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RESEARCH ARTICLE

Repurposing Wood Waste for the Production of Wooden Carved Doors for Environmental Sustainability

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Abstract

This study discusses the potential use of disposed wooden beams at construction sites that have become waste materials for the creation of functional items such as wooden carved door for environmental conservation. The growing problem of waste management has led to the need for more economical, artistic and environmentally friendly alternatives. The purpose of the study was to repurpose wood waste for the creation of economically-viable artefacts to achieve environmental sustainability. The researchers employed a studio-based research design under the qualitative research approach with direct observation, personal interviews and photographs as research instruments for the study. It was found out that wooden beam waste materials could be creatively transformed into carved floral patterns on the

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wooden door panels with floral patterns that are functional, decorative and able to generate income. The research recommends that using discarded wood to create functional and aesthetically pleasing products such as furniture, decorative items and flooring that can contribute to a greener economy and environmental sustainability.

Introduction

Repurposing of waste is a key concept in environmental conservation research. By recycling and reusing materials, we can reduce waste and minimize the negative effects of human activity on the environment (Yang, 2022). According to Maddodi (2022) recycling of waste materials is important because it helps to save natural resources, reduce the emission of greenhouse gases and minimize the amount of waste that ends up in landfills and water bodies. This is an effective way to reduce energy consumption and save money on production costs. Overall, waste recycling is a key strategy to achieve a more sustainable future. Fitzsimmons (2004) considers wood waste to be a major environmental problem due to the impact of deforestation on ecosystems and loss of biodiversity. In addition, improper disposal of wood waste can lead to soil and water pollution and greenhouse gas emissions that contribute to climate change. Strive for environmental protection by producing artifacts innovation to solve environmental crises (Adom et. al, 2023). Tammana (2020) opined that wood waste could be used in construction technology. Also, Udoeyo (2006) discussed how wood waste could be burnt to ash and used as an additive in the production of concrete. All the strategies suggested in the previous studies are relevant in the quest for solutions to the environmental crises from wood waste materials. This study was aimed at the innovative recycling of wood waste by creating carved wooden doors as an important strategy for environmental conservation. This would help to reduce the amount of wood waste that ends up in landfills. The use of wood waste in the design and production of wooden carved door would help transform wood waste into environmentally friendly and sustainable products.

Wood Waste in Art: History, Techniques and Aesthetic Qualities

The history of using wood waste in art goes back to ancient times (Knauf, 2015; Munib, 2021). According to Garcia (2017), wood waste has been used for producing useful and decorative items in many cultures. Soeriatmadja (2018) supports the view that in Japan, for example, the art

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of kintsugi involves repairing broken pottery with lacquer mixed with ground gold, silver or platinum, and wood dust. In the Middle Ages, wood waste was used in kilns where ceramics and glass were fired (Wood, 2011). During the Renaissance, wood waste was used as a substrate for gesso used in painting and sculpture. In the 20th century, artists began to experiment with using wood waste as their medium. For example, the American artist Louise Nevelson created sculptures from discarded wood waste, which she painted black to create a uniform surface (Mousseau, 2005). Berger (2020) opines that throughout history, artists have found creative ways to repurpose wood waste into useful and decorative objects from fueling kilns in the Middle Ages to creating sculptures in the 20th century.

Today, many artists continue to use techniques incorporating wood waste in their work and explore their unique textures, colors and patterns. The use of wood waste in art has also gained attention for its environmental benefits, as it can reduce the amount of waste going to landfills and help mitigate the environmental impact of the art industry. As the world becomes more aware of the effects of human activity on the environment, many artists are turning to recycled materials to create works that are both aesthetically pleasing and environmentally friendly. Indeed, the use of wood waste in art is a rich and diverse tradition that speaks to the creativity, ingenuity and social awareness of artists throughout history.

There are several techniques for processing wood waste into various art forms. In sculpture, artists have used wood waste in creating intricate patterns and textures or complex shapes (Fink, 1992). In printmaking, wood waste can be used to create textured backgrounds or add depth and dimension to a print (Kayode, 2011). In furniture design, scrap wood can be recycled into unique and functional pieces such as benches, doors or tables (Bovea, 2004). In addition, wood waste can be used as a basis for painting or drawing, or as a material for making collages or mixed media works.

The aesthetic properties of wood waste in art are many and varied (Broman, 2001). Sutucu (2013) supports the view that one of the most striking features of wood waste is its structure. Because wood waste is often irregularly shaped and has a different grain pattern, it can create a unique and visually interesting surface. In addition, using wood waste can create a sense of depth and dimension in the work, as different pieces of wood can be layered or textured. Another aesthetic characteristic of wood waste is its color. Depending on the type of wood and the age of the material, wood waste can vary from pale to dark brown or even black. This color choice can create a sense of warmth and richness to a piece, as well as a sense of history and depth. Finally, using wood waste in art can create environmental awareness and social responsibility. By using materials that would otherwise be thrown away, artists can create works that are both beautiful and environmentally friendly. This can increase the meaning of the work and create a connection between the artist, the viewer and nature.

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Cultural Significance and Economic Benefits of Wood Waste into Art

The cultural meaning of wood waste in art is multifaceted and varies according to the culture and environment of use (Kim, 2016). One of the important aspects of the cultural importance of wood waste in art is its connection with sustainability and environmental friendliness. In many cultures, the use of recycled materials is seen as a way to reduce waste and protect the environment. By incorporating wood waste into their work, artists can create works that speak to these values and promote a more sustainable lifestyle.

Another cultural significance of wood waste in art is its connection to tradition and history (Johnson 2021). In many cultures, woodwork is a traditional craft that has been passed down from generation to generation. By using scrap wood in their work, artists can connect with its rich history and pay homage to the craftsmen who came before them. Finally, the use of wood waste in art can also have a political or social meaning. By creating works that use discarded materials, artists can comment on topics such as consumption, waste, and the disposable nature of modern society. It can create a sense of social awareness and encourage viewers to think more deeply about their consumption and waste habits. In summary, the cultural significance of wood waste in art is complex and multifaceted. By incorporating this material into their work, artists can create works that speak to different cultural values and concerns. Ritter (2011) is of the view that the use of wood waste in art can have a number of economic benefits for businesses and communities. One of the key benefits is that it can reduce waste disposal costs for businesses that generate wood waste (Birdsey, 2018). Rather than paying to have the waste hauled away and dumped in landfills, businesses can donate or sell it to artists who can use it in their work. This can help to reduce the amount of waste that ends up in landfills, which can be a significant expense for businesses.

Another economic benefit of using wood waste in art is that it can create new markets for businesses that specialize in wood waste management and recycling. As more artists and designers begin to use wood waste in their work, there may be an increased demand for these materials and for businesses that can process and supply them. This can lead to new job opportunities and economic growth in these industries. In a nutshell, waste in art can also create opportunities for artists and designers to sell their work at a higher price point. Because these works are seen as more environmentally friendly and socially responsible, they may be more valuable to collectors and buyers. This can help to support artists and designers who are using sustainable materials in their work, and can also help to promote more sustainable and responsible practices in the art and design industries.

Social and Sustainable Impacts of wood waste

According to Phalan (2009), wood waste has both positive and negative social and cultural impacts. On the other hand, Kim (2019) shares the view that improper disposal of wood waste

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can lead to environmental problems such as deforestation, habitat destruction and climate change. When wood is discarded and left to rot in landfills, it releases methane, a powerful greenhouse gas that contributes to global warming. However, there are ways to mitigate these negative effects. Recycling wood waste, for example by chopping, grinding or shredding, can provide opportunities for sustainable practices. Recycled wood can be used to create new products, such as furniture, building materials or even paper. This reduces the demand for new wood and helps preserve forests (Skodras, 2004).

Masum (2019) talks on another positive effect of wood waste and its potential for biomass energy production. Wood waste can be transformed into biofuels, such as wood pellets or wood chips, which can be used for heating, electricity generation or even as a renewable alternative to fossil fuels. This encourages the transition to cleaner and more sustainable energy sources. Bebbington (1999) opines that from a cultural point of view, the correct use of wood waste corresponds to the values of environmental protection and sustainable development. By reducing waste and finding innovative ways to reuse wood, we can promote a more environmentally conscious society. This can inspire and encourage others to adopt similar practices, creating a positive cultural shift towards a more sustainable lifestyle. The recycling and reuse of wood waste can lead to the development of new industries and businesses, the creation of job opportunities and the revitalization of the local economy. This can have a positive impact on communities, providing income and livelihoods for individuals and contributing to overall economic growth.

In addition, Slootweg (2001) talks about the responsible management of wood waste that can contribute to the preservation of culture. Many cultures have a deep connection with forests and wood traditions. By promoting sustainable practices and reducing waste, we can help preserve these cultural practices and ensure that future generations can continue to engage with and appreciate the cultural significance of wood. Finally, to sum it up, awareness and action in handling wood waste can promote environmental awareness and a sense of responsibility in society. By understanding the impacts of consumption and waste production, we can make more informed choices and promote a more sustainable future. This can lead to a change in social values, where conservation of natural resources and the environment becomes a common cultural norm.

Environmental impacts and market viability of wood waste

Eshun (2012) comments that waste can have negative environmental effects. Jahan (2022) supports that the improper disposal of wood waste can contribute to the loss of forests. When trees are cut down and not used effectively, it leads to habitat loss and loss of biodiversity. In addition, Bakar (2023) adds to their opinion that the transportation and processing of wood waste can cause carbon dioxide emissions and air pollution. Bakar (2023) throw light on the

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proper management of wood waste that can have positive benefits on the environment. Recycling or reusing wood waste reduces the need for new wood, which helps to save the forests and preserve their ecological value. Wood waste can be turned into valuable products such as mulch, composites or even used to generate energy through processes such as biomass burning or gasification. By diverting wood waste from landfills and using it in a sustainable way, we can reduce greenhouse gas emissions and promote a circular economy. This requires the implementation of effective waste management practices such as recycling, composting or the use of advanced technology to convert wood waste into bio-fuels or other valuable resources.

In general, the environmental impact of wood waste depends on how it is processed. By prioritizing recycling and sustainable use, we can minimize its negative impacts and maximize its potential as a valuable resource. The marketability of wood waste depends on several factors (Pandey, 2022). The availability of wood waste, processing costs and the demand for sustainable alternatives play a role. Various products can be made from wood waste, such as bio-fuels, composite materials or even used for energy production (Coloma-Jiménez, 2023). Shibu (2023) sum it up by saying market sustainability is influenced by factors such as government policies, consumer preferences and a general shift towards sustainable practices.

Methods

This study adopted the studio-based research design under the qualitative research approach. Direct observations through visits were made to workshops of carpenters and the Sokoban wood village to critically evaluate and describe tools and equipment, workshop designs and operations. Interviews were conducted and events recorded. The data collected were stories and pictures of doors and panels used in making the door, which were then described in detail. The study also used information obtained from secondary sources such as documentaries, books, magazines, internet sources, unpublished and other printed literature such as brochures and pamphlets. These data were critically evaluated and conclusions drawn. The design model was adapted in the studio based research illustrated in Figure 1. The first step involved defining the problem at hand. Wood wastes left over at the construction site are not properly disposed, but left in an environment where environmental conservation is not considered. The second step was to collect the wood. The various wooden beams and boards are collected for the wooden carved door. The third step was to brainstorm and analyze. Discussions to produce ideas and analyzing which beams are suitable for the parts for further processing. The next step was to develop new ideas for the problem. Various designs were modeled and employed in the making of the wooden carved door to improve on the existing designs of doors or create new ideas in solving the problem. The wooden carved door is constructed with the idea of environmental conservation and also bringing into light new generation of doors incorporating wooden carved designs on doors.

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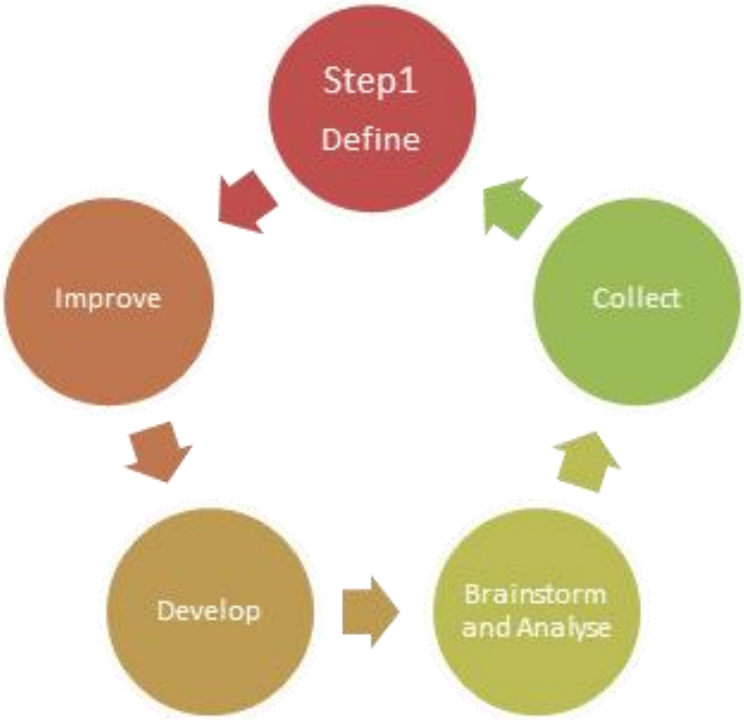

Figure 1: The Design Process for the Study

Collection of Waste Wood from Construction Sites

Beam and flat board of wood used at the construction site were disposed and left to decay. Collecting and assembling of wood (wood beam and flat boards) are grouped and sent to the wooden machine shop which is illustrated in Figure 2.

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Figure 2: Collection of Wood

Shooting and Cutting of Wooden Beams into Wooden Boards

Shooting is the process by which the irregular part of one side of the wood beam or the wood board is flattened to take a regular surface. One side of the wood is shooted using a shooting machine to ensure precision of the wood faces and also ensure flatness and smoothness for the production of the door which is illustrated in Figure 3. The wooden beams are cut using the circular saw into flat boards adding to the other flat boards obtained from the construction site. The thickness of the flat boards for the door should 3 inches. It is further planed to 2 inches using the Planer machine which is the desired thickness for the work. The desired wooden boards are marked and cut out according to the cutting list for the various parts of the door to be assembled.

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Figure 3: Shooting of wood

Figure 4: Cutting of wood

Making Moldings for the Joints for the Assemblage of the Door

The spindle molder was used for making the tongue and groove joints. One wooden panel producing a tongue and the other a groove into which a tongue fits. The tongue side of the wooden panel consists of the part with the projected edge whiles the grooved part of the door has an open slit in which the tongue part was joined (Figure 5). The door is assembled together by using an adhesive (white glue). The door is clamped together for firmness using the sash clamp.

Transferring of Design unto the Door Panel for Carving

The design for the carving is transferred unto the surface of the door panel by means of a printed sticker which is illustrated in Figure 6. The V-gouge is used to carve the outlines of the designs shown in Figure 7. The flat chisel is used to carve out the negative side of the door panel illustrated in Figure 8 to bring out the relief features allowing the positive portion to stand out creating an illusion.

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Figure 5: Tongue and groove joint of panel

Figure 6: Transfer of design unto door

Figure 7: Marking lines with the v-gouge

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Figure 8: Carving of door

Finishing of the Wooden Carved Door

Using the various sandpaper grades (60- 600) to sand the wooden carved door to ensure smoothness. Emulsion paint is applied which serves as a priming agent to seal the pores of the wood. Application of putty filler to further seal the cracks and dents which is later sanded to ensure a much finer surface, illustrated in Figure 9. The wooden carved door is sprayed with the primer to serve as a bond between the emulsion paint and the putty filler, illustrated in Figure 10. A finer grade of sandpaper is used to sand to attain smoothness for the final spraying of the wooden carved door. Auto based paint is used for the finishing of the wooden carved door to be able to withstand harsh weather conditions, dirt and moisture, and also resist termites and insect attacks.

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Figure 9: Application of primer on the door

Figure 10: Application of putty filler

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Emphasis on Waste Wood

The collection of waste wood (beams or flat boards) for wooden carved door was assembled at Ayeduase-New Site where these found objects had been used by construction workers and laid to waste away. Metal particles such as nails were removed before planning in a manner that would not damage the blade of the planer, if it were planed using the planning machine. After the planning, the boards or beams were aligned and glued together to get the exact rectangular door shape or frame before the integration of the floral designs. This complex process was done to ensure that when carving no panel of door will come off. The door after clamping was left to dry for three days. Since the wooden beams have been dried openly, there were no concerns of retaining of moisture in the wood which will hinder the carving process from commencing.

Exploration of Floral Designs

The finished wooden carved door illustrated in Figure 11 depicting the floral design was influenced by globalization of new trends of doors. For example China doors which mostly have these floral designs. Because imported doors and furniture have the floral designs which make them market driven. Appropriating the floral design on the door produced which is solid and durable than the Chinese doors imported in the country which arouses the interest of the local buyers.

Justification of Wood

The use of Mahogany which is a hard wood for the construction of the wooden carved door is of an interest to the researchers or the artists because of its durability and grain compatibility for a smoother finish and its non-porosity. The compact nature of the wooden grain makes it difficult for termites and insects attack. Because the beam was exposed to the weather, it makes it seasoned. Where there is no moisture content in it. Seasoning is the process of doing away with the moisture content in the wood. In seasoning of wood there are two types of seasoning; the open air drying and the mechanical drying. Because it was an open air drying, the lost moisture content was very good for the wooden carved door.

Finished Wooden Carved Door

The dimension for the wooden carved door was 80 inches by 36 inches wide. Mahogany is a beauty choice of wood with its rich reddish brown colour and distinctive grain for the wooden carved door. An auto clear finish was a suitable choice for the wooden carved door as it provides a clear protective layer that can help prevent damage from moisture, sunlight and other weather conditions. It also enhances natural beauty of the wood by bringing out the grain and colour. The finished wooden carved door is illustrated in (Figure 11).

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Figure 11: Finished wooden carved door

Conclusion

Wood waste can be a valuable resource in the field of art. Artists can create unique and environmentally conscious works of art using and repurposing discarded wood materials. This does not only reduces waste and promotes sustainability, but also showcases the beauty and versatility of wood in various art forms. Ultimately, embracing wood waste in art encourages creativity, conservation, and a deeper appreciation of the artistic potential of reclaimed materials.

Wood waste can be used in many artistic practices, from sculpture and carving to woodworking and mixed media installations. It offers artists a wide palette of textures, grain patterns and natural colors to work with, allowing them to create visually stunning and impactful pieces. The inherent warmth and organic quality of wood also adds to the overall aesthetic appeal of the artwork.

In addition, incorporating wood waste into wooden carved door promotes sustainable practices and raises awareness of the importance of reducing our environmental footprint. By using materials that would otherwise end up in landfills, artists promote a circular economy by extending the life of these resources. It sends a strong message about the possibilities of creative solutions in the field of waste management.

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In conclusion, the use of wood waste for the production of wooden carved doors not only produces wonderful and exciting works of art, but also emphasizes the importance of recycling, ingenuity and environmental awareness. It shows the ability of artists to transform discarded materials into something beautiful and thought-provoking artefacts, encouraging viewers to rethink their approach to waste and sustainability. By using wood waste in art, we not only enhance the artistic experience, but also contribute to the creation of a more sustainable world.

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Authorship and Level of Contribution

All authors contributed equally.

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