Original Article
J. Korean Wood Sci. Technol. 2023, 51(5): 392-409
https://doi.org/10.5658/WOOD.2023.51.5.392

Journal of the Korean Wood Science and Technology
pISSN: 1017-0715 eISSN: 2233-7180
http://www.woodj.org

Environmental Ethics Policy in Jepara: Optimization of Handicraft Designs from Wood Waste in the Furniture Industry

Deni SETIAWAN[1,†] · Arif HIDAYAT[2] · Supriyadi SUPRIYADI[3] · Wahyu LESTARI[4]

ABSTRACT

The amount of wood waste from furniture production is increasing. Wood waste is diverse and ranges from wood-splitting residues to leftovers from furniture production. Wood waste occurs in companies, household-based industries, and other forms of business where waste accumulates; therefore, an environmental and ethical policy is needed. The aim of this study was to identify products created using wood waste and describe government regulations related to environmental policies. We analyzed the management of wood waste for use as a new product so that it is useful, does not become waste, and complies with policies related to environmental ethics. A case study design using qualitative methods was used. This research focused on managing wood waste in Jepara's furniture and crafts industry for the 2010–2021 period, using 23 sources from primary, secondary, and other supporting documents. Data were collected through observation or gathering information related to research needs, conducting closed-door interviews with research sources, documenting data to strengthen research findings, and using online questionnaires to corroborate information related to wood waste management. This article presents wood waste products designed with optimized environmental ethics and awareness of environmental laws in wood-based industries.

Keywords: environmental ethics, wood waste, furniture industry, handicrafts, Jepara-Indonesia

1. INTRODUCTION

The furniture and handicraft industries are spread evenly throughout Jepara. According to a Jepara district statistical report, 5,993 business units are engaged in the furniture sector. This number is relatively stable because it produces products for export to several Asian and European countries, including the Archipelago, such as Yogyakarta, Jakarta, and Surabaya (Sofiana, 2011). The products include furniture and interior and exterior equipment. Tables, chairs, cabinets, and other living room and bedroom equipment are often exported. Of course, the prices vary. Managing Jepara's furniture industry requires a balanced technology to sustain trade growth (Murdiyani and Harsasto, 2015).

The situation is that the more furniture industries

Date Received April 13, 2023, Date Revised May 10, 2023, Date Accepted August 29, 2023
[1] Elementary School Teacher Education Department, Faculty of Education, Universitas Negeri Semarang, Semarang 50229, Indonesia
[2] Law Sciences, Faculty of Law, Universitas Negeri Semarang, Semarang 50229, Indonesia
[3] Physics, Faculty of Math and Science, Universitas Negeri Semarang, Semarang 50229, Indonesia
[4] Drama, Dance, and Music Education, Faculty of Language and Art, Universitas Negeri Semarang, Semarang 50229, Indonesia
[†] Corresponding author: Deni SETIAWAN (e-mail: deni.setiawan@mail.unnes.ac.id, https://orcid.org/0000-0001-7991-6238)

there are in Jepara, the more wood waste is produced (Eskak, 2016). Wood waste starts with the sawmill industry. So far, wood waste is mostly used for plywood production. Young wood, woo many eyes or some consideration of suitability, will be removed and used for plywood. Wood waste also occurs in the business or production units in the form of small, long, and irregularly shaped pieces of wood, making it impossible to use in furniture manufacturing (Sudiryanto and Suharto, 2020).

The manufacturing of products results in large amounts of teak wood waste, including sawdust, wood shavings, and wood chips. The various sizes and irregular shapes of wood waste is not used optimally (Ratniarsih and Santoso, 2013). Several business units allow waste, in the form of wood piles, to deteriorate due to exposure to rain or sun, be eaten by termites, or be used as fuel by the community. This can cause more serious problems, such as emissions that are harmful to health (Szczurek *et al*., 2021). In addition, burning wood requires special techniques so as not to cause pollution (Moreno *et al*., 2017).

The use of wood waste in handicrafts, souvenirs, and furniture offers potential marketing opportunities. The use of wood is predicted to increase in areas intimately connected to everyday life, such as wooden furniture, wooden structures, and interior materials (Han *et al*., 2022). One study aimed to create sustainable craft products using wood waste as a basic material to support business continuity amid a pandemic. This resulted craft prototypes made from wood waste produced by furniture small and midsize enterprises (Muttaqien and Adiluhung, 2021). One of the efforts to realize the green design of teak wood furniture is to utilize waste in the form of wood and wood branches with coloring that is safe for human health (Hidayat and Pramono, 2020). The furniture industry in Indonesia uses alternatives to various types of solid, processed, and waste wood (Figs. 1–5).

In addition to the limited supply of wood, social and

Fig. 1. Waste products in the form of souvenirs (match holders). Adapted from permission of Laser Kayu (2023a).

Fig. 2. Waste products in the form of decorative and functional objects (wooden calendars). Adapted from permission of Rumah Tulip (2023).

cultural factors also influence the emergence of various alternative types of wood (Puspita *et al*., 2016). The furniture and furniture industry needs to pay serious attention to wood waste management to create awareness and facilitate understanding within the wood furniture manufacturing industry about how much wood is wasted in the production process and how this translates in financial terms, how wood waste can be reduced, what can and cannot be recycled, and what services are available to help businesses recycle (Daian and Ozarska,

Fig. 3. Waste products in the form of functional objects (spoons). Adapted from permission of Laser Kayu (2023b).

Fig. 4. Waste products in the form of jewelry (watches). Adapted from permission of LAzone.id (2023).

2009).

In Jepara, some businesses focus only on producing furniture, rather than making other products as well. However, some businesses focus on souvenir production (Sofiana, 2011). The furniture production business has been in operation for a long time and is sustainable today. Wood and wood culture are viewed as material and cultural heritage, respectively (Han and Lee, 2021). Furthermore, furniture production activities continue so that space is available to develop new products. Some of these new products have been used to optimize wood

Fig. 5. Waste products are ornamental objects (e.g., fish). Adapted from Eskak (2016) with CC-BY.

waste production. Waste technology management requires serious handling by all parties, including paying attention to ethical environmental policies.

Environmental ethics is often seen as a branch of applied ethics, the task of which is to offer solutions to ethical dilemmas that arise in ecological contexts (Valera *et al*., 2020). Corporate environmental ethics plays an intermediate role between stakeholder pressure and green innovation. Environmental awareness positively moderates this relationship (Rui and Lu, 2021). An important aspect of security is environmental security, which will affect every other form of security. Effective environmental governance should be achieved if stable environmental security is achieved. Environmental governance must be based on non-anthropocentric ethics. Environmental governance is understood as bringing about human policies, governments, and certain legal frameworks to underwrite the management of environmental resources (Ikeke, 2020).

Corporate environmental ethics have a positive effect on green products and process innovation. Moreover, this study verified that green product innovation mediates the positive relationship between corporate environmental ethics and competitive advantage, whereas green process innovation does not. In addition, corporate environmen-

tal ethics affected competitive advantage directly and indirectly influenced it through the green product innovation of the manufacturing industry in Taiwan (Chang, 2011).

2. MATERIALS and METHODS

This study uses a case study approach. A case study is a detailed qualitative research model of an individual or social unit over a certain period. More profoundly, a case study is a comprehensive, intense, detailed, and in-depth model that is more directed at examining contemporary (time-limited) problems or phenomena (Sugiyono, 2019). A case study is a research strategy in which the researcher carefully investigates a program, event, activity, process, or group of individuals. Cases are limited by time and activity, and researchers collect complete information using various data collection procedures (Sugiyono, 2019). This study focuses on and analyzes the management of wood waste to be converted into new products so that it is useful, does not become waste, and complies with policies related to environmental ethics.

Researchers must be careful, thorough, and in-depth in uncovering a case or event, both individually and in groups. In this study, case studies were discussed as part of the research methodology (Hidayat and Purwokerto, 2019). The case study research method is the right strategy to use in research that uses the main research questions “how” or “why” it takes little time to control the events studied, and the research focus is on a contemporary phenomenon (Nur’aini, 2020). A case study is a process of in-depth, detailed, and detailed investigation or examination of a particular or special event. Case studies can be derived using formal research methods. The word case in a case study can refer to individuals, groups, events, phenomena, behavior, and many others (Karim, 2021).

This research focused on developing designs using leftover wood waste in Jepara for the 2010–2021 period, using 23 sources as primary data. Primary data were collected for the specific purpose of solving the problems being addressed. The secondary data sources were literature, articles, journals, and websites related to the research. Secondary data related to wood waste management using supporting sources such as books, photos, or other research data that strengthen the research, were used. The background for using this method is 1) to analyze the management of wood waste in the furniture and craft industry in Jepara in depth and 2) to analyze the environmental policy on the management of wood waste in the furniture and craft industry in Jepara.

3. RESULTS and DISCUSSION

Wood is part of a plant’s stem, branches, or twigs, which hardens owing to lignification or natural aging. The use of wood cannot be distinguished from human life. Teak wood is used to make various household furniture such as chairs, tables and cabinet doors and to fill exterior needs. The data collection results for product design, product feasibility, and tight competition can support traders or entrepreneurs, especially furniture entrepreneurs, who are always in demand from customers every day. Besides supporting increased sales, the wood used is of good quality and is not porous, indicating that experts have inspected the wood.

The wood waste sources used were from various regions, such as Jepara and Blora, because these areas are areas where the soil is still fertile; therefore, the center of the wood is sufficient for industrial purposes. The wood did not require special preservation techniques. Most materials used for household furniture are teak wood; therefore, household appliances are durable and not porous.

Design planning does not involve other parties because the artisans/experts imagine and design how to make or carve these household tools. Wood waste

products include keychains, furniture (tables and chairs), jewelry, wall hangings, cutlery, storage boxes, and small souvenirs. During the design process, other parties do not contribute to the design and management of wood waste materials. The design developed by a company is the adoption or example of a product in the market. However, independently designed models are sometimes adopted from other products, depending on the order or customer needs. Product design is based on research of the market's customer needs. These designs have been published and marketed in various regions, nationally, and even in foreign countries. The wood waste used to produce the products was mostly teak wood.

The producer conducts market research to determine one type of product for approximately one week, depending on the time specified when receiving an order from a consumer. Product trending in the market for approximately two months, according to the level of work done by the handyman. Market-trending opportunities are significant because they greatly influence customers' desires in various regions. The company conducts quality control because the wood required is of high quality. Before shipping, quality control was performed for each product approximately twice a week. This depends on the requirements of the company or factory. The company involves experts to control product quality, especially products that requires good quality wood such as teak wood, which is mainly used. Quality control was carried out for the wood waste used to learn the model and the form of the quality wood to be produced.

Household customers use the products they produce. Products are also used to decorate weddings and institutions because furniture is almost always needed. The number of sales in one week is still being determined; sometimes, four to five sets are distributed to consumers, depending on their needs. Monthly sales are highly dependent on seasonality, such as when there is high demand during the wedding season. A profit between IDR. 1,000,000 and 2,000,000 is earned, depending on the customer order model. Consumers who use these products have weddings, bridal makeup, and attend institutions such as schools, as needed.

Small companies do not export to other countries when consumers order products because the cost of the expedition or delivery of goods is not balanced by the price of the product. Small companies also do not have special packaging for marketing; thus far, they have provided thick cardboard so that products are not easily damaged. Small companies sometimes work with specific service parties for marketing purposes. This depends on customer ordering. Outside Java, the delivery uses an expedition service. The company still needs to obtain a well-known brand or product; it takes time and effort to market it in various regions, especially outside Java.

Wood waste sources are from regions such as Jepara, Blora, Central Java, and Indonesia; because these areas still have fertile soils, wood centers are still readily available. The wood did not require special preservation techniques. Product design planning does not involve other parties and is based on market research or customer orders. The manufacturer conducts market research to determine one type of product for approximately one week and trends products on the market for approximately two months. The company conducts quality control for one product approximately twice a week. The industry controls the comfort of using the product by paying attention to customer complaints to assess the suitability of the product design and the wood used. The role of certain institutions or industries in determining product standards is very important because furniture production can facilitate the support of personal and agency needs and infrastructure.

Small and medium-sized enterprises dominate the Jepara furniture industry and are Indonesia's largest centers for carving and furniture manufacturing. Household customers use the products they produce. Products are also used to decorate weddings and institutions,

because furniture is almost always needed. Small companies do not export to other countries because the cost of the export or delivery of goods is not balanced by the price of the product. The most popular products include souvenirs, tables, and chairs made from wood waste. These products are in demand because of their classic carvings and affordability. The use of high-quality wood can increase sales value, demand, and support for the furniture industry.

Jepara's environmental management policy considers Law No. 23 of 1997. Regarding Environmental Management, the Government (Central and Regional) is obliged to prepare reports on environmental management and disseminate them to the public. Law Number 32 of 2004 concerning Regional Government has delegated the authority of 'Environmental Control' as a mandatory matter to the Regional Government; Letter of the State Minister for the Environment No. B-4433/MENLH/08/2002, dated August 12, 2002, concerning the Preparation and Submission of Environmental Status Reports for Provinces and Districts/Cities, and Letter of the Head of the Environmental Impact Management Agency (BAPPEDAL) for Central Java Province No.660.1/BPDL.IV/0385, March 21, 2003, concerning the Guidelines for the Preparation of Regional Environmental Status.

The wood-based industry has the potential to contribute to better management of natural resources to provide income and employment opportunities. The lack of incentives from the government for the utilization of wood waste, inadequate dissemination of information about the economic benefits of wood waste utilization, poor enforcement of environmental laws, and the weakness of an ethically based environmental policy framework for the management of wood waste mean that the business has not developed optimally and is still in the informal and traditional stages.

This study explores industrial products made from waste wood and various options for government policy support to accelerate the development of wood waste-based businesses into environmentally friendly industries. This is useful for the economic, social, and industrial development of a country. The policy framework includes standardization of the business categories of wood produced by independent plantations (informal small and medium enterprises), forest product wood (industrial), forest ecosystem services (ecotourism and carbon), and forest bioenergy.

3.1. Wood waste-based production in Jepara

Some of the benefits of wood that are often found are construction materials for houses and buildings, household appliances, artwork, furniture, and handicrafts (Fandiyanto, 2018). To reduce the energy consumption of buildings, it is possible to expand the use of wood as a structural or thermal insulation material with a low thermal conductivity (Yang *et al*., 2020). The selection of wood used for these purposes is based on various considerations, such as the strength and durability of wood, wood price, fiber texture, and other wood properties because the wood produced by each tree has different characteristics (Bowyer *et al.*, 2003).

Manufacturing wood products requires many processes, from the extraction of logs to the finished product, all of which can pollute the soil, air, and water. Approximately 50% of wood is converted into valuable products, and the rest goes into waste, such as bark, slabs, sawdust, chips, coarse residue, planar shavings, core log strippers, and end pieces (Zeng *et al.*, 2013). Several types of wood waste are produced during the production process, including sawdust waste, wood shaving waste, and wood chip waste. Various attempts have been made to add value to each type of wood waste, including the manufacturing of laminated wood, particle wood, medium-density fiberboard (MDF), high-density fiberboard, wood briquettes, and wood ornaments (Suprijono *et al*.,

2020). Several studies have attempted to develop novel pretreatment processes to improve the economic feasibility of biorefinery processes using lignocellulosic biomass (Han *et al*., 2020). MDF is a wood-based composite panel widely used in the building and furniture industries (Khanjanzadeh and Park, 2020).

Teak wood is of high quality (Febrian and Prabowo, 2017). Muna teakwood, especially from old stands, has been popular as a raw material in the timber industry in Indonesia for the past ten decades (Savero *et al*., 2020). Teak wood furniture has an aesthetic value and economic potential for national and global trade because of its high durability and aesthetic value (Hidayat and Pramono, 2020). Wood waste management activities are conducted using independent capital from artisans and entrepreneurs. This wood waste can be recycled to make dining tables and blackboards, including the production of various products such as dragon shapes (Retantoko and Sulbi, 2016). The production process that must be considered when developing a waste-based product, namely wood materials, must be studied, and the source of wood is very important because customers want quality goods. In addition, it is necessary to pay attention to creativity and carving techniques to produce high-quality products. Recycled teak wood products based on wealth and local wisdom can improve the community's economy (Sukesi *et al*., 2019).

For the area around Jepara, if old wood is used, teak wood is of higher quality than the others (Suranto *et al*., 2015). A special method is needed to determine wood quality (Malik, 2012; Nurfaroka *et al*., 2016). Quality wood can increase sales value, and there is considerable interest and support for furniture production. Quality wood can increase sales to local buyers and buyers from various regions (domestic). Each wood is known to have different characteristics, namely, color, pattern, texture, grain direction, luster, tactile impression, odor, wood hardness, growth circle, pore arrangement, pore size, pore frequency, pore content, area perforations, radius groups, radius arrangement, parenchyma shape, and intercellular canals. These characteristics affect the strength, durability, and uniqueness of each type of wood. In addition, it significantly affects the purchase and selling prices (Sumardi, 2014).

The processing techniques are machine-based and partly manual; thus, the results are better than expected. During the product processing process, the wood is first measured and then sawed. Subsequently, it is cut according to the plan and design of the product being worked on. The stages of working on waste products involve selecting the type of wood according to the order and wishes of the customer. Subsequently, the wood is cut. The finishing technique mostly involves spraying because the results are better and more satisfactory. The average processing time from design to finished product was approximately two weeks, depending on the complexity of the product design and the mason's work duration per day.

3.2. Feasibility of wood waste-based industrial products

When making product revisions, porous wood is inappropriate for household appliances such as cabinets. Artisans are also involved in the production of various products. Production is sourced from the company's personnel, and most people plant teak trees on their land. Jepara has adequate skilled human resources. Competency development is one of the determining elements in improving creative industry performance, providing a sharper and more specific perspective of workers and their work. Human resource management strategies that align with a company's strategy encourage high effectiveness and efficiency, accelerate the company's business processes, and improve organizational quality (Muizu and Effendi, 2015).

The industry controls the convenience of using the product by paying attention to customer complaints so

that the suitability of the wood used can be assessed. Products of small companies are not copyrighted. Small-home industry-scale companies also do not have trademarks or trade rights for certain products that are officially registered. The products do not have standard certificates from certain institutions; only international companies have certificates. However, Jepara-carved furniture is protected by a certificate of Geographical Indication (GI; Jazuli, 2016). Communal ownership means that it belongs to all people with registered GIs (Adnyana, 2019). The protection of GIs must be taken seriously because it is the result of intellectual work to avoid infringement or abuse of rights arising from the birth of intellectual work (Dewi and Landra, 2019).

GI is a separate Intellectual Property Right that is different from other intellectual property rights because it can only be registered as a shared/communal right. Law Number 20 of 2016 regulates GI and trademarks. GI is a communal right; therefore, carrying out its protection can cause various problems, both in terms of product marketing by external parties and the community that owns the GI itself (Mahila, 2019). The registration of GIs includes obstacles such as the public not knowing about the protection of GIs, the government not actively fostering potential GI products, and legal concerns when there is a blurring of norms (Sinaga and Priyanto, 2020).

The role of certain institutions or industries in determining product standards is very important because furniture production can make it easier to support facilities and infrastructure, similar to other agencies and institutions. There are no specific rules or regulations from the government related to product standardization; however, an inspection team always controls furniture products.

3.3. Market competition and tight selling power

Small- and medium-sized enterprises dominate the Jepara furniture industry. It is Indonesia's largest center for carving and furniture manufacturing, with exports worth US$ 150 million per year, or around 10 percent of Indonesia’s total furniture exports. In 2020, the Ministry of Small and Medium Enterprises Cooperatives, together with the Indonesian Furthermore and Craft Industry Association, agreed to double furniture and handicraft exports (Catriana, 2020). The manufacturing industry plays an important role in boosting investment and export values, making it the mainstay sector for accelerating national economic growth (Kemenperin, 2019).

Marketing strategies are often implemented through limited exhibitions and promotions in Jepara. In addition, these products are manufactured at affordable prices. The affordable price strategy is very supportive of the product, especially for other products, and is related to the use of high-quality wood. Consumer interest is strongly influenced by the quality of the designs created (Sutiyem *et al*., 2019).

Market competition among business actors is strongly influenced by conditions, demands, and related supporting industries (Handayani *et al*., 2012). Small and medium entrepreneurs’ strengths include products that the market can accept, good customer relationships, product innovations, and the ease of obtaining human resources (Riyoko and Lofian, 2020). The impact of the presence of foreign companies is marked by the emergence of new furniture companies, increasing new job opportunities in both formal and informal sectors, teaching discipline in work, awareness of achievement orientation, growing and varied furniture designs, and expanding partnership networks between foreign and local entrepreneurs (Muhson, 2004).

Some companies experienced a decrease of 16.57% due to tight competition in the furniture trade. This decline was caused by various factors, such as product quality, design, and features (Nuha and Sutopo, 2015). The determinants of competitiveness include a company’s

ability to provide products according to market needs, company policy, company vision and mission, production process, price and design, product development, demand growth expectations, experts, production machinery, cooperation with foreign companies, sources of funding for research, and cooperation with supporting institutions (universities; Riyoko, 2012). In facing global trade competition, the government's efforts to increase the competitiveness of the local wood-carved furniture industry, called Jepara Carved Furniture (JCF), are carried out by upgrading the Global Value Chain. First, the JCF upgrade form was divided into two phases: static and dynamic. Second, policy for upgrading the JCF industry is urgently needed to face global trade competition and increase value addition. Third, due to several constraints, the upgrading strategy applies only to certain JCF industries. The main challenge in global trade competition is the knowledge and awareness of the government and society about developing more efficient production (Widiartanti, 2016).

Factors that have become obstacles for the government to facilitate free trade among furniture entrepreneurs in Jepara include a) limited raw material needs. The need for wood raw materials for small and micro-scale construction in Jepara Regency is less than 99.27 m^3 per year; b) Overall the local government facilities are assisting the furniture industry, but in terms of capital facilities there are certain conditions that make small and medium industries prefer not to accept capital assistance provided by the local government because it is considered complicated; c) Emergence of new competitors: emerging competitors, both in domestic and global markets; d) Certification and Intellectual Property Rights: provisions relating to environmentally friendly raw materials from international certification bodies and the lack of bar protection, resulting in several furniture product items being rejected by several countries; e) Regeneration of human resources, in terms of improving the quality of skilled human resources is very weak; and f) Marketing: access to marketing both through product exhibitions and through online media is very weak (Murdiyani and Harsasto, 2015).

3.4. Optimization of environmental ethics policy in the utilization of wood waste in Jepara

Excluding oil and gas, furniture is one of Indonesia's four main export commodities, along with palm oil, textiles, and rubber. This added value is enjoyed by tens of millions of people in the value chain. However, the furniture industry faces serious challenges due to certification issues, forest products (green or certified furniture), and wood scarcity. Certified furniture aims to conserve forest resources, promote healthy furniture manufacturing processes, and improve the welfare of artisans. Large producers are ready to supply certified furniture, whereas small producers are not (Purnomo *et al*., 2011). The use of wood is also an important issue from a national perspective in terms of responding to climate change, and the Korea Forest Service enacted the Act on the Sustainable Use of Timber for the revitalization of wood use (Han *et al*., 2021). Wood waste from furniture can be a source of raw materials for production and high-value-added applications. In addition, using wood waste can help the wood business reduce environmental impacts while simultaneously meeting the increasing demand for wood-based products without destroying the world's forests. Therefore, reducing, recovering, and increasing wood waste utilization should be used as strategies by forest-based industries. Proper wood waste utilization significantly helps reduce environmental impacts without destroying the world's forests (Pandey, 2022).

The wood-based business sector generates large amounts of wood waste that must be properly managed, reused, marketed, or disposed of. Wood is the most widely used material for preparing structures, floors, and interiors of a building (Jang, 2022). The utilization of

teak wood waste reduces waste and reduces air pollution because, so far, teak wood waste has only been used as firewood. This is detrimental to the environment and the society. Many people are affected by pollution because they are poisoned by smoke resulting from a lack of utilization of teak wood waste (Wicaksono and Wijayanto, 2018). Good wood waste management significantly reduces emissions (Bergeron, 2014). Using wood waste materials in the form of sawdust and wood fibers provides a greener alternative for recycling industrial waste, owing to existing waste management options, as well as saving natural resources and CO_2 emissions. They are required to manufacture raw materials for mortar (Ince *et al*., 2021).

In European countries, various legal and regulatory policies related to wood waste have diverse implications. However, there is reluctance to invest in and support the use of wood waste, perhaps not because of a lack of resources alone but also a lack of understanding of the potential benefits of valuing waste and the impact of not doing so (Borzęcki *et al*., 2018). In Turkey, ethical morality regarding literacy and awareness of environmental preservation, related to four topics, including (i) professions and livelihoods related to the environment; (ii) species protection; (iii) environmental awareness; (iv) taking advantage of nature and love of animals (Alabaş, 2019), has become a compulsory basic education curriculum since the early 20th century.

In 2015, Germany generated 11.9 million tons of wood waste from the demolition, construction, packaging, and processing industries. Finland produces approximately 207,000 tons of wood waste per year with a recovery rate of approximately 31,000 tons/year. Sweden produces more than 10% of the global timber industry waste in pulp and paper products (Garcia and Hora, 2017). The furniture industry uses forest products in the form of wood as the main raw material in the production process. The amount of wood used by the furniture industry in Indonesia reaches 2.6 million m^3 per year. The waste generated accounts for 54.24% of total production (Desiasni *et al*., 2021).

Australia, Finland, Zimbabwe, and Japan have learned that the timber industry has a high recovery rate of at least 52%, which reduces waste. The Australian use of waste wood produces various building materials and engineered wood, such as plywood, laminated veneers, and glued plywood particleboards. The annual revenue scale of this sector is quite large, at approximately 7.3 million Euros (Bruns, 2017). The development of wood-waste-based products in Finland is growing rapidly for various products, including textiles, chemicals, biofuels, and plastic substitutes (Ramage *et al*., 2017). Local people in Zimbabwe use wood waste in the form of wood chips as fresh wood and use it in commercial sawmills to generate steam for drying cloth (Charis *et al*., 2019). In Japan, the furniture industry produces 15 million m^3 of wood waste, more than 90% of which is recycled to produce wood-based panels and fuels (Hiramatsu *et al*., 2002).

Wood waste can be used as a resource for the production of different materials by reshaping or creating new economic products. Various techniques have been used to utilize wood waste. In Jepara, wood waste is turned into products in the form of handicrafts, carving products, household furniture, non-furniture crafts, and engineered wood products (Fig. 6).

The government is tasked with protecting the entire Indonesian nation, including the environment and both the biotic (living community) and the abiotic (inanimate community) communities: “Earth, water, and the natural resources contained therein are controlled by the state and used for the greatest prosperity of the people” (Article 33, Paragraph 3 of the 1945 Constitution). The state must protect and maintain the environment so that people can prosper (Asshiddiqie, 2009). The past decades have been dominated by ongoing urbanization and the development of technology, particularly renewable energy sources. Following this trend, Japan introduced a Green

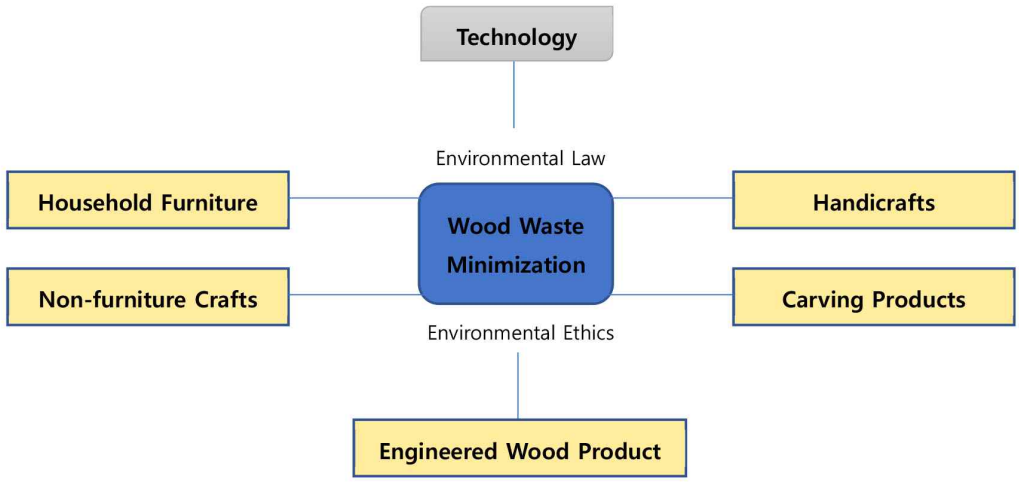

Fig. 6. Wood waste production in Jepara.

Growth Strategy set of policies aimed at achieving carbon neutrality by 2050 (Marinova *et al*., 2023).

Paragraph (1) in Article 28H of the 1945 Constitution states that "everyone has the right to live in physical and spiritual prosperity, to have a place to live, and to get a good and healthy environment and has the right to receive health services" (Yusa and Hermanto, 2018). This clearly shows Indonesia's recognition of environmental rights as part of the Indonesian people's basic rights (human rights). This means that the constitutionalization of the environment aims to prevent policies, laws, and regulations under the 1945 Constitution from contradicting the 1945 Constitution, which is already pro-environmental. Law No. 32 of 2009 also included other rules concerning Environmental Protection and Management (Pratama, 2020). A good and healthy environment is a fundamental right of every Indonesian citizen, as mandated in Article 28H of the 1945 Constitution (Sugiartha and Widiati, 2020). The concept of environmental sovereignty is regulated in Articles 25A and 28H, paragraph (1), and Article 33, paragraphs (3) and (4). These articles provided green nuances to the 1945 Constitution to realize environmental sovereignty (Sodikin, 2019).

A comparison of the results of the two approaches leads to the conclusion that current waste wood management is coherent with the various goals of Swiss federal policies, but the waste wood potential for energy production is not fully exploited (Bergeron, 2014). To minimize environmental impacts and provide a scientific basis for the decision-making process of wood waste management systems, a life cycle assessment approach was used in this study to evaluate potential management systems from an environmental point of view (Hossain and Poon, 2018). In Europe, approximately 46% of wood waste is recycled into particleboard and fiberboard, whereas the remaining fraction is incinerated (Pazzaglia *et al*., 2023).

Waste treatment in Jepara, as a carving city, still needs to be improved, as management mistakes harm the environment and society and cause environmental pollution (Sa'idah *et al*., 2020). However, the government's role in waste management needs to be maximized, even though this role has been carried out (Sumadi and Prathama, 2021). The Indonesian government's efforts to overcome environmental pollution problems

have been carried out by issuing laws and regulations from both governments and ministries. However, the results still need to be improved significantly, and these problems persist (Yudo and Said, 2017).

Legal policies must begin by organizing the management of wood waste and its utilization. Based on the theory of an organic state, if looking at it from the aspect of enforcing environmental administration law, the state has regulated the enforcement of environmental administrative sanctions in which the state can regulate every activity and business in the environmental sector in Indonesia (Thahira, 2019). Therefore, the government must create comprehensive information and databases on wood waste to help policymakers plan and formulate policies for its management. It is important to formulate an environmentally sound development strategy to protect the environment by identifying problems that are handled with the concept of the environment and the role of the local community in optimally and sustainably supporting environmentally sound development (Yanti and Badriyah, 2018).

Modern technology and experiences from developing countries must be studied in terms of wood waste utilization to educate business actors, including innovations according to market demand. It is also necessary to increase environmental law awareness regarding ethical, social, discretionary, legal, and economic responsibilities. The theory of cultural adaptation argues that each individual undergoes several stages of cultural adaptation or assimilation, namely enculturation, deculturation, and acculturation (Ambar, 2018). Teak wood crafts and furniture in Jepara are the hereditary cultures of the previous generation. In Korea, cultural resources have been academically defined as resources that have been created, maintained, and transmitted through human cultural activities and are evaluated as valuable for the foundation of a new cultural industry, including cultural heritage handed down through history (Han and Lee, 2021).

Wood waste can be minimized by increasing the efficiency of primary wood utilization and using raw wood materials derived from sustainable forest management without further impacting the natural environment and forests. Potential utilization requires technology related to (i) good operational practices, (ii) recycling, (iii) reuse, and (v) recovery and a combination of technological changes. In addition, it should pay attention to the provisions of Article 57 of the Constitution as guidelines for recycling and reuse with due regard to the environment. In the provisions of Article 57, paragraph (1) it is regulated regarding procedures for environmental maintenance, namely: “Environmental maintenance is carried out through efforts: a. natural resource conservation; b. reserves of natural resources; and/or c. preservation of the function of the atmosphere” (Ma’ruf, 2018).

In formulating environmental policies, the government usually implements goals to be achieved through environmental policies, accompanied by follow-up directions on how to set goals that can be achieved so that the public can observe them (Thahir, 2021). Preventive efforts carried out by officials include counseling and community monitoring by building stakeholder commitment in perception and collaboration to protect, preserve, and manage the environment and preventive efforts. The apparatus’s repressive efforts involve thoroughly investigating the threats of criminal, civil, and administrative sanctions (Hartati, 2018). In discussing the legal aspect of controlling environmental pollution, the problem revolves around human efforts to prevent and deal with pollution using the law (Soekanto, 1982).

In addition, there is a need for the dissemination of creative management and effective exploitation of wood waste. The management and utilization of wood waste in Jepara need to adopt multidimensional experiences in various countries to develop the quality and quantity of product design. It is necessary to measure the spatial (space) and temporal (time) dynamics of wood waste to ensure the sustainability of future supply, transportation

costs, optimal location, and size of energy conversion facilities. In environmental protection and management, systematic and integrated efforts are made to preserve environmental functions and prevent environmental pollution and damage, including supervision, rather than planning, utilization, control, maintenance, and law enforcement (Evita and Ariyanti, 2018). Some principles of good governance that form the basis for community involvement in environmental management are based on rights, obligations, and community participation, namely, the principles of public participation, transparency, and equality. The basis for community involvement in environmental management is Article 2 of Law Number 32 of 2009, which regulates the principles of environmental protection and management (Nopyandri, 2014).

Eco centric management requires a working paradigm regarding (i) marketing for consumer education, (ii) financing for long-term sustainable growth, (iii) accounting for environmental costs, and (iv) human resource management to create meaningful work and safe and healthy workplaces (Zaman, 2013). The main goal of ecocentrism is ecological sustainability (Yusran and Asnelly, 2018). Eco centric ethics are applied to preserve the environment and biodiversity (Mumpuni *et al*., 2015).

4. CONCLUSIONS

Market observations are conducted during the design process, and consumers receive inputs. Designers obtain contributions from other parties to the design and management of wood waste materials by conducting trials and design evaluations. Based on the development and evaluation processes, products made from wood waste can be produced with a creative market orientation and high value. Wood waste products include children's toys, keychains, furniture (tables and chairs), jewelry, wall hanging, cutlery, storage boxes, and small souvenirs.

Furthermore, furniture and handicraft products based on waste must pay close attention to wood. The creativity of artisans is needed, as well as the accuracy of artistry. In addition, certain legal policies from central and regional governments are related to the standardization of environmental management of the wood waste produced. Simultaneously, a team of inspectors always controls health and environmental friendliness. Jepara furniture and handicrafts industry entrepreneurs pay attention to and comply with applicable environmental, ethical, and legal policies. The management of wood waste according to environmental ethics reduces air pollution and damage and provides comfortable living for the people of Jepara.

CONFLICT of INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENT

This research was funded by Universitas Negeri Semarang.

REFERENCES

Adnyana, A.A.N.T. 2019. Perlindungan hukum terhadap produk indikasi geografis dari tindakan peniruan. Jurnal Magister Hukum Udayana 8(1): 49-60.

Alabaş, R. 2019. Environmental topics and environmental ethics in primary school humanities and social sciences education during the Late Ottoman period (1913−1918). International Electronic Journal of Environmental Education 9(2): 120-141.

Ambar. 2018. Teori adaptasi budaya dalam komunikasi antar budaya. https://pakarkomunikasi.com/teori-adaptasi-budaya-dalam-komunikasi-antar-budaya

Asshiddiqie, J. 2009. Green Constitution: Nuansa Hijau

Undang-Undang Dasar Negara Repubik Indonesia Tahun 1945. PT Raja Grafindo Persada, Jawa Barat, Indonesia.

Bergeron, F.C. 2014. Assessment of the coherence of the Swiss waste wood management. Resources, Conservation and Recycling 91: 62-70.

Borzęcki, K., Pudełko, R., Kozak, M., Borzęcka, M., Faber, A. 2018. Spatial distribution of wood waste in Europe. Sylwan 162(7): 563-571.

Bowyer, J.L., Shmulsky, R., Haygreen, J.G. 2003. Forest Products and Wood Science: An Introduction. Iowa State University Press, Ames, IA, USA.

Bruns, A. 2017. Tweeting to save the furniture: The 2013 Australian election campaign on Twitter. Media International Australia 162(1): 49-64.

Catriana, E. 2020. Kemenkop UKM genjot ekspor mebel dan kerajinan. https://money.kompas.com/read/2020/02/06/193300126/-kemenkop-ukm-genjot-ekspor-mebel-dan-kerajinan?page=all

Chang, C.H. 2011. The influence of corporate environmental ethics on competitive advantage: The mediation role of green innovation. Journal of Business Ethics 104: 361-370.

Charis, G., Danha, G., Muzenda, E. 2019. A review of timber waste utilization: Challenges and opportunities in Zimbabwe. Procedia Manufacturing 35: 419-429.

Daian, G., Ozarska, B. 2009. Wood waste management practices and strategies to increase sustainability standards in the Australian wooden furniture manufacturing sector. Journal of Cleaner Production 17(17): 1594-1602.

Desiasni, R., Chandra, R., Widyawati, F. 2021. Pengaruh volume limbah serbuk kayu jati (*Tectona grandis*) terhadap daya serap air pada komposit partikel dengan matriks epoksi. Jurnal Tambora 5(2): 74-78.

Dewi, L.K., Landra, P.T.C. 2019. Perlindungan produk-produk berpotensi hak kekayaan intelektual melalui indikasi geografis. Kertha Semaya 7(3): 1-17.

Eskak, E. 2016. Krisis bahan baku seni kerajinan kayu di Jepara dan solusi pemecahannya. Dinamika Kerajinan dan Batik 30(2): 73-84.

Evita, L., Ariyanti, E.R.N. 2018. Pengawasan terhadap ketaatan penanggung jawab usaha dalam upaya melestarikan dan mencegah terjadinya pencemaran dan kerusakan lingkungan hidup di wilayah kota administrasi Jakarta timur. ADIL: Jurnal Hukum 9(1): 001-020.

Fandiyanto, R. 2018. PKM pengembangan teknologi produksi dan pemasaran berbasis digital pada kelompok penghasil produk furniture di kelurahan dawuhan situbondo. Integritas: Jurnal Pengabdian 2(1): 25-37.

Febrian, P.M., Prabowo, S. 2017. Pemanfaatan limbah tunggak kayu jati dalam pembuatan karya kriya kayu bertema ikan hiu dan buaya. Jurnal Pendidikan Seni Rupa 5(01): 136-140.

Garcia, C.A., Hora, G. 2017. State-of-the-art of waste wood supply chain in Germany and selected European countries. Waste Management 70: 189-197.

Han, S.Y., Park, C.W., Kwon, G.J., Kim, J.H., Kim, N.H., Lee, S.H. 2020. Effect of [EMIM]Ac recycling on *Salix gracilistyla* Miq. pretreatment for enzymatic saccharification. Journal of the Korean Wood Science and Technology 48(3): 405-413.

Han, Y., Lee, S.M. 2021. Investigation on the awareness and preference for wood to promote the value of wood: II. Awareness of wood cultural resources. Journal of the Korean Wood Science and Technology 49(6): 643-657.

Han, Y., Lee, S.M., Choi, J., Park, C.Y. 2021. A study on classification of wood cultural resources in South Korea. Journal of the Korean Wood Science and Technology 49(5): 430-452.

Han, Y., Yang, M.S., Lee, S.M. 2022. Investigation on the awareness and preference for wood culture to promote the values of wood: III. Living environment and trend of wood utilization. Journal of the

Korean Wood Science and Technology 50(6): 375-391.

Handayani, N.U., Santoso, H., Pratama, A.I. 2012. Faktor-faktor yang memengaruhi peningkatan daya saing klaster mebel di Kabupaten Jepara. Jurnal Teknik Industri 13(1): 22-30.

Hartati, S. 2018. Penegakan hukum terhadap pencemaran lingkungan hidup di Indonesia. Hukum dan Dinamika Masyarakat 16(1): 31-44.

Hidayat, J., Pramono, R. 2020. Desain hijau: Pemanfaatan limbah kayu jati untuk desain furnitur naratif dengan aplikasi finis ramah lingkungan. Jurnal Visual 14(1): 31-40.

Hidayat, T., Purwokerto, U.M. 2019. Pembahasan studi kasus sebagai bagian metodologi penelitian. Jurnal Study Kasus 3: 1-13.

Hiramatsu, Y., Tsunetsugu, Y., Karube, M., Tonosaki, M., Fujii, T. 2002. Present state of wood waste recycling and a new process for converting wood waste into reusable wood materials. Materials Transactions 43(3): 390.

Hossain, M.U., Poon, C.S. 2018. Comparative LCA of wood waste management strategies generated from building construction activities. Journal of Cleaner Production 177: 387-397.

Ikeke, M.O. 2020. Environmental ethics and environmental governance for security in Africa. European Journal of Sustainable Development 9(3): 67-77.

Ince, C., Tayançlı, S., Derogar, S. 2021. Recycling waste wood in cement mortars towards the regeneration of sustainable environment. Construction and Building Materials 299: 123891.

Jang, E.S. 2022. Investigation of sound absorption ability of *Acanthopanax senticosus* wastes. Journal of the Korean Wood Science and Technology 50(6): 404-413.

Jazuli, A.K. 2016. Tinjauan mashlahah terhadap perlindungan seni ukir melalui indikasi geografis. Jurisdictie: Jurnal Hukum dan Syariah 7(1): 20-32.

Karim, R. 2021. Pengertian studi kasus: Jenis, cara membuat dan contoh. https://deepublishstore.com/blog/pengertian-studi-kasus/

Kemenperin. 2019. Industri manufaktur berperan penting genjot investasi dan ekspor. https://kemenperin.go.id/artikel/20091/Industri-Manufaktur-Berperan-Penting-Genjot-Investasi-dan-Ekspor-

Khanjanzadeh, H., Park, B.D. 2020. Characterization of carboxylated cellulose nanocrystals from recycled fiberboard fibers using ammonium persulfate oxidation. Journal of the Korean Wood Science and Technology 48(2): 231-244.

Laser Kayu. 2023a. Kotak tempat korek api kayu jati. https://laserkayu.com/product/kotak-tempat-korek-api-kayu/

Laser Kayu. 2023b. Sendok kayu / sendok / sendok souvenir. https://laserkayu.com/product/sendok-kayu-sendok-sendok-souvenir/

LAzone.id. 2023. Terbuat dari kayu, 5 jam tangan lokal ini keren abis! https://www.lazone.id/lifestyle/style/terbuat-dari-kayu-5-jam-tangan-lokal-ini-keren-abis-wr21f

Mahila, S. 2019. Problematika perlindungan hukum terhadap produk indikasi geografis. Jurnal Ilmiah Universitas Batanghari Jambi 19(3): 639-643.

Malik, U. 2012. Penelitian berbagai jenis kayu limbah pengolahan untuk pemilihan bahan baku briket arang. Jurnal Ilmiah Edu Research 1(2): 21-32.

Marinova, S., Bach, V., Yokoi, R., Motoshita, M., Islam, K., Finkbeiner, M. 2023. Country-level criticality assessment of abiotic resource use in Japan: Application of the SCARCE method. Journal of Cleaner Production 412: 137355.

Ma'ruf, A. 2018. Aspek hukum lingkungan hidup dalam upaya mencegah terjadinya kerusakan dan pencemaran lingkungan hidup di Indonesia. Wacana Hukum 24(1): 38-51.

Moreno, A.I., Font, R., Conesa, J.A. 2017. Combustion of furniture wood waste and solid wood: Kinetic

study and evolution of pollutants. Fuel 192: 169-177.

Muhson, A. 2004. Insdustrialisasi dan perubahan masyarakat studi tentang dampak industri mebel asing terhadap perubahan masyarakat di Kabupaten Jepara. Jurnal Penelitian dan Evaluasi Pendidikan 6(2): 139-156.

Muizu, W.O.Z., Effendi, N. 2015. Penguatan sdm industri kreatif melalui peningkatan kompetensi dan *knowledge management*. Pekbis Jurnal 7(3): 222-233.

Mumpuni, K.E., Susilo, H., Rohman, F. 2015. The role of society toward concervation. Proceeding Biology Education Conference 12(1): 779-782.

Murdiyani, M., Harsasto, P. 2015. Peran pemerintah kabupaten Jepara dalam rangka fasilitasi terhadap industri mebel dalam perdagangan bebas. Journal of Politic and Government Studies 5(1): 51-60.

Muttaqien, T.Z., Adiluhung, H. 2021. Usaha kecil menengah di bandung mendukung *sustainable design* melalui pembuatan furnitur berbahan limbah kayu menggunakan konsep nirmana dwimatra. Gorga: Jurnal Seni Rupa 10(1): 01-05.

Nopyandri. 2014. Hak atas lingkungan hidup dan kaitannya dengan peran serta dalam pengelolaan lingkungan hidup dalam perspektif otonomi daerah. Jurnal Inovatif 7(3): 33-44.

Nuha, A.L.D., Sutopo. 2015. Pengaruh kualitas produk, fitur dan desain terhadap keputusan pembelian mebel pada Cv. munawir furniture di Jepara. Diponegoro Journal of Management 4(4): 1-11.

Nur'aini, R.D. 2020. Penerapan metode studi kasus yin dalam penelitian arsitektur dan perilaku. INERSIA: Informasi dan Ekspose Hasil Riset Teknik Sipil dan Arsitektur 16(1): 92-104.

Nurfaroka, A.R., Ukkas, M.I., Pratiwi, H., Purnamasari, D. 2016. Sistem informasi pemilihan kualitas kayu sebagai bahan baku produksi mebel menggunakan metode promethee. Theses 16(1): 34-43.

Pandey, S. 2022. Wood waste utilization and associated product development from under-utilized low-quality wood and its prospects in Nepal. SN Applied Sciences 4: 168.

Pazzaglia, A., Gelosia, M., Giannoni, T., Fabbrizi, G., Nicolini, A., Castellani, B. 2023. Wood waste valorization: Ethanol based organosolv as a promising recycling process. Waste Management 170: 75-81.

Pratama, A. 2020. Penegakan hukum terhadap pencemaran lingkungan limbah industri di perairan Karawang, Jawa Barat. Logika 11(1): 24-31.

Purnomo, H., Irawati, R.H., dan Wulandari, R. 2011. Kesiapan produsen mebel di Jepara dalam menghadapi sertifikasi ekolabel. Jurnal Manajemen Hutan Tropika 17(3): 127-134.

Puspita, A.A.P.A., Sachari, A., Sriwarno, A.B. 2016. Dinamika budaya material pada desain furnitur kayu di Indonesia. Panggung 26(3): 247-260.

Ramage, M.H., Burridge, H., Busse-Wicher, M., Fereday, G., Reynolds, T., Shah, D.U., Wu, G., Yu, L., Fleming, P., Densley-Tingley, D., Allwood, J., Dupree, P., Linden, P.F., Scherman, O. 2017. The wood from the trees: The use of timber in construction. Renewable and Sustainable Energy Reviews 68(Part 1): 333-359.

Ratniarsih, I., Santoso, N.A. 2013. Pemanfaatan limbah potongan kayu jati untuk penyekat ruang non permanen. https://publikasiilmiah.ums.ac.id/bitstream/handle/11617/4082/A19.pdf;sequence=1

Retantoko, C., Sulbi. 2016. Pemanfaatan limbah kayu jati dalam pembuatan karya seni kriya kayu berbentuk naga eropa. Jurnal Pendidikan Seni Rupa 04(03): 374-380.

Riyoko, S. 2012. Studi penentu daya saing terhadap investasi pada industri mebel di Kabupaten Jepara. Jurnal Dinamika Ekonomi & Bisnis 9(1): 33-44.

Riyoko, S., Lofian, B. 2020. Model penguatan daya saing sebagai upaya peningkatkan kinerja bisnis UKM klaster mebel di Jepara. Jembatan: Jurnal

Ilmiah Manajemen 17(2): 135-148.

Rui, Z., Lu, Y. 2021. Stakeholder pressure, corporate environmental ethics and green innovation. Asian Journal of Technology Innovation 29(1): 70-86.

Rumah Tulip. 2023. Retro vintage wooden calender, kalender kayu. http://www.rumahtulip.com/Retro-Vintage-Wooden-Calender-Kalender-Kayu.html

Sa'idah, N., Farida, Y.E., Widagdo, J. 2020. Pemanfaatan limbah kayu melalui *puzzle* wayang sebagai media pengenalan budaya untuk anak usia dini. E-DIMAS: Jurnal Pengabdian kepada Masyarakat 11(1): 66-70.

Savero, A.M., Wahyudi, I., Rahayu, I.S., Yunianti, A.D., Ishiguri, F. 2020. Investigating the anatomical and physical-mechanical properties of the 8-year-old superior teakwood planted in Muna island, Indonesia. Journal of the Korean Wood Science and Technology 48(5): 618-630.

Sinaga, T., Priyanto, I.M.D. 2020. Kendala dalam pendaftaran perlindungan indikasi geografis. Journal Ilmu Hukum 8(11): 1825-1833.

Sodikin, S. 2019. Gagasan kedaulatan lingkungan dalam konstitusi dan implementasinya dalam pelestarian lingkungan hidup. Masalah-Masalah Hukum 48(3): 294-305.

Soekanto, S. 1982. Segi hukum dalam pengendalian pencemaran lingkungan hidup. Jurnal Hukum & Pembangunan 12(3): 205-212.

Sofiana, Y. 2011. Analisis strategi peningkatan produksi mebel di sentra industri kayu. Humaniora 2(1): 294-305.

Sudiryanto, G., Suharto, S. 2020. Analisa jenis limbah kayu di Jepara. Jurnal Disprotek 11(1): 47-53.

Sugiartha, I.N.G., Widiati, I.A.P. 2020. Tanggungjawab pemerintah dalam pengelolaan lingkungan hidup berbasis partisipasi masyarakat untuk pembangunan daerah Bali. Kertha Wicaksana 14(2): 96-102.

Sugiyono. 2019. Metode Penelitian Pendidikan (Kuantitatif, Kualitatif, Kombinasi, R&D dan Penelitian Pendidikan). Alfabeta, Bandung, Indonesia.

Sukesi, T.W., Irjayanti, A., Hapsari, S.D., Efendi, A. 2019. Pemberdayaan masyarakat dalam peningkatan ekonomi dengan memanfaatkan kearifan lokal. Jurnal Pemberdayaan: Publikasi Hasil Pengabdian kepada Masyarakat 3(1): 111-116.

Sumardi. 2014. Implementasi fuzzy logic multi criteria decision making (MCDM) untuk menentukan jenis kayu sebagai bahan baku produksi mebel. Jurnal Ilmiah Infokam 10(2): 23-32.

Sumadi, M.F., Prathama, A. 2021. Peran pemerintah daerah dalam pengembangan usaha mikro kecil dan menengah (UMKM) "Handycraft" limbah kayu jati sebagai produk unggulan kabupaten bojonegoro. Syntax Literate; Jurnal Ilmiah Indonesia 6(5): 2322-2335.

Suprijono, H., Wijaya, D.K., Kusmiyati. 2020. Edukasi dan pelatihan pembuatan papan kayu laminasi dari limbah kayu jati di kelompok industri meubel rumahan desa mangunsari. Abdimasku 3(2): 25-33.

Suranto, Y., Prayitno, T.A., Marsono, D., Sutapa, J.P.G. 2015. Pengaruh umur pohon, bonita dan posisi aksial batang terhadap struktur makroskopis dan kualitas kayu jati sebagai bahan furnitur. Jurnal Manusia dan Lingkungan 22(1): 84-93.

Sutiyem, Ravelby, T.A., Trismiyanti, D. 2019. Pengaruh desain produk dan harga terhadap minat beli konsumen mebel jati jepara pada Toko Usaha Baru Furniture di Lubuk Alung. Jurnal Kajian Manajemen Bisnis 8(2): 66-72.

Szczurek, A., Maciejewska, M., Zajiczek, Ż., Mościcki, K. 2021. Detection of emissions from the combustion of wood-based materials being furniture industry waste. Atmospheric Pollution Research 12(2): 375-385.

Thahir, T. 2021. Aspek hukum dalam lingkungan hidup. JISH: Jurnal Ilmu Syariah dan Hukum 3(1): 17-27.

Thahira, A. 2019. Perkembangan negara hukum demokrasi ditinjau dari aspek penegakan hukum adminis-

trasi lingkungan hidup di Indonesia. Jurnal Selat 7(1): 118-132.

Valera, L., Vidal, G., Leal, Y. 2020. Beyond application. The case of environmental ethics. Tópicos 60: 437-460.

Wicaksono, D., Wijayanto, D.W. 2018. Mengolah limbah kayu jati menjadi elemen dekoratif dan furniture interior ruang. Seminar Nasional Kolaborasi Pengabdian Pada Masyarakat 1: 476-482.

Widiartanti, F. 2016. Mebel ukir Jepara dalam menghadapi kompetisi perdagangan global: Analisis upgrading dalam global value chain. Jurnal Sosial Politik 2(1): 56-70.

Yang, S.M., Kwon, J.H., Kim, P.L., Kang, S.G. 2020. Analysis of heat transfer characteristics by material based on closed conditions using acrylic hemispheres (II): Comparison by type of building structural materials. Journal of the Korean Wood Science and Technology 48(5): 710-721.

Yanti, N., Badriyah, N. 2018. Implementasi pembangunan berkelanjutan berwawasan lingkungan hidup. https://www.academia.edu/download/59440200/Implementasi_Pembangunan_Berkelanjutan_Berwawasan_Lingkungan_Hidup20190529-32932-q93irv.pdf

Yudo, S., Said, N.I. 2017. Kebijakan dan strategi pengelolaanair limbah domestik di Indonesia. Jurnal Rekayasa Lingkungan 10(2): 58-75.

Yusa, I.G., Hermanto, B. 2018. Implementasi *green constitution* di Indonesia: Jaminan hak konstitusional pembangunan lingkungan hidup berkelanjutan. Jurnal Konstitusi 15(2): 306-326.

Yusran, Y., Asnelly, A. 2018. Kajian *green politics theory* dalam upaya menangani krisis ekologi laut Indonesia terkait aktifitas *illegal fishing*. Indonesian Journal of International Relations 1(2): 35-53.

Zaman, M.D.K. 2013. Environmental ethical commitment (EEC): The interactions between business, environment and environmental ethics. Procedia: Social and Behavioral Sciences 85: 392-399.

Zeng, N., King, A.W., Zaitchik, B., Wullschleger, S.D., Gregg, J., Wang, S., Kirk-Davidoff, D. 2013. Carbon sequestration via wood harvest and storage: An assessment of its harvest potential. Climatic Change 118(2): 245-257.