

## Application of Design Innovation and Digital Technology in the Upcycling-based Clam Shell Craft Industry

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### ABSTRACT

Mekar Sari, a craft industry based on shell waste in Situbondo, East Java, encounters challenges related to limited production technology and monotonous product designs. These factors impede productivity and competitiveness in both local and international markets. This community service program aims to address these challenges through three primary activities: (1) assisting in the utilisation of a tuner engraving drill, a bench sander, and a CNC laser engraving machine to enhance production efficiency and quality; (2) facilitating the diversification of raw materials and the development of more innovative product designs, including the exploration of wood waste as an additional material; (3) offering training in the creation of more functional and aesthetically pleasing product designs; and (4) conducting digital marketing training to broaden market reach. The outcomes of these activities indicate a significant improvement in both the productivity and quality of Mekar Sari's craft products, characterised by more creative and appealing design variations. Furthermore, the diversification of raw materials has successfully expanded the product range, creating new opportunities for market expansion in domestic and international contexts.

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### ARTICLE INFO

#### **Article History:**

*Submitted/Received 24 Sep 2024*

*First Revised 6 Oct 2024*

*Accepted 7 Oct 2024*

*First Available online 21 Oct 2024*

*Publication Date 21 Oct 2024*

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#### **Keyword :**

*Production technology*

*Raw material diversification*

*Product design*

*Shell craft*

*Upcycling*

## INTRODUCTION

Indonesia, renowned for its rich cultural heritage and abundant natural resources, has long been recognized as a producer of handicrafts made from natural materials, including shell waste. In Situbondo, East Java, the handicraft sector plays a vital role in the local economy, particularly in the tourist area of Pasir Putih Beach, which serves as a central hub for souvenir sales. (Muthahharah & Adiwibowo, 2015). One of the key players in this sector is Mekar Sari, a shell craft industry established in 2002 in Klatakan Village, Kendit District, Situbondo. Mekar Sari utilizes shell waste sourced from the local coastline to produce a range of decorative crafts, including representations of turtles, fish, and birds. See Figure 1 below.



**FIGURE 1.** Crafts Made from Shell Waste by Mekar Sari.

However, this enterprise faces significant challenges in maintaining competitiveness amid the increasing competition from similar industries in nearby areas such as Panarukan and Bungatan (DINAS KOPERASI DAN USAHA MIKRO KABUPATEN SITUBONDO, 2018). The primary challenges encountered by Mekar Sari include limitations in production technology, a lack of innovation in product design, and reliance on manual tools that slow down the production process and hinder product diversification. Furthermore, traditional marketing strategies limit the market reach of Mekar Sari's crafts, both at the local and national levels.

Based on this situational analysis, a community service program has been designed to provide comprehensive solutions to enhance Mekar Sari's productivity and competitiveness. This program includes implementing new production technologies, such as a tuner engraving drill and CNC laser engraving technology (Hidayat & Wahmuda, 2018), to improve production efficiency and create more complex and diverse product designs. Furthermore, the program also involves exploring raw material diversification by utilizing local wood waste as an additive in the craft products. This approach is expected to minimize dependence on shell waste by integrating wood waste into the production process.

In the context of Industry 4.0, the potential of shell waste can be further explored. These craft products can serve not only as decorative items but can also be developed into interior elements, such as wall decorations or small furniture kecil (Haidar & Wahmuda, 2019; Suzandoko & Wahmuda, 2019; Wahmuda, 2015; Wahmuda & Puspitasari, 2015; Wahmuda & Sulisty, 2015), as well as fashion accessories like jewelry or bags (Adhianti & Wahmuda, 2019; Girsang & Wahmuda, 2018; Rochman & Wahmuda, 2019; Silvanto & Wahmuda, 2021). This diversification is expected to enhance Mekar Sari's competitiveness in an increasingly competitive market. Thus, Mekar Sari is anticipated to develop craft products that possess not only aesthetic value but also broader functionality, such as serving as elements of interior decor. This program is expected to serve as a model that can be applied to similar craft industries across Indonesia, focusing on enhancing production efficiency, product diversification, and utilizing digital technology to expand market reach.

## METHOD

The methodology corresponding to the proposed solutions consists of five major stages: 1) Observation and interviews, 2) Problem analysis, 3) Development of problem-solving solutions, 4) Implementation of community service, and 5) Evaluation of program implementation. The scheme for implementing this Community Service activity can be seen in Figure 2 below.

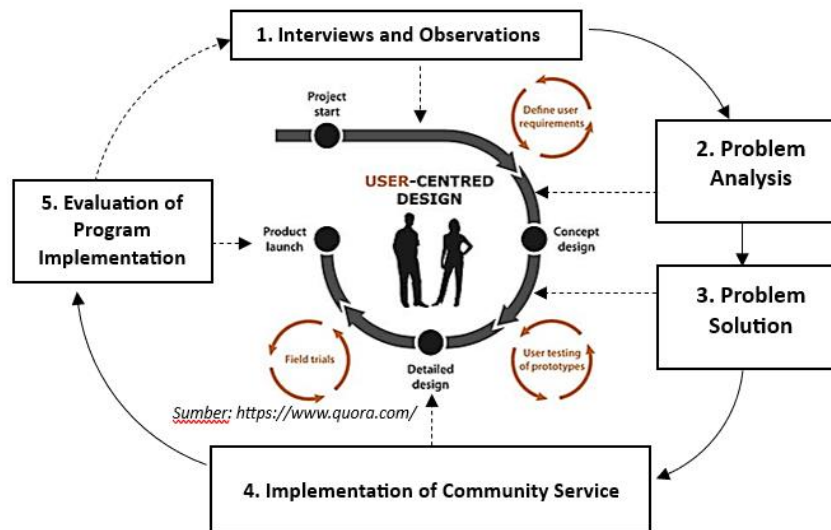


FIGURE 2. Implementation Methodology.

This stage represents the implementation of the proposed solutions. The following outlines the implementation of the community service activities and partner participation:

- Assistance in the Application of New Technology: Partners will receive guidance on the use of new machinery in their production processes and will be directly involved in applying this new technology.
- Socialization of Results from Exploration of Simple Forms and Raw Material Diversification: Partners will participate in the socialization and application of results related to raw material diversification and developing new product designs.
- Training with Design Experts on Product Design Development: Partners will actively engage in training sessions with design experts to learn about product design principles and development techniques to generate new product diversification.
- Implementation of the Mekar Sari Logo and Assistance with Website Application for Product Catalogue Entry: Partners will receive support in understanding and using the website application for product catalog entry and implementing the Mekar Sari logo.

## RESULTS AND DISCUSSION

### Assistance in the Application of New Technology

The technology application assistance activities were conducted through a Focus Group Discussion (FGD). This assistance aimed to enhance productivity through the utilization of new machinery. The activities involved academics and students from industrial engineering operations management. The event occurred on Saturday, 31 August 2024, at the residence of Mr Abu Hasan, the owner of Mekar Sari, located in the Pesisir Timur Klatakan area, Klatakan Village, Kendit District, Situbondo. Below (Figure 3) is the technology application assistance activities documentation.



**FIGURE 3.** Technology Application Assistance Activities.

The evaluation results of the new technology implementation indicate that the utilization of new machinery has significantly impacted the improvement of production process efficiency at Mekar Sari. Artisans have successfully adapted to operating the latest equipment, such as the Hang Flexible Shaft Machine and bench sander, which have directly accelerated the workflow and reduced production time for each product. Moreover, the application of laser engraving technology on the CNC machine has enabled the development of more precise and intricate pattern variations, enhancing the quality and aesthetics of the craft products. See Figure 4 below.



**FIGURE 4.** Implementation of New Technology at Mekar Sari.

The technical obstacles that were previously concerning, such as artisans' inability to master the technology in a short period, were successfully addressed through practical and ongoing training. Consequently, no significant technical challenges were encountered in the use of the equipment. In fact, with the introduction of these new machines, productivity increased by up to 30%, while production costs per unit were reduced by 15%. This success provides a solid foundation for the subsequent activities, which involve the socialization of simple form exploration and raw material diversification.

## Socialization of Results from Simple Form Exploration

The socialization activities were held on Saturday, 7 September 2024, at the residence of Mr Abu Hasan, the owner of Mekar Sari. This event involved academics and, industrial engineering operations management and product design students. The socialized exploration process focused on combining shell waste materials with bintaos wood waste, which is also a by-product of Klatakan Village. The product resulting from this wood waste is a miniaturized souvenir of a surfboard with carved motifs, which have traditionally been crafted using manual carving techniques. See Figure 5 below.



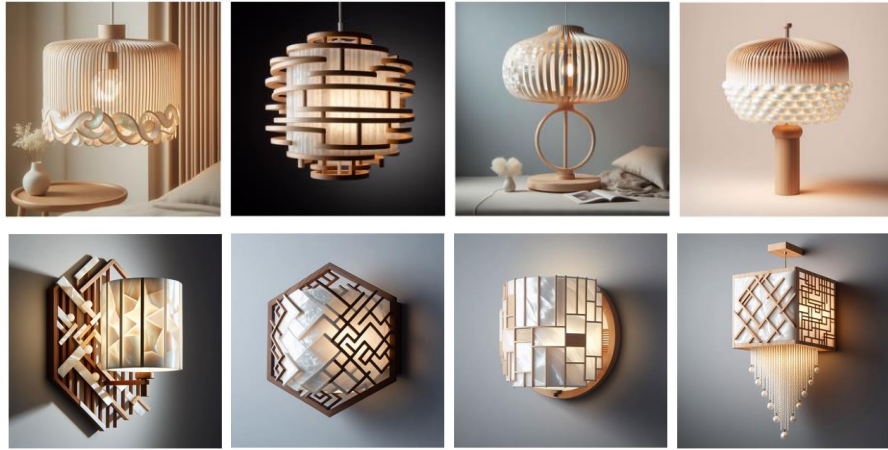
**FIGURE 5.** Miniature Surfboard Souvenir Product.

The exploration results were socialized to the partners at Mekar Sari, attended by ten artisans from Pesisir Klatakan Village in Situbondo. See Figure 6 below.



**FIGURE 6.** Socialisation Activities of Raw Material Exploration and Simple Forms.

The evaluation results of the socialization activities for exploring simple forms and raw material diversification indicate significant success in understanding and application by the partners at Mekar Sari. The partners have successfully identified and explored various simple forms of shell waste, including geometric and curved shapes, which can be quickly developed into more aesthetically appealing and functional craft products. The raw material diversification process also proceeded as planned, with partners effectively utilizing local wood waste as additional material in their products, thereby expanding product variety and innovation. Figure 7 below illustrates the exploration and combination of raw materials.



**FIGURE 7.** Exploration of Simple Form Lampshade and Raw Material Diversification.

The partners' understanding of the potential for product diversification has significantly increased, particularly in integrating shell waste materials with wood to create interior elements with higher market value. With this innovation, the partners can enhance the appeal of their products and expand their market by offering a more comprehensive range of offerings. This success demonstrates that the partners are prepared to advance further in developing new product designs while enhancing their competitiveness in both local and international markets.

### **Development of Functional Product Designs**

The development of product designs was carried out following the socialization activities of exploring simple forms and raw material diversification. Based on the evaluation of the assistance in implementing new machinery technology and the socialization of raw material diversification, the product selected for development was a lampshade. This choice was made due to the unique characteristics of shell waste, which can enhance aesthetic appeal when integrated with lighting elements. Below are the design exploration results for the lampshade (Figure 8).



**FIGURE 8.** Exploration of Lampshade Product Using Shell Waste and Wood Materials.

### **Implementation of Logo and Website Application**

After the product development training, the following activities involved implementing the Mekar Sari Logo and assisting with using the Website Application. Here is a detailed explanation of both activities:

1. Implementing the Mekar Sari Logo: This activity aims to strengthen Mekar Sari's visual identity in the market. Following the product development training, the new logo, designed previously (see

Figure 9), will be consistently applied to all craft products and promotional materials. This step is crucial for enhancing the branding of Mekar Sari, making the produced items more easily recognizable to consumers (Wahmuda & Hidayat, 2020). Logos can effectively communicate the brand's message and appeal to the target audience (Aini et al., 2024). Partners will be guided on how to effectively utilize the logo within marketing strategies, both offline and online.



FIGURE 9. Mekar Sari Logo Design.

2. Assistance with Website Application Usage: In the digital era, having an online platform is crucial for expanding market reach. This activity will focus on guiding partners in utilizing the website application that has been created (see Figure 10) to promote and sell craft products more widely. Mekar Sari will receive training on managing the product catalog, updating information, and processing customer orders through the digital platform. By effectively using the website, Mekar Sari can reach a more extensive consumer base in local and international markets and enhance sales through e-commerce.



FIGURE 10. Home Display of the Mekar Sari Website.

Both activities complement each other. Implementing the logo will strengthen the brand identity, and using the website application will maximize Mekar Sari's presence in the digital market.

## CONCLUSION

The community service program aimed at enhancing the productivity and competitiveness of Mekar Sari, a shell craft industry in Situbondo, has successfully demonstrated the potential of integrating design innovation and digital technology. The various activities implemented, including introducing new machinery, exploring raw material diversification, product design development, and establishing a robust online

presence, have collectively contributed to significant improvements in both production efficiency and product aesthetics.

The application of modern technologies, such as CNC laser engraving and flexible shaft machines, has allowed artisans to streamline their production processes and achieve higher-quality outcomes. Furthermore, exploring new materials, including integrating wood waste with shell products, has enabled Mekar Sari to diversify its product range, enhancing both functionality and market appeal.

Implementing a new logo has reinforced Mekar Sari's brand identity. Developing a user-friendly website has facilitated greater market reach and improved sales opportunities. This dual approach strengthens the brand's visibility and positions Mekar Sari to compete effectively in both local and international markets.

In summary, this initiative is a model for similar craft industries in Indonesia, showcasing the benefits of adopting innovative design practices and digital technologies. The outcomes of this program underline the importance of continuous support and training for artisans, empowering them to adapt to changing market demands and enhance their entrepreneurial capabilities. Future efforts should focus on further scaling these initiatives, ensuring sustainable growth and continued innovation within the craft sector.

## ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to the Directorate of Research, Technology, and Community Service - Directorate General of Higher Education, Research, and Technology - Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia for their grant support for this community service program under the community partnership empowerment scheme in 2024.

We also extend our appreciation to the Institute for Research and Community Service (LPPM) of Adhi Tama Surabaya Institute of Technology for their unwavering support and guidance throughout the implementation of this initiative.

Special thanks are directed to the Mekar Sari Shell Craft Industry and the artisans in the Coastal Village of Desa Klatakan, Situbondo, Indonesia, whose collaboration and dedication have been essential in achieving this project's goals. Their commitment to innovation and improvement has been an inspiration, and we look forward to witnessing the sustainable success of their craft industry.

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