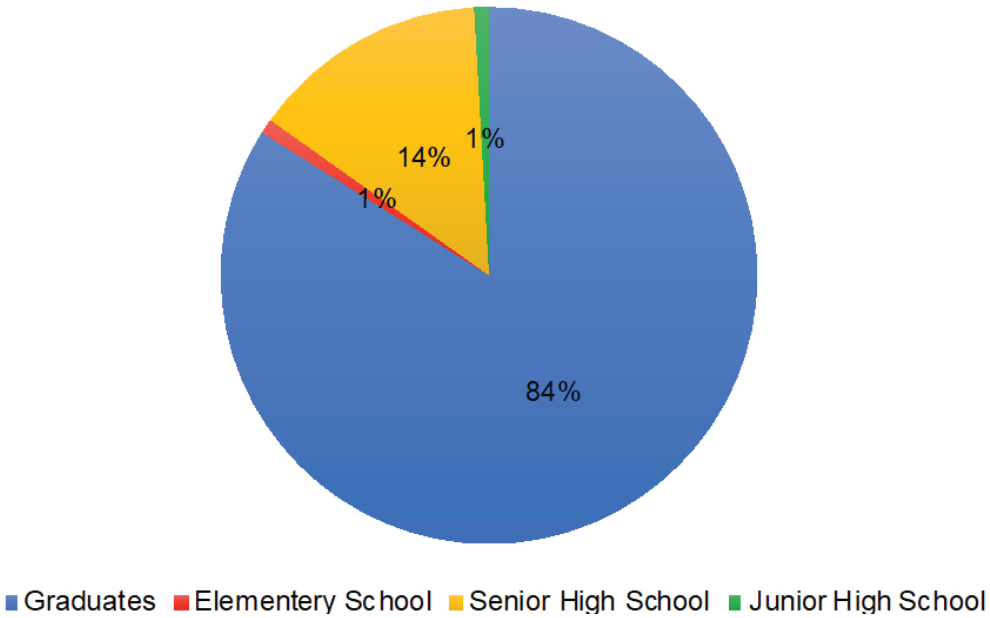

Figure 72 Profile of respondents by education level

The respondents in this activity were grouped into three generations: the baby boomers, the millennials, and the generation Z. The baby boomer generation, known as the generation born after World War II, has become a major force in the world of work and politics. They are often regarded as generations of enthusiastic, innovative, and strong traditional values. Baby Boomers are very competitive because the number of them is large, and they're superior, especially in work situations. (Lase dan Daeli, 2020). The millennial generation uses face-to-face and computer-mediated communication, while the younger members use mainly electronic and digital technologies for interpersonal communication. On the other hand, generation Z, often called digital natives, has grown up with advanced technology and the Internet. Generation Z was born in the world of technology, and they feel comfortable in that world; it's very important for them, and they want the environment to surround the brand. They tend to be more open to change and have more inclusive views regarding ethnicity, sexuality, and culture. In this study, the presence of these two generations offers a rich insight into the differences and similarities between different generations. Different generations are represented in this research, including the baby boomer generation and the Z-generation. The baby boomers, born between 1946 and 1964, accounted for about 47% of the respondents, while the Z and millennials accounted for 22% and 31% of all respondents. (Figure 73).

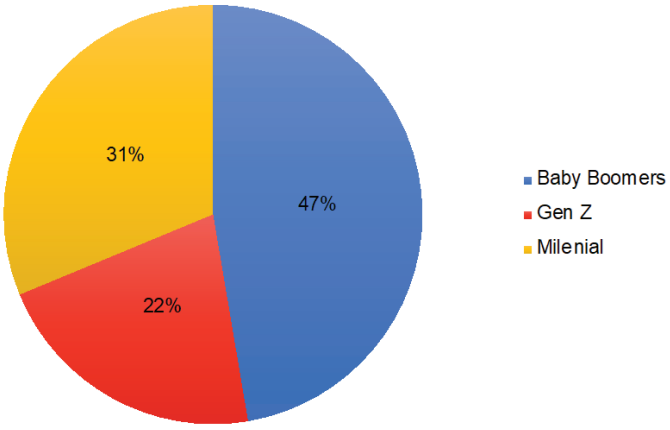

Figure 73 Profile of respondents by generation

In terms of income rates, the study involved respondents from a range of income categories ranging from low to very high. Based on the questionnaire, about 15% of respondents were categorized as low-income, while the other 25% were in the middle-income category.

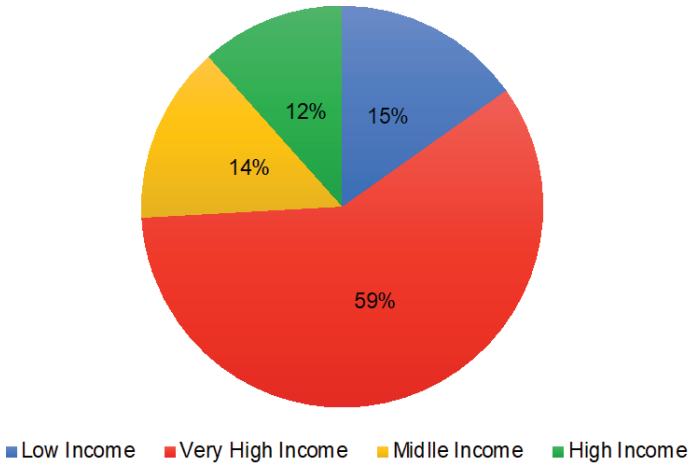

Figure 74 Profile of respondents by monthly income

b. Consumers' preference for the product by type of consumers

1. Type of products

East Java province produces various types of wood used by the community for various furniture needs, such as solid wood, Plywood, particle board, and others. One of the most commonly used types of wood is solid wood, which is often used to make household furniture, such as wooden floors. Solid wood is also frequently used to create structures like beams and poles. In addition to its strength, solid wood has a beautiful natural appearance, making it a top choice. However, solid wood has some weaknesses, such as its higher price than other types of wood and a high likelihood of exposure to wood pests. Therefore, for solid wood to remain stable and durable, it is very important to take good care of it.

Plywood is a strong wooden sheet made of thin layers that are placed side by side and provide good stability. Plywood has become popular in construction and interior design because of its cheaper price than solid wood. However, the weakness of Plywood is its less beautiful appearance compared to solid wood and can look "sharper" or "layered". Nevertheless, with proper care, Plywood can remain stable and function well for many wood projects. Plywood has several advantages compared to solid wood, including the strength of shrinkage of wood and size. The width of the length is greater than with solid wood (Yunus et al., 2018).

Wood lamination is another wood processing product usually used as a surface layer on furniture or decorative material. Laminate is highly resistant to scratches and water, making it ideal for environments often exposed to water. In addition, lamination is available in various colours and textures that can be selected to meet the design needs. According to Sucipto and Ruhendi (2012), laminated wood has several advantages compared to solid wood or hardwood. Among others, laminated timber is easier to use, more efficient as a raw material, has aesthetic value, and is easy to maintain because it can be tempered or coated with anti-fire material. However, it should be remembered that lamination is less strong than solid wood and can break if exposed to strong pressure or impact. Therefore, use lamination carefully according to the use and environment where it is used. This will protect objects or surfaces from additional damage.

A wood processing product made of compressed wood powder is called a Medium Density Fiberboard (MDF). MDF has a high density and is often used to make furniture. Due to its smooth and flat surface, the surface can be laminated, which improves the appearance of the furniture and protects it from damage and water. Lamination on MDF is highly recommended to increase the durability and beauty of furniture made of this material, as lamination prevents scratches, stains, or even damage caused by water, which can damage the wood powder. Like other types of board, MDF has weaknesses, such as not strong nails like solid wood, poor surface glue, and screws on thick sides that are less strong (Hakim *et al. I*, 2011)

Particleboard is a wood made of wood powder mixed with adhesives such as resin or adhesive. (Andini et all, 2019). Though lighter than MDF, the particleboard remains robust for lightweight constructions such as cabinets or tables. Another advantage of particleboards is that they are cheaper than the MDF.

Based on the questionnaire results of the type of product selected for furniture as the main material in the manufacture of wood processing products, the majority of respondents (63%) chose solid wood, particleboard (10%), and the rest (27%) chose other materials or did not have a particular preference. However, although solid wood and particleboard are the primary options, there are still some factors to consider in choosing materials for wood processing products. One important factor is the sustainability of the wood used. In an age of increasing environmental concern, timber from well-managed and recycled resources is becoming more of a priority. Based on the results of the research, Puspita et al. (2016) stated that the choice of solid wood for raw materials is increasing, so other alternatives are needed. The lack of solid wood for furniture, among others, requires a lot of components, connections, and hardware to make it stand alone (Hartanto, 2022). Depending on the design, dining chair components include heels, front feet, rear legs, plywood, heel frame, backup, and others.

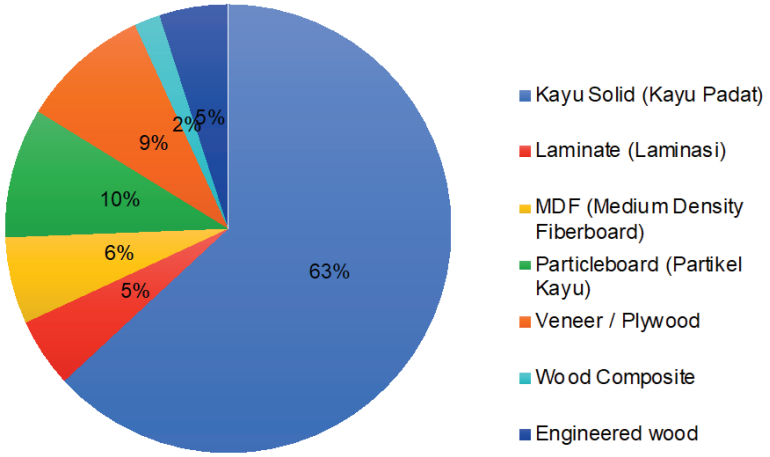

Figure 75 Respondents' preferences for wood materials in East Java

In addition, the strength and durability of the material are important considerations in choosing the material for wood processing products. Solid wood is generally stronger and more durable than particleboard, but particleboard can be cheaper and easier to process. Based on the results of research by Sulaeman and Yoza (2010), particleboards are more suitable for making children's toys, and sound absorbers do not require such high power. However, solid wood may be more recommended if wood-processed products are to be used outdoors or in humid conditions due to its strength and resistance to extreme weather. In addition, aesthetic factors also need to be considered when choosing materials for wood processing products. Solid wood usually looks more natural and beautiful, while particleboard may look plain and less visually attractive. Considering all these factors, the right material selection will ensure that wood-processed products are good quality and fit the user's needs.

2. Product design

Public preferences in determining furniture based on design, among others: (1) custom design, (2) classic and traditional design, (3) modern and stylish design. All these factors become important considerations for choosing furniture that fits their needs and tastes. According to Harto (2014), designers and furniture manufacturers need to undertake research or research to design and make products that are market-acceptable and meet the needs of prospective buyers. In designing designs, designers

must consider and pay attention to some basic rules: (a) function of furniture, (b) proportions of shape and aesthetics, (c) materials, (d) construction, and (e) user anatomy.

Custom design allows consumers to choose the size, material, and colour that suits their space and style. For example, a consumer who wants to decorate their living room with unique furniture to suit their tastes can order chairs and tables with custom designs. They can choose the size that suits their living rooms, choose durable materials such as wood or leather, and choose colours that match the colours of the walls and other furniture in their living area. It will give satisfaction and pride to the consumer because the furniture will be unique and personal. Besides, custom design also provides flexibility for consumers in adapting furniture to their needs and changing their room style in the future. By choosing custom design, consumers can have furniture that truly fits their wishes and needs.

Figure 76 Various types of seating designs

Classic and traditional designs are attractive for those who want an elegant and timeless look. For example, a couple who just got a new home decided to book a living room sofa with a custom design. They wanted to combine modern and traditional elements in their sofa designs. After discussing with the interior designers, they chose a neutral-colored fabric with traditional batik motifs on the backup and pillows-pillows as a classic touch. They also chose solid wooden frames with detailed engravings that add a traditional touch to the sofa. As a result, they managed to get a living room sofa that depicts their uniqueness and personality and fits their wishes and needs. The sofa became the center of attention and an elegant and timeless fashion statement in their living room.

Modern and stylish design suits those who want a fresh and contemporary look. For example, the couple chose a white sofa with traditional batik motifs on the backup and pillows. They also chose a wooden frame with detailed engravings that add a traditional touch to the sofa. As a result, the sofa became the center of attention in their living room and depicted their uniqueness and personality. All this shows that people's design preferences are very diverse and important in buying furniture. It also suggests that furniture design can reflect the identity and characteristics of the individual or family that owns it.

Based on the questionnaire, results from respondents showed that the most sought-after are modern and stylish designs at 45%, classical and traditional designs at 33%, and custom designs at 22%. Thus, interesting and unique furniture design is crucial in attracting consumer interest. Modern and stylish designs are the main favorites because of the fresher and more contemporary impressions. However, it cannot be ignored that some consumers still prefer classic and traditional designs, probably because they want to depict the values of tradition and eternity. Finally, the custom design also has a significant market share, suggesting that people value the uniqueness and personalization of their furniture.

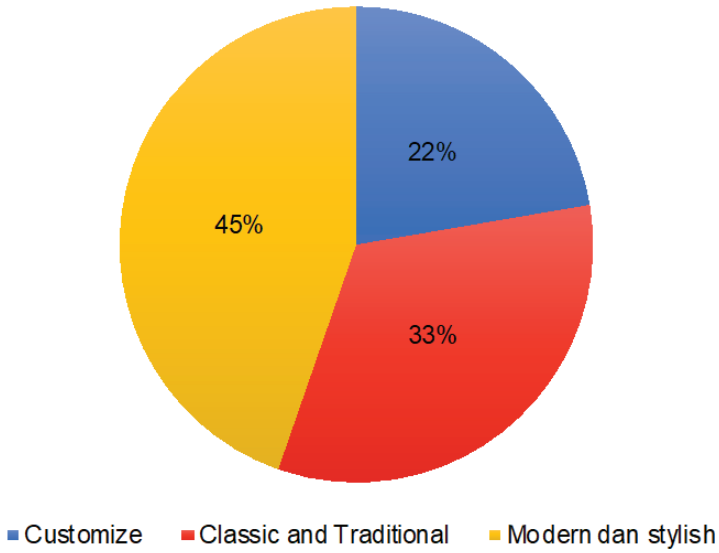

Figure 77 Respondents' preferences for wooden furniture design

The results of Trumansyahjaya's (2015) research stated that, before choosing and arranging the interior element of the house, it is very important to consider the concept of its inhabitants. The choice of furniture, furniture, or furniture must be tailored to the needs, size, and function. Choosing furniture with excessive designs or sizes for a small house with limited space will make its aesthetics and functions non-optimal and obscure. Instead, choose furniture that is adapted to the daily activities of the family to maximize the amount of limited space.

Furniture companies must pay attention to the designs the public wants to increase sales and satisfy customers' needs. Customers who need furniture for the convenience of work or office space must also be equipped for personal use. Wardani (2010) stated that the purpose of office furniture design is to enhance the creativity, productivity, interaction, and spontaneity of human work. The furniture must be adapted to employees' needs to improve the quality of expression of the workspace, the comfort of work, and the optimization of work. Consider the important relationship

between the interior environment and human productivity during the design process. Considering these diverse design preferences will help furniture companies to present products that match consumer tastes. Besides, companies also need to keep up with the latest design trends and innovate to remain relevant in a competitive market. By understanding the wishes and needs of customers, furniture companies can create effective marketing strategies and increase their sales.

3. Type of wood

The type of wood chosen for the furniture can be customized to the needs and style of the desired design. Furniture is made of wood, pine, mahogany, and other kinds of wood. Some people choose wood for its natural strength and beauty, while pine is often chosen for its lower price and coloring ability. Mahoni wood, on the other hand, is often chosen because of its long durability and attractive appearance. In addition, many other types of wood, such as walnut, acacia, or limestone, can be used for furniture, depending on people's needs and preferences. According to Rochyat (2013), the wood used for furniture should be medium-weight, stable in size, and decorated with accents. Besides, wood should be easy to squeeze, fold, screw, dilemma, and various other ways. Woods like sonokelling, Ramin, mahonia, jati, and meranti are recommended for furniture.

Every kind of wood has its advantages and disadvantages. For example, if someone wants to make a dining table out of wood, they might prefer wood because of its strength and beautiful natural appearance. However, if they have a smaller budget and want to have the color they want, the dining desk of pine may be more suitable. Others may use mahogany wood for their desks because of its rich color and insect resistance. The acacia wood is popular for its strength and weather resistance. Limestone is often used to make outdoor furniture because of its resistance to water and its soft fiber. Lastly, walnut wood is often used for furniture because of its dark color and beautiful fiber, which makes it look luxurious. As a result, users have various wooden options that can be customized to their style and needs.

Based on the questionnaire results, the majority chose wood for furniture by 70%, and 28% did not choose any wood that could be used for the furniture. Hardwood has become a popular furniture material due to its extraordinary strength and durability. Besides, the wood looks luxurious because of its fibers and beautiful colors. However, it is important to remember that personal preferences and the room's conditions influence the choice of wood for furniture. Therefore, customers should consider utility and aesthetics when choosing wood for furniture. Plywood is a wood that is suitable for use as a raw material for furniture because it has characteristics such as artistic patterns, medium to smooth texture, moderate strength, and toughness to make it easy to work, high enough natural durability (Class Awet I-III), good precision and finishing, and stability (Wahyudi, 2013). Old timber is of very good quality, but fast-growing timber is also very good to use as a raw material for furniture.

Anggraini et al. (2023) stated that fast-growing wood could be used as a raw material for furniture because it has superior properties to other types of wood at the same time. Fast-growing wood has superior qualities compared to other types of wood, such as Gmelina (Gmelina arborea), Mindi (Melia azedarach), Mahoni (Swieteniaspp.), Akasia (Acacia mangium), Pinus (Pinusspp.), and Sungkai (Peronema cases) at the same time of harvest.

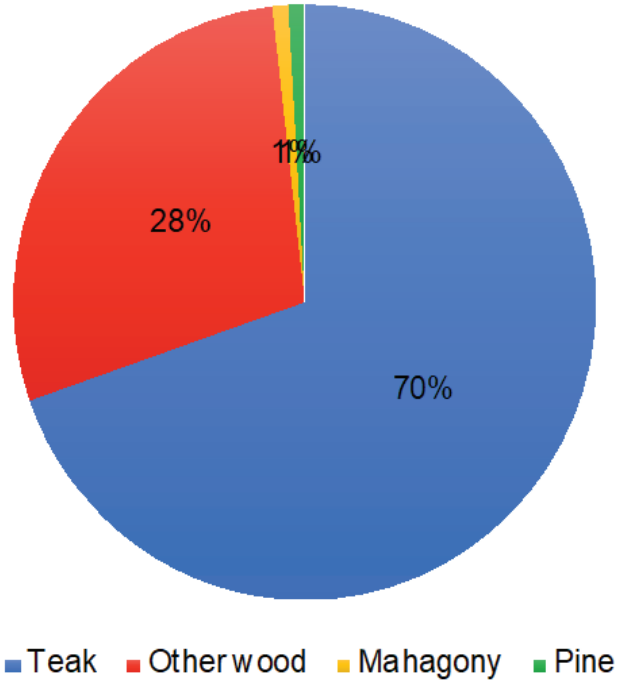

Figure 78 Respondents' preferences for the type of wood used

4. Price

For some people, choosing cheap furniture is a top priority because they want to save money. However, some prefer to invest in more expensive furniture for better quality and durability. Ultimately, the choice of furniture from the price depends on each individual's value and personal preferences. Based on furniture preference based on price, most consumers choose 57% moderate 34% expensive, 5% very expensive, and 4% cheap. According to the furniture preferences, most choose 57% of the price, 34% of that price, 5% of that cost, and 4% of that value. Only a small % of consumers choose furniture with a very high price, only 5% of the cost. This is probably because the vast majority prefers furniture at a fairly affordable price (moderate), 57%. However, some consumers still prefer furniture of a high price to 34%. Only 4% of the customers are looking for very cheap furniture.

In terms of the relationship between the price and the purchase decision, the buyer is influenced by their choice to buy the goods. If the price is higher, the purchaser will make a lower choice, and vice versa; if the prices are lower, the buyers will make higher choices. (Kotler, 2009). Customers make monetary expenses called prices when they buy goods or services. The main factor that influences consumer decisions to make transactions is price (Kusuma et all, 2018). Customer behaviour is heavily influenced when evaluating and assessing the price of a product.

Another factor that affects the preference of furniture choice is the style and design desired. Some people may prefer cheap furniture but have designs that fit their taste. Meanwhile, some prefer expensive furniture with exclusive and luxurious designs. In addition, the material's quality and the furniture's durability are also important considerations in the selection. Thus, the choice of furniture from the price depends on the combination of these factors.

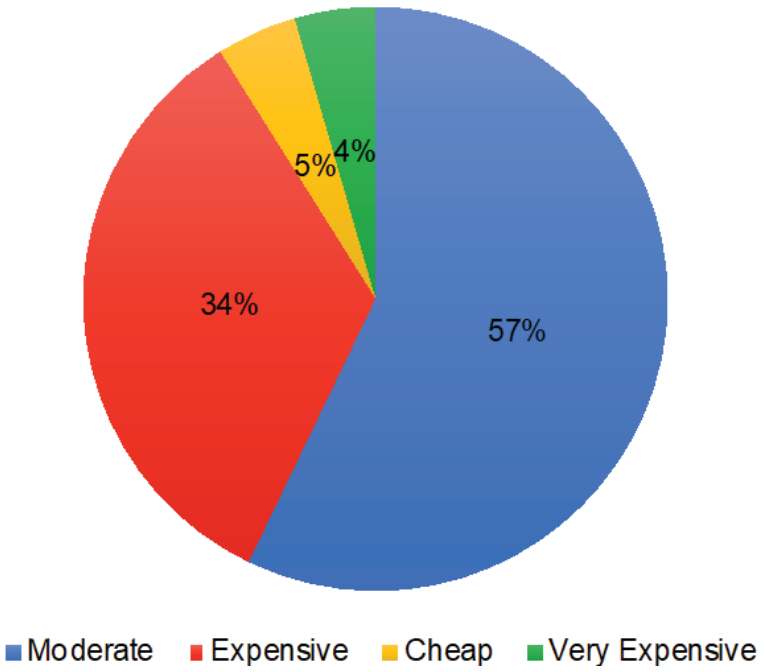

Figure 79 Respondents' perceptions of the price of furniture

5. Quality

People's preferences in choosing furniture can be seen from its quality, ranging from bad to enough, good to excellent. Good quality furniture becomes a top choice for a society that looks forward to comfort and durability. They tend to choose furniture with high-quality materials and aesthetic design. In addition, good quality furniture also guarantees safety and hygiene for users, thus becoming an important factor in meeting the needs and preferences of the public in choosing furniture. For example, a newly married young couple chooses high-quality home furniture. They buy sofas with high-quality leather materials and modern designs that fit their home's interior style. By choosing good quality furniture, the couple can enjoy the comfort and beauty of their home while guaranteeing safety and hygiene. They do not have to worry about the rapid damage or weariness of their furniture because of the good quality of the material. In addition, good quality furniture also gives confidence to the user because there is no need to be worried about potential health problems such as allergies or skin irritation that may arise from poor furniture material. The couple has met their needs and preferences by choosing good quality furniture to create a comfortable, beautiful, safe, and clean home.

Based on the questionnaire, 53% chose good quality, and 34% chose enough. However, not everyone understands the importance of having good quality furniture. Some people may prefer to save money by buying cheaper furniture, although they realize such furniture may only last for a while. They may think they can replace such furniture if it is damaged or as quickly. However, they may not realize that the long-term cost of replacing often corrupt furniture or aus can be much more expensive than buying good quality furniture from the start. Besides, they may ignore the potential health problems from poor furniture materials, such as allergies or skin irritations.

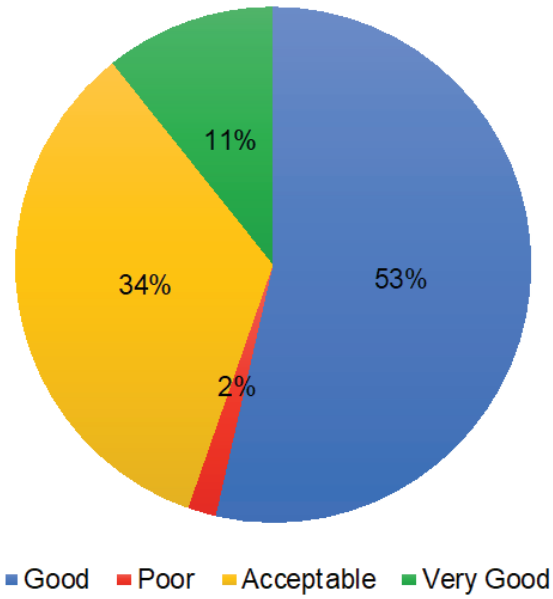

Figure 80 Respondents' perceptions of the quality of furniture

6. Innovation

Furniture innovation in the eastern Java province continues to flourish with an environmentally friendly design and safe materials for health. Companies in the East Java province is becoming increasingly aware of the importance of providing quality and durable furniture to consumers. Thus, consumers can save long-term costs and also maintain their health.

Besides, innovation is also done in terms of environmentally friendly furniture design. Many companies in the eastern Java province are starting to use environmentally friendly materials, such as wood obtained from sustainably managed forests. It not only has a positive impact on the environment but also provides benefits for consumers who care about environmental issues. In addition, these companies also take care of consumer health by using safe ingredients that do not contain hazardous substances. Thus, consumers do not have to worry about health problems such as allergies or skin irritation when using the furniture. For example, a furniture company uses wood from a sustainably managed forest. Thus, they reduce excessive deforestation and ensure that their raw materials do not damage the environment. It is attractive to consumers who care about preserving forests and the environment. They also use environmentally friendly paints and coatings that do not contain harmful chemicals such as lead or mercury. In addition, the coating is also free of harmful substances such as formaldehyde or VOC. (volatile organic compounds). By using safe and environmentally friendly materials, the furniture companies assure consumers that their products are high quality and not harmful to health and the environment.

Based on the questionnaire results, most of the respondents judged that innovation in furniture products in eastern Java was already innovative (48%) and moderately innovative (38%). The results of the questionnaire also showed that most respondents believed that furniture companies in Eastern Java had successfully introduced innovative products. Furthermore, the high ratings of innovation of furniture products in East Java also indicated that the company has successfully created products that meet the needs and wishes of consumers. However, a small proportion (14%) still believes that the innovation in furniture production in Eastern Java is still

less innovative.

Anshory research results (2021) show that consumers want to buy furniture and design innovation elements will be the main focus. Consumers see this directly or visually through the entire product packaging, which displays various design elements such as material usage, function, attractive colour quality, and size. The results of these reviews can help customers understand the phenomenon that has occurred in the last few years and the impact of the furniture product business in the future. These results can also meet the community's needs for quality products that meet society's standards.

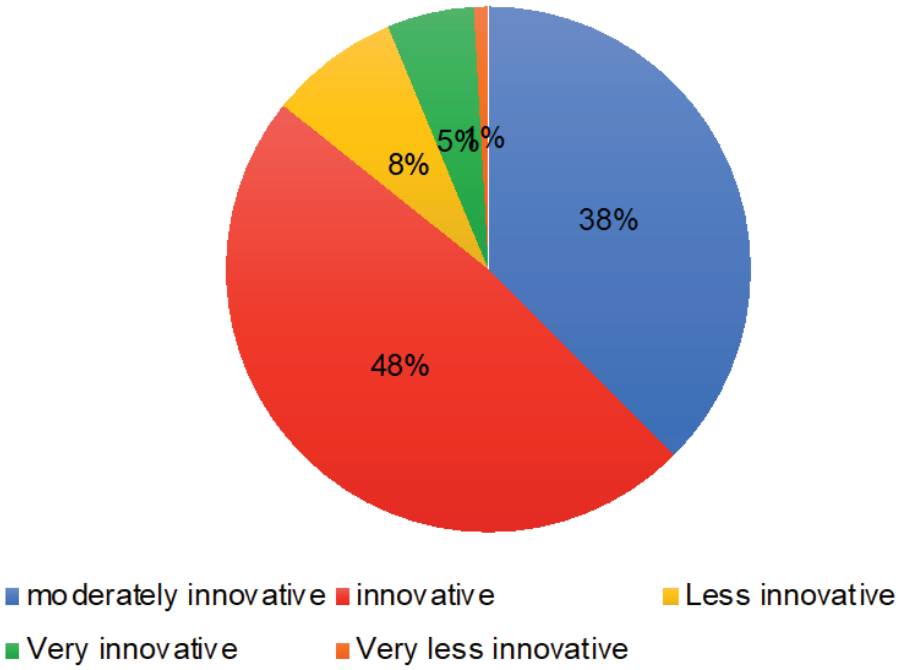

Figure 81 Respondents' perceptions of the innovation of furniture

7. Innovation Strategic

Furniture innovation strategy helps companies to remain relevant and compete in an ever-expanding market. One of the furniture innovation strategies that companies can use is to develop new designs and technologies. Companies can research and develop more functional, ergonomic, and environmentally friendly furniture products. In addition, companies can also leverage new materials and more efficient production techniques to produce more quality and value-added furniture. By implementing these innovations, companies can attract consumer interest and distinguish themselves from competitors in the market. This will help companies gain a competitive advantage. For example, furniture companies can undertake research and development to create seat designs that can automatically adjust the user's posture. Using sensors and special technology, these seats can automatically change their position to provide maximum comfort and reduce the risk of postural injury. In addition, companies can also use environmentally friendly materials to make these chairs. It will attract the interest of consumers who care about the environment and provide a competitive advantage for companies in markets that are increasingly aware of environmental issues. Thus, companies can create added value for consumers and distinguish themselves from competitors.

Based on the questionnaire, the majority of respondents stated that innovation strategies for furniture were highly needed at 44%, needed at 38%, and quite needed at 15%. In an increasingly fast-growing industry, innovation strategies are the key to staying competitive and meeting ever-increasing consumer needs. With a high percentage of respondents saying that innovative strategies for furniture are important or necessary, this suggests that industry players need to pay serious attention to the innovation aspects of their products. The importance of innovation strategies is also becoming increasingly clear, given the increasing competition and changing consumer needs. Therefore, companies need to continue to implement effective innovation strategies to ensure the growth and sustainability of their business in the future.

For example, a furniture company that manages to survive and grow amid tight competition is a company that continues to develop innovative products. For example, the company designs a chair that can change shape according to the user's needs. With this feature, consumers can easily adjust their seat position to suit their comfort and preferences. It gives customers a unique experience and can increase customer satisfaction. Furniture companies can remain relevant and attract growing consumer interest by continuing to produce innovative products like this. In addition, effective innovation strategies can also help companies position themselves as leaders in their industry and distinguish themselves from competitors. Thus, companies can ensure the growth and sustainability of their business in the future.

c. Enriched assortment of wood products sold in the East Java market

The wood product innovation exhibition is an event designed specifically to facilitate the promotion of the latest innovative wood products, such as society or small and medium-sized enterprises. (UKM). The "East Java Wood Product 2023" event runs for two days, Wednesday-Thursday, December 13-14, 2023. The event on the first day was the Focus Group Discussion (FGD) located in the Photo Studio Room on the 5th floor and the Wood Products Innovation Exhibition on the 3rd floor of the Malang Creative Center building. (MCC). This kind of event provides a strategic platform for parties involved in the timber industry, including manufacturers, designers, and consumers, to meet, interact, and gain insight into the latest developments in the world of timber products.

The exhibition covers various wood products, including furniture, equipment, decoration, or decoration furniture. Participants can exhibit cutting-edge products that demonstrate wood design, technology, and materials innovation. This creates an opportunity for stakeholders to explore the range of applications and potential of wood products. These can include the use of advanced technology in production processes, the development of revolutionary designs, or the application of new, environmentally friendly wood materials. The exhibition became a container to introduce new ideas and creative solutions in the wood industry.

The wood product innovation exhibition allows industry actors to establish partnerships and cooperation. According to Suyatno (2010), innovation consists of five types, among others: (1) product innovation, (2) process innovation, (3) marketing innovation, (4) organizational innovation, and (5) business model innovation. Product innovation: A type of innovation that involves the development or change of a product or service offered by an organization. This includes changes in the product's design,

features, quality, or function. The results of Nurivianti and Fitriani's research (2021) state that customers want a multifunctional wardrobe that is robust, neat, safe, quality material, attractive colours, unique shape, multifunctional, practical, lightweight, modern, space-free, comfortable, affordable, and easily accessible.

Process Innovation: Focus innovation on the company's production- or operational processes. The aim is to increase efficiency, reduce production costs, or speed up production times through changes in the methods or technologies used. Marketing Innovation: Marketing innovations relate to new or updated marketing strategies and tactics. This can involve changes in product placement, promotions, prices, or even changes in target market segments. Organizational Innovation: This type of innovation involves organizational structure, corporate culture, or management system changes. Organizational innovation aims to improve the company's performance by adapting or changing how the organization operates. Business Model Innovation: Relates to a change in how a company creates, provides, and extracts value from its product or service. This could include changes in revenue models, cost structures, or even new strategic partnerships.

Manufacturers can interact with designers to create innovative products. At the same time, consumers can communicate directly with manufacturers of timber products to gain a deeper understanding of the production process and the product's benefits. Participants present from students, and the general public can cooperate with producers or help with the sale of the products produced. In addition, the focus group discussions and presentations of each participant aimed to provide education and information to the participants regarding the latest trends, new technologies, and issues related to the timber industry. This can enhance the general understanding of sustainability, innovation, and potential uses of timber products. The exhibition can also serve as a container to promote sustainability in the wood industry. Manufacturers can highlight environmentally friendly practices in their production and showcase wood products from sustainably managed sources. Through the promotion of innovative wood products, the exhibition can also be a boost to economic growth in the wood industry. Participants can explore new business opportunities for the community, especially students, and increase the visibility of their products on the market.

Figure 82 Innovation products of SMEs in East Java Province

The wood product innovation exhibition brought several industry wood products that have their respective products, including Ingco Tools Malang, SalingXSilang Hastakarya, Artdias Gallery, Ravie Furniture and Craft dan Kayu Apik Jati Belanda. The exhibition participants exhibited the products produced to the visitors. Ingco Tools Poor is a world industry of tools and power tools with a simple design. The industry has been around since 2016 and has built a reputation as a reliable tool provider and the top choice for professionals, artisans, and DIY enthusiasts. The industry also offers a wide range of complete engineering tools at the best prices, such as electrical machines, cordless tools, hand tools, measuring tools, wood cutting machines, wood paint with quality materials, and strong wood glue as needed. The results of the wood products offered have been tested for use by household mothers, according to the results of interviews. Products of wood production tools have been equipped with safety and design tools that make it easy to use.

Silang Hastakarya is a creative woodworker from Lawang who produces a variety of unique handcrafts and some handly furniture. The industry has existed since 2012 and has been producing unique products with unique motifs. As for the products produced, the handcrafted bracelets are made using tools with the “Friendship” technique. Besides, there are figures of used wood with unique designs, unique patterns, and strong raw material efficiency. Other products have wall decorations and ropes of flower pots that are attractively sculpted. So attract the attention of visitors to buy it. Of course, the price is affordable and includes good-quality products. Another innovative product is a foldable and practical chair that can be carried anywhere.

Artdias Gallery is a creative woodworker from Pasuruan who uses wood materials to decorate walls, key hangers, unique clocks, and wall watches. Besides, the industry also makes children’s environmentally friendly toys and early education with the products. The industry has been around since 2020 and has produced a key hanging

product that attracts visitors with a funny-coloured mini house design. Besides, the industry also offers private classes with the concept of learning together to make, assemble, design, and colour used wood that has been cut neatly so that the result of the work is more satisfactory according to the wishes.

Ravie Furniture and Craft is one of the creative woodworkers who originated in the poor district of Kiyum. Ravie Furniture & Craft uses the waste of wood branches in various furniture products, such as tables, chairs, mirrors, and various other crafts. This industry has existed since 2020, when there was a pandemic in Indonesia. Although this industry is quite new, the products from Ravie Furniture Craft are not only available in the local markets of eastern Java; they have even reached international markets such as Australia.

On December 14, 2023, the event was held as a product innovation exhibition. As for the exhibition, participants showcased the uniqueness of the products and offered them to the visitors. Visitors can also try and buy a variety of products from these industries. Dutch Pinewood produces pine wood from wood waste that is processed into new products such as shelves for plates and glasses, bookshelves, and work bags.

The product innovation competition is one of the activities aimed at the creative ideas of society in general in the manufacture of wood products. The competition activity is intended to encourage the development of a more innovative and sustainable wood industry, not only for the industry but also for the general public. The wood product innovation competition allows participants to expand their knowledge of the latest technologies and designs in manufacturing wood products. In addition, the competition can also be a promotional event for participants who have succeeded in creating unique products and attracting public interest. Through this race, the public can see the potential and beauty of the timber products produced by the participants. The wood product innovation race also serves as a reservoir for collaboration between participants, companies, and governments in creating better solutions for sustainable wood processing and use.

In addition, the competition also allows participants to expand their business network and gain opportunities for collaboration with other parties in the timber industry. Participants can exchange knowledge and experience through this collaboration to develop better and environmentally friendly timber products. The wood product innovation race is also an opportunity to educate people about the importance of sustainable use of wood. The evaluation criteria for the competition are multifunctional, handly, raw material efficiency, value-added, and technology. The competition also aims to encourage participants to produce wood products with various functions, thereby increasing the value added and the efficiency of using raw materials. In addition, the evaluation will also cover the technological aspects used in the manufacture of such wood products. This competition is an occasion to introduce wood product innovations and raise public awareness of the importance of the sustainable use of wood in industry.

Participants will also be judged based on the creativity and originality of their products. In addition, the competition also gives awards to participants who succeed in creating wood products with an attractive and aesthetic design. Through this competition, participants will be allowed to develop innovative ideas using wood products. The competition also encourages participants to use the latest wood production and processing technology.

The innovation race activities include announcements, video delivery, photos and posters of wood product innovation race products, and exhibitions of wood-processed products. Participants will be free to develop their creative ideas in exploiting the potential of timber products. Participants are expected to positively contribute to improving the quality of wood products and broadening their knowledge and connections in this industry. The timber industry is expected to grow and become more high-quality and sustainable. Participants are expected to generate new and innovative ideas for developing timber products through this competition. Participants can also broaden their connections in the timber industry, opening up future collaboration opportunities. This innovation competition is also expected to bring about innovations that can drive the growth of the wood industry in the future. The competition also allows participants to gain wider recognition and exposure, which can increase their chances of success in the wood business.

This product innovation race is followed by various groups, including students, lecturers, researchers, industry, and the general public. The involvement of these different groups creates a variety of product creativity. The wood product innovation competition aims to encourage the actors of the timber industry to create innovative products from raw wood materials that are more environmentally friendly and economically valuable. Innovation products that emerged from the innovation race of wood products include all-purpose products based on wood wastes combined with the touch of technology. From the product innovation, this race resulted in three winners based on matching race criteria.

Me Time is a multifunctional digital watch product formed from waste wooden pieces that have yet to be used and combined with lamination techniques to optimize the treatment of waste wood pieces. This product innovation has the technological advantage of using Arduino Uno, which can function as a digital watch, alarm, Bluetooth speaker, and sleep lamp with a light sensor. Me Time has a 5v power supported by a rechargeable battery. Then the brute product is an innovation of the fragrant basket of wood powder and coffee mash waste as alternative energy to support sustainable industries with the concept of the circular economy reaching net zero emission in 2060. This product has the advantages of being durable during combustion, aromatic, flammable, more efficient, economical, safe, and producing less ashes. At the same time, Ergo-charged lounge chairs are an innovation of wooden chairs developed by combining the technology needed today. This lounge chair is ergonomically designed to provide optimal comfort with an elegant design and contours that fit the body. This chair brings a sedentary experience to its users.

One of the main strategies for presenting the innovative products designed is to organize an exhibition of these innovative products. The exhibition is called “East Java Wood Product Fest 2023”. The exhibition took place with the Focus Group Discussion (FGD) event, featuring speakers from academics, wood industry practitioners, and representatives of the wood industry associations. We hope the presence of speakers can provide comprehensive insight into forest sustainability, wood product innovation, and the economic benefits of wood products.

d. Recommendation for the development of the enriched assortment of wood products sold in the East Java market

The recommendation to increase the variety of wood products available in the Eastern Java market is to expand the selection of designs and models of timber products. Providing more attractive and inventive design options can attract buyers to buy wood products. To improve the quality and sustainability of the wood products sold, it is also important to adopt responsible production practices and use environmentally friendly timber raw materials. It will attract customers who care about the environment and look for sustainable goods. Increasing the sales of timber products can also be helped by better promotion and marketing. Using social media and e-commerce platforms, they can reach a wider target market and raise consumer awareness of timber products sold in the East Java market. This effort is expected to boost the growth of the timber product market in East Java and provide significant financial benefits for the timbers there. For example, a furniture producer in East Java used timber from sustainably managed forests.

Furthermore, they promote their products through social media and e-commerce platforms, focusing on sustainability and attracting consumers who care about the environment to buy. These furniture companies managed to attract the attention of specific target markets and increase their sales with clear communication about product sustainability. In addition, sustainable timber use improves forest sustainability and reduces deforestation. This furniture company provides long-term economic benefits for East Java as nature conservation enables tourism and eco-conscience growth. This nature conservation also provides social benefits through product sustainability, reducing deforestation, and creating jobs for the surrounding communities. In addition, consumers have confidence that they are buying responsible and environmentally friendly products because products are communicated about sustainability. It boosts the company's reputation and increases its market share. Therefore, the timber entrepreneurs' conservation of nature provides significant social and economic benefits. These furniture companies can create sustainable jobs for the surrounding community by-product sustainability and reducing deforestation. In addition, companies can improve their image and increase their market share by building consumer confidence through clear communication about the sustainability of products.

IV. CONCLUSIONS AND RECOMMENDATION

4.1. Conclusion

The development study of enriched wood products sold in the domestic market analyses consumer preferences towards using processed wood products versus subtitled products such as plastic, steel, and aluminium. Consumer interest in using processed wood products can be determined in terms of design, price, quality, and payment method. Besides knowing consumer preferences for using wood products, there is also the development of innovative products. Innovative product development aims to create new products or improve existing wood products, as for the advice given to consumers on improving wood products as well as to the market or producers.

In West Java, Banten, and Jakarta Province, the activity is carried out through a product innovation competition at the "**Green Timber Innovation Challenge** (GTIC): Processed Wood Product Innovation for Sustainable Forestry Business". The competition combines creativity, innovation, and education to realize positive changes in the use of processed wood products in a sustainable forestry industry. The target of the product innovation competition involves students in West Java and Banten to design wood product innovations that are unique, creative, functional, and affordable. The innovation competition products were shown at the workshop and exhibition held on Thursday, December 21, 2024, at the Sylva Pertamina Auditorium, Faculty of Forestry and Environment IPB.

Expanding the variety of wood product types begins with an analysis of the wood's potential and the furniture market in Central Java. The furniture on shelves and benches was selected to strategically satisfy the interior design demands of public areas like parks, libraries, museums, cafes, etc, as well as, houses. The introduction and promotion of engineered wood, for example, the CLT products and their application as furniture is carried out in collaboration with the Furniture Industry and Wood Processing Polytechnic, Kendal, Central Java. An exhibition titled **FURNECRAFT**: "Sustainable Furniture for Better Living" was held on 16-19 November 2023 at the Oudetrap Building, Kota Lama, Semarang City, Central Java. This exhibition was attended by various wood industries and Micro Small and Medium Enterprises (UMKM) specializing in furniture and crafts from Central Java and surrounding regions, as well as product introductions from the Furniture and Wood Processing Polytechnic students and CLT products introduction from the Faculty of Forestry, Gadjah Mada University.

The "**East Java Wood Product 2023**" event runs for two days on December 13-14, 2023 in Malang Creative Center (MCC) for the East Java locus. The event also conducted the Focus Group Discussion (FGD) to capture information regarding the wood industry and its challenges in East Java Province. This exhibition became a container to introduce new ideas and creative solutions in the wood industry, and provides a strategic platform for parties involved in the timber industry, including manufacturers, designers, and consumers, to meet, interact, and gain insight into the latest developments in the wood industry. The exhibition covers various wood products,

including furniture, daily equipment, and crafts. Participants can exhibit cutting-edge products demonstrating wood design, technology, and materials innovation. This creates an opportunity for stakeholders to explore the range of applications and potential of wood products. These can include the use of advanced technology in production processes, the development of revolutionary designs, or the application of new, environmentally friendly wood materials.

The innovative products are expected can meet the preferences of the consumers due to several considerations such as wood type, product quality, price, and product type. In addition, sustainability and environmental aspects are also important factors in choosing wood products. Consumers are increasingly aware of the importance of choosing wood products from legal and sustainable sources that are produced using environmentally friendly methods. In addition, consumers can also consider alternative materials such as recycled wood or engineered wood. Thus, wood product innovations are needed, including multifunctionality, practicality (handy), efficiency of raw materials, added value, and technology.

4.2. Recomendation

The recommendation to increase the variety of wood products is to expand the selection of designs and models of wood products. Providing more attractive and inventive design options can attract buyers to buy wood products. To improve the quality and sustainability of the wood products sold in the domestic market, it is also important to adopt responsible production practices and use environmentally friendly wooden materials. It will attract customers caring about the environment and look for sustainable goods. Increasing the sales of timber products can also be helped by better promotion and marketing. Using social media and e-commerce platforms, they can reach a wider target market and raise consumer awareness of wood products. This effort is expected to boost the growth of the wood products market in the project locus area and provide significant financial benefits for the timbers there.

Furthermore, they promote their products through social media and e-commerce platforms, focusing on sustainability and attracting consumers who care about the environment to buy. The wood industry should attract the attention of specific target markets and increase their sales with clear communication about product sustainability. In addition, sustainable wood use improves forest sustainability which provides long-term economic benefits and nature conservation enables tourism and eco-conscience growth. This nature conservation also provides social benefits through product sustainability, reducing pressure on the forest in particular the natural production forest, and creating jobs for the surrounding communities.

In addition, consumers have confidence that they are buying responsible and environmentally friendly products because products are communicated about sustainability. It boosts the company's reputation and increases its market share. Therefore, the wood industry entrepreneurs' conservation of nature provides significant social and economic benefits. They also can improve their image and increase their market share by building consumer confidence through clear communication about the sustainability of products.

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