



Optimising Wood Waste Utilization: A Study on Upcycling Techniques to Create High-Value Products in Boyolali's Creative Industry

Nughthoh Arfawi Kurdhi^{1*}, Dewi Retno Sari Saputro², Purnami Widyaningsih³, Sutanto⁴, Ririn Setiyowati⁵, Nugroho Arif Sudibyo⁶

^{1*,2,3,4,5}Department of Mathematics, Faculty of Mathematics and Natural Sciences, Universitas Sebelas Maret, Indonesia

⁶Department of Informatics Engineering, Universitas Duta Bangsa, Indonesia

Email: ^{1*}arfa@mipa.uns.ac.id, ²dewiretnoss@staff.uns.ac.id, ³purnami_w@staff.uns.ac.id,

⁴sutanto@staff.uns.ac.id, ⁵ririnsetiyowati@staff.uns.ac.id, ⁶nugroho_arif@udb.ac.id

Abstract

The UMKM involved in this community partnership program is engaged in the production of teak wood furniture. The issues currently faced are (1) a limited range of furniture products and (2) traditional management and marketing methods. This study aimed to implement technological induction to enhance productivity, creativity, and competitiveness within these UMKMs. The technological induction involved providing modern production tools for creating innovative products and developing an application boot program and server computer to enhance marketing efforts. A mixed-methods approach was used, combining case study observations and user-centred design principles to create technological solutions. The program's outcomes were assessed through partner training and mentoring, employing a problem-solving approach to address post-implementation challenges. The study found that introducing advanced production tools and digital marketing strategies significantly increased the variety of products, streamlined production processes, and expanded market reach, positioning the UMKMs for improved competitiveness in the national market. This research underscores the importance of integrating technology into small-scale industries for sustainable growth. Future efforts should focus on scaling these practices to other creative sectors for broader economic impact.

Keywords: Creative Industry, Waste Wood, Production, Management, Marketing.

A. INTRODUCTION

The COVID-19 pandemic has profoundly impacted Indonesia's economy and various sectors, including the creative industry. According to Hanoatubun (2020), the pandemic significantly disrupted economic activities, with many businesses struggling to survive. However, despite the initial setbacks, some sectors—particularly the creative industries—emerged resilient by adopting innovative strategies to cope with the crisis. Heryani et al. (2020) noted that creative industries played a crucial role in fostering innovation and helping businesses pivot their models toward digital platforms, which became vital for business continuity. As industries evolve, the creative sector demonstrates its capacity to remain adaptable and forward-thinking, often leveraging new trends such as digitalisation to reach broader audiences. The transition to digital platforms has reshaped the marketing and sales landscape. As Sari (2020) pointed out, this shift enabled businesses to maintain customer engagement during challenging times and introduced new avenues for growth. The

ability to reach global markets through e-commerce platforms has allowed businesses to expand their reach and experiment with different sales models. Wisataone, AW, and Hidayati (2021) highlighted how utilising marketplaces and e-commerce platforms allowed businesses to continue selling their products and tapping into new customer segments. Moreover, integrating artificial intelligence and data analytics into marketing strategies has enabled businesses to understand consumer behaviour better, optimise their offerings, and provide personalised experiences.

In addition to using digital marketing tools, the creative industries also explored sustainable practices, such as upcycling and using waste materials, to address environmental concerns and reduce costs. Setiawan et al. (2023) examined how Jepara's furniture industry optimised wood waste for crafting new, innovative products. This shift towards sustainability was also evident in other sectors, such as the calligraphy industry, where wood scraps were used creatively to produce unique artworks (Rahman, Anda, & Putra, 2023). These efforts

showcase how businesses can contribute to environmental conservation while enhancing product value, blending sustainability with creativity. Adopting circular economy principles is becoming crucial as companies increasingly focus on reusing and recycling materials to reduce their environmental footprint.

The creative use of waste materials became a growing trend in various crafts, with Fajarwati et al. (2023) emphasising the importance of upcycling wood waste into fashion products. Similarly, Nanda et al. (2024) focused on the potential of wood waste in Londut Village, where local artisans utilised discarded wood to create handicrafts, benefiting both the environment and the local economy. Moreover, Sumarliani (2024) analysed the advantages of using ampullar wood waste for producing household chairs, showcasing this practice's economic and environmental benefits. As artisans continue to innovate, there is increasing interest in developing eco-friendly products catering to a growing conscious consumer market. These initiatives not only support sustainability but also empower local communities by offering new sources of income and fostering a culture of creativity and environmental stewardship.

Innovation in product development, such as the application of sculpture art using plantation wood waste materials, also emerged as a critical trend in the creative industries. Rachmadi et al. (2023) discussed how sculpture artists creatively used plantation wood waste, transforming it into sustainable artworks that align with global trends toward sustainability and circular economies. The use of unconventional materials in art, such as recycled plastics and metals, further highlights the sector's innovative potential. By redefining the boundaries of traditional craftsmanship, artists can challenge perceptions of waste and turn it into valuable and marketable pieces of art. This shift also encourages the development of new eco-art and sustainable design markets. In addition to sustainability, human resource development played a crucial role in ensuring the creative sector's resilience. Yoga, Sadana, and Prianto (2023) highlighted that enhancing the skills and capabilities of workers in the creative industries would be crucial for long-term growth. By investing in human capital, businesses could better navigate the rapidly changing market and adopt new technologies that improve productivity and competitiveness. Moreover, continuous education and skill development programs tailored to the evolving needs of the industry are essential for ensuring that workers are equipped with the tools to stay competitive in a global market. Fostering a culture of lifelong learning is a critical driver in the industry's overall growth and sustainability.

The role of local craftsmanship in driving sustainable development was also emphasised by Rosyadi et al. (2020), who noted that creative industries, mainly rural areas, can contribute significantly to economic growth. This was further supported by Susanto et al. (2024), who explored how upcycling Mindi wood waste into fashion bags has helped local artisans in Kreet, Bantul, and Yogyakarta increase their income while promoting sustainability. Local artisans are not only creating products that reflect their communities' cultural heritage but also adapting to global trends, positioning their work in international markets. This combination of tradition and innovation is vital in preserving cultural identity while fostering economic development in rural areas. Another critical factor for the growth of the creative industries is the adoption of technology. Kusmayadi et al. (2021) argued that incorporating technological tools is essential for businesses in the creative sector to stay competitive. From improving the design process to enhancing marketing efforts, technology provides various opportunities for innovation. Similarly, Ilhamuddin et al. (2018) stressed the need for technology adoption in the creative industries to streamline operations and increase efficiency. Technologies such as 3D printing, virtual reality, and augmented reality transform product design, providing businesses with new ways to showcase their products and interact with customers. Additionally, integrating technology in production processes helps improve scalability and precision, particularly for small and medium enterprises.

The importance of design innovation in the creative industries was explored by Wahmuda, Rachman, and Prabowo (2024), who looked into the use of digital technology in the upcycling-based clam shell craft industry. Their research highlighted how design innovation could enable artisans to create more sustainable and marketable products. Moreover, Robustin et al. (2021) emphasised that product innovation within the handicraft sector is essential for differentiating products in an increasingly competitive market. Design thinking and user-centred design are becoming more prevalent as businesses seek to align their products with consumer preferences and sustainability goals. By focusing on both form and function, designers can create products that are aesthetically pleasing and socially and environmentally responsible. Meanwhile, Sheth (2020) observed how consumer behaviour shifted, with more people interested in sustainable and locally-made products. As consumers became more aware of environmental and social issues, businesses in the creative industries quickly adopted sustainable practices, such as using upcycled materials or supporting local artisans. This trend reflects a more significant cultural shift towards ethical consumption, where

buyers prioritise products that align with their values. Creative industries are uniquely positioned to capitalise on this shift by offering products that tell a story and support sustainable practices, fostering strong connections between consumers and creators.

The creative industry's role in rural development was also a significant theme. According to Sudarwati and Prasetyawati (2015), small businesses could leverage the creative sector to boost economic activity by utilising local resources and optimising their products for the digital market. Has (2010) further explored this concept, discussing how Gorontalo's local arts and crafts sector benefited from using waste logs as raw materials for creating new products. By integrating local cultural knowledge with modern production techniques, rural areas can develop unique offerings that stand out in regional and global markets. These efforts strengthen the local economy and create new job opportunities while preserving traditional craftsmanship. Kamil (2015) stressed that creative industries in Indonesia must adopt a performance analysis approach to stay competitive in the long run. Businesses can navigate challenges more effectively by monitoring industry trends and identifying growth opportunities. Performance analysis tools allow businesses to understand market demands and adjust their strategies accordingly. This proactive approach ensures companies can anticipate changes, mitigate risks, and seize new opportunities, which is significant in dynamic and fast-paced industries like creative design and fashion.

The development of digital platforms, particularly those that support small and medium-sized enterprises (SMEs), has been instrumental in driving the growth of the creative industries. Mahdayani et al. (2017) noted that establishing online platforms for micro, small, and medium enterprises (UMKM) was critical in helping businesses thrive. Online marketplaces, content management systems, and social media channels have provided SMEs with the tools needed to scale their operations, reaching larger audiences at a fraction of the cost compared to traditional methods. This digital transformation has allowed businesses to compete globally, breaking down barriers that once limited their market access. Similarly, Praditya and Soepeno (2014) showed how companies could use content management systems like WordPress to design websites as practical product promotional tools. This technological shift enabled many businesses to expand their market reach during a challenging period. Beyond marketing, these platforms also provide an essential means of managing customer relationships and tracking sales performance,

offering valuable insights that help businesses refine their strategies. Lastly, Kusmayadi et al. (2021) concluded that embracing technology was vital for improving business competitiveness in the creative industry. By leveraging technological tools, businesses in the sector can enhance their production capabilities and explore new market opportunities. Technologies like artificial intelligence and machine learning are increasingly important in improving operational efficiency and driving innovation, further positioning the creative industries as critical players in the global economy.

In conclusion, Indonesia's creative industries demonstrate remarkable resilience and innovation. By embracing technology, sustainability practices, and human resource development, businesses within the creative sector can survive and thrive. These shifts emphasise the importance of creativity, local craftsmanship, and environmental consciousness, all of which contribute to the ongoing transformation of Indonesia's economy. Moving forward, businesses must continue investing in innovation and sustainability to ensure long-term growth and a positive economic and societal impact. Figure 1 illustrates the location of the UMKM furniture production facility.



Figure 1. Martha Mebel Furniture Workshop

Problem identification was conducted through direct observations at the UMKM location and interviews with the UMKM owner. The findings categorise the issues into two main areas: (1) a limited range of furniture products and (2) conventional management and marketing practices. Figure 2 shows the identified problems faced by the partner.

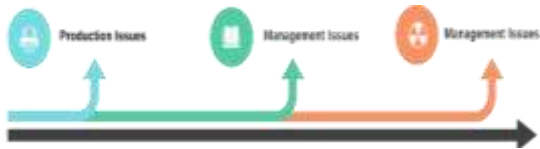


Figure 2. Partner Problem Identification

B. METHODS

The partner organisation is in Pandeyan Village, Ngemplak District, Boyolali Regency. The technological induction aims to enhance the business processes of this UMKM. Previously, operations were conducted using conventional methods, often less efficient and accurate. Introducing advanced software solutions will replace these outdated methods, providing more reliable and precise data management tools. By implementing these technological advancements, the UMKM engaged in the creative industry can significantly boost productivity and creativity in their product offerings. This technological support will enable UMKM to develop innovative products that stand out in the competitive market, thereby improving their business competitiveness. In the long term, technology integration is expected to foster a more self-reliant community by empowering local businesses and contributing to sustainable economic growth. Through this initiative, the goal is to enhance individual business operations and promote broader economic independence and resilience within the community. Based on the identified issues faced by the UMKM, the proposed solutions encompass providing supportive equipment and the implementation of a Facebook marketing bot for product promotion. These solutions address the specific challenges highlighted during the assessment (see Figure 3).

Solution to Product-Related Problems

The analysis of production issues indicates that the UMKM needs more essential equipment for efficient operation. The solution involves acquiring and installing advanced production tools to address this gap. This strategic investment aims to significantly enhance the production capacity and efficiency of the UMKM, thereby facilitating an increase in output and product quality (Mizar & Hermawan, 2014). By integrating these tools into their operations, the UMKM will be better positioned to meet market demands and improve its competitive edge. Additionally, the service team will provide hands-on assistance throughout the production process, ensuring that the tools are utilised effectively and that the resulting products meet industry standards. This support will help transform UMKM into a critical player in the national market by fostering the development of innovative and high-quality products.

Solution to equipment-related issues	Solution to management and marketing issues
<ol style="list-style-type: none"> 1. Provision of supporting equipment for creative product manufacturing. 2. Training on creative product trends to develop products that meet current standards. 	<ol style="list-style-type: none"> 1. Rental of server computers to address conventional management practices. 2. Facebook Marketing Bot for Product Promotion.

Figure 3. Solution to Product-Related Problems and Management and Marketing Problems

The solution to Management and Marketing Problems

In addressing management and marketing challenges, the proposed solution involves the implementation of a Facebook marketing boot camp and renting a server computer. In the current digital landscape, live selling and the strategic use of social media have become indispensable for business success. The Facebook marketing boot camp will equip the UMKM with the skills and strategies to engage with customers and promote their online products effectively. Additionally, renting a server computer will facilitate the management of digital marketing activities and ensure the smooth operation of online sales platforms. The integration of these technological tools will enable UMKM to enhance its online presence and reach a broader audience. The growing importance of the Internet for sales and marketing activities underscores the necessity of these interventions (Kusmayadi et al., 2021). By adopting these solutions, UMKM will be able to overcome traditional marketing limitations and leverage digital channels to boost visibility and sales.

C. RESULT AND DISCUSSION

The implementation stages of the solutions to the partners' issues follow the 4P method: Observation, Application, Training, and Assistance, as detailed in Figure 4.



Figure 4. Stages of Partnership Program Implementation

The approach used in the technological induction process includes case studies, User-Centered Design (UCD), and problem-solving techniques. Case studies are conducted during the observation phase

to identify problems or obstacles faced by the partners in their business processes, particularly in production, marketing, and management. This phase aims to define the solutions needed based on the resources available to the partners, ensuring that the solutions are targeted and effective. The subsequent application phase employs a User-Centered Design approach to ensure that the technology induction is targeted and aligned with the partners' specific needs. Finally, the problem-solving approach is applied during the training and assistance phases, allowing for immediate resolution of any issues that arise during the technology induction process.

Partners play an interactive role from the beginning of the community partnership program's implementation phase. Participation is conducted horizontally, ensuring that the partners and the implementation team have an equal standing to collaborate and synergise in the technology induction process. Partners' involvement is evident in defining the design and development of the required technology induction. Additionally, partners are willing to respond to and grow through technology induction. This condition indicates that the technology induction enhances the partners' business competitiveness and fosters self-reliant communities.

Designating the partners as guided SMEs ensures program sustainability. This step facilitates coordination between the service team and the partners after the technology induction has been implemented. The implementation team maintains coordination through telephone communication and regular site visits every two months. These activities are intended to provide ongoing support and evaluate the impact of the technology induction that has been applied.

Partner Participation in Program Implementation

The use of specialised tools significantly enhances the production of creative products based on wood waste (see Figure 5 and Figure 6). The Makita Belt Sander is essential for smoothing and finishing wood surfaces, ensuring a high-quality finish on all wooden components. The Makita Circular Saw enables precise cutting of wood into various sizes and shapes, which is crucial for crafting detailed designs. The Makita Trimmer is employed for edge trimming and shaping, adding intricate details and achieving clean, professional results. The Spoon Hinge Drill Bits and Allwin Drill Bits provide the accuracy needed for secure and reliable fittings for drilling and attaching hardware. Additionally, Pantek Wipro Rail Clamps hold wood pieces firmly in place during assembly and finishing processes.

These tools collectively contribute to an efficient and effective production workflow, transforming wood waste into innovative and valuable products. By integrating these instruments into the production process, artisans can maximise the utility of wood scraps, reduce waste, and enhance the overall quality of their creative products. The careful application of these tools supports sustainable practices and ensures that the final products meet the desired standards of craftsmanship and durability.



Figure 5. Support and Provision of Production Equipment to Service Partners



Figure 6. Use of Tools for the Production Process

The creative products made from wood waste showcase a diverse range of functional and aesthetic items that highlight the potential of recycled materials (Figure 7 and Figure 8). Among these products are wall-mounted display racks, which offer an elegant solution for organising and showcasing decorative items or collectables. These racks, crafted from reclaimed wood, serve a practical purpose and add a rustic charm to any interior. Complementing the wall racks, the table lamps provide both illumination and style, featuring unique designs that emphasise the natural beauty of the wood.

In addition to the wall and table fixtures, the collection includes table display racks and photo frames. The table display racks are designed to hold various items, from books to small decorative pieces, while the photo frames elegantly showcase cherished memories. Both products utilise the inherent textures and patterns of the wood, demonstrating how waste materials can be transformed into attractive, functional objects. Tissue holders, speakers, and wall clocks further enhance the product lineup, offering practical solutions with a touch of creativity. The range of products is completed by stylish and functional furniture pieces such as tables. These tables are designed to integrate seamlessly into modern and traditional settings, proving that wood waste can be repurposed into high-quality, durable furniture. Each item in this collection reflects a commitment to sustainability and creativity, showcasing how innovative designs can breathe new life into otherwise discarded materials.



Figure 7. Creative Products Based on Wood Waste



Figure 8. Creative Products Based on Wood Waste

The wooden-based products are available through our dedicated website, Martha Meubel. This online platform offers a comprehensive range of items, from wall-mounted display racks and table lamps to photo frames and functional furniture. By visiting our website, customers can explore our products' unique designs and craftsmanship, all made from reclaimed wood. Our website showcases the diverse collection and provides detailed information about each product, including its features and pricing. This convenient online shopping experience allows customers to easily browse, select, and purchase their desired items. Additionally, the site is designed to ensure a user-friendly experience, making it simple for customers to find and order the perfect wooden-based products for their needs. For those interested in sustainable and creative solutions for home décor and furnishings, Martha Meubel offers a reliable and accessible avenue to acquire these unique items. We invite you to visit our website to discover how repurposed wood can be transformed into beautiful, functional products that enhance your living space.

D. CONCLUSION

This study explored how advanced tools and technologies can transform wood waste into high-value products, driving sustainability and growth in Indonesia's creative industry, particularly among small and medium-sized enterprises (UMKMs). The findings highlight the significant role of tools like the Makita sanding machine, circular saw, trimmer, and specialised drill bits in streamlining production processes, enabling the creation of diverse, high-quality products such as wall display racks, table lamps, photo frames, tissue holders, and more. These innovations addressed production challenges and facilitated the conversion of raw wood waste into marketable goods, meeting both market demands and environmental goals.

Furthermore, the strategic use of digital platforms, such as websites, for online marketing has proven effective in expanding market reach, enhancing sales, and ensuring business sustainability. The comprehensive support provided through equipment provision, training, and ongoing assistance has

strengthened UMKMs' competitive edge, positioning them for long-term success in the national market.

In conclusion, this study underscores the transformative potential of combining technology with creative product development to resolve operational challenges and stimulate business growth. These results are compelling for adopting similar approaches across various sectors to promote economic resilience and sustainability. Future research should focus on assessing the long-term financial impacts of integrating such technologies into UMKMs and exploring the scalability of these practices in other industries. Additionally, examining consumer preferences for wood waste-based products and the potential for export markets could provide valuable insights into further expanding the reach of these innovations.

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