EXPLORING GUMURUH VILLAGE'S UPCYCLING POTENTIAL USING CREATIVE INNOVATION TO TURN PLASTIC WASTE INTO COMMERCIAL PRODUCTS

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ABSTRACT

Plastic waste presents a major environmental challenge worldwide, with improper disposal endangering ecosystems. Upcycling offers a solution by conserving natural resources, reducing carbon emissions, and minimizing waste, all while lowering the demand for new production. Additionally, recycling generates significant economic benefits, particularly by producing high-quality commercial products in sectors like furniture. In Gumuruh Village, Bandung, the community actively participates in recycling efforts, including the processing of organic waste, to create sustainable products. Through the Design Thinking approach and Service Learning, academics and local SMEs collaborate to design and develop products that directly benefit the community.

Keywords: Upcycling, Plastic Waste, Community Development, Design Method.

A.INTRODUCTION

Plastic and paper waste represent critical environmental challenges globally. While plastic and paper are valuable due to their low cost, durability, and versatility, they pose significant risks to ecosystems. Annually, vast amounts of these materials are discarded as waste, often contaminating land and oceans and causing severe damage to marine and terrestrial habitats. The difficulty in decomposing plastic naturally exacerbates the problem, making sustainability a major concern. Recycling offers a viable solution by collecting, sorting, cleaning, shredding, and reprocessing plastic waste into reusable materials (Berliana et al., 2022; Maitlo et al., 2022). This process not only reduces environmental pollution but also decreases the need for new production, conserving natural resources and lowering carbon emissions.

Recycling plastic and paper offers substantial economic benefits by turning these materials into valuable commercial products, creating new business opportunities and jobs in the manufacturing and recycling sectors (Roslinda et al., 2022). These products span various industries, including apparel, construction, and home goods. Notably, the furniture industry is increasingly utilizing recycled plastic and paper as alternatives to traditional materials (Kurniasari et al., 2019; Yosianita, 2022). Furniture made from recycled materials provides sustainability, durability, and cost-effectiveness, appealing to modern consumers who value environmental responsibility. Additionally, recycled furniture often proves to be more affordable than conventional options, making it a popular choice among budget-conscious and eco-minded buyers. Gumuruh Village in Bandung City is an example of a community embracing this approach.

Kelurahan Gumuruh, a 95-hectare neighborhood in Bandung's Batununggal District with about 18,538 residents, is known for its active recycling and gardening initiatives. Inspired by these practices, we aim to develop a strategy for recycling inorganic waste, such as paper and plastic, particularly from the Gumuruh Neighborhood Office and the Batununggal District Office.

The project focuses on upcycling plastic waste into commercial products like furniture, fashion accessories, and decorative items. It involves advanced techniques for sorting, cleaning, shredding, melting, and molding, supported by community workshops and waste management training. Local partners play a key role, ensuring effective solutions and contributing to environmental sustainability and local economic growth.

B. IMPLEMENTATION AND METHODS

This case study combines design thinking with service learning to tackle plastic waste in Gumuruh Village. BINUS academics collaborate with local SMEs to create marketable products, applying theoretical knowledge to real-world issues (Ani et al., 2022; Musa et al., 2017). The approach uses Design Thinking's phases: Empathize (understanding problems and engaging SMEs),

Define (research and analysis), Ideate (generating ideas), Prototype (developing models), and Test (evaluating products). Findings may reveal that high participant turnover affects knowledge transfer, while strategies like peer mentoring can help. The study might show that upcycled HDPE plastic products are sustainable and cost-effective, and that community workshops increase environmental awareness and behavioral change. Additionally, it could identify economic opportunities and logistical challenges in recycling, suggesting improvements like better collection systems. Overall, these insights aim to advance community engagement, sustainable design, and waste management.

C. RESULTS AND DISCUSSION

The community service program in Kelurahan Gumuruh involves various inputs such as human resources, materials, and support from stakeholders like Karang Taruna participants, lecturers, students, and local agencies. The program is structured into four phases (as shown as picture 1): initial socialization and workshops on plastic waste education; a creative workshop focusing on design, color theory, and product development; prototyping recycled plastic into slabs and products; and finally, showcasing and testing products at IFFINA 2024. Outputs include enhanced knowledge on recycling, creative designs, prototypes, and exhibitions. The outcomes are increased public awareness, improved skills in recycling, potential economic benefits from commercial products, and the creation of a sustainable community model for managing plastic waste.

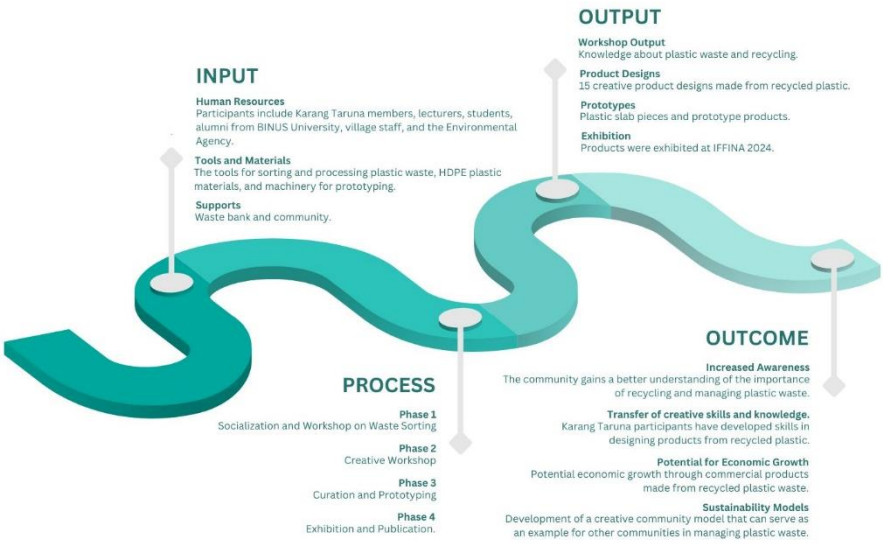


Figure 1. Process Diagram of Reactivation of The Gumuruh Village Community In Bandung City Based on Creativity Through The Exploration of Plastic Waste Into Commercial Products Activities (Source: Private Documentation, 2024).

1. Phase 1 : Socialization Awareness of Plastic Waste in Bandung City

Begin with the results from Phase 1, which involved a seminar and workshop on plastic waste sorting held on June 22, 2024, at the Gumuruh Village Office in Bandung. The event was attended by 15-20 participants from Karang Taruna, a youth organization active in social and environmental activities. During the event, participants received educational material presented by the head of the community service team in collaboration with the Plastavfall community. The focus was on the negative impacts of waste on the environment and the significance of recycling, particularly plastic waste. Participants gained a comprehensive understanding of recyclable plastic types and how recycling can mitigate environmental harm.

(a) (b) (c)

Figure 2. Plastic Waste Socialization to Increase Societies' Awareness. (a) Plastic Material Categories by Community Partner (Plastavfall). (b) Bandung Waste Overview by Bandung City Environmental Service (DLH). (c) Program Socialization by Interior Design (Bandung) BINUS teams (Source: Private Documentation, 2024)

Phase 1, held on June 22, 2024, at the Gumuruh Village Office in Bandung, featured a seminar and workshop on plastic waste sorting, attended by 15-20 participants from Karang Taruna. Led by the community service team and Plastavfall, the event focused on the environmental impact of plastic waste and the importance of recycling. Participants learned about recyclable plastics and recycling processes, gaining practical skills for daily life. The workshop aimed to raise awareness, inspire sustainable recycling practices, and explore economic opportunities through commercial products made from recycled plastics.

(a) (b) (c)

Figure 3. The Plastic Waste Sorting Workshop. (a) Plastic Waste Sorting Workshop by 7 Plastic Categories. (b) HDPE Plastic Categories Color Sorting Workshop. (c) Sorted Colors' of HDPE Plastic Categories (Source: Private Documentation, 2024).

The program featured a hands-on session where participants sorted and shredded plastic to make reusable pellets. Guided by experts, they learned sorting, shredding, and melting techniques. The workshop, held outside Gumuruh village, involved 14 members of Karang Taruna who sorted plastic waste and focused on bottle caps made of HDPE plastic for slab production. The shredded caps were used to evaluate waste and determine the amount of material for slabs, with Phase 2 concentrating on product design through a creative workshop.

(a) (b) (c) (d)

Figure 4. The Plastic Waste Shredding Process Workshop. (a) Preparation Step by sorting the HDPE by colors. (b) Placement Process into The Shredded Machine (c) Shredding Process Result. (d) Shredded Plastic Placement into the Container for Further Process.(Source: Private Documentation, 2024).

2. Phase 2 : Creative Workshop and Ideation

On July 21, 2024, a workshop began with a 15-minute presentation on color theory and entrepreneurship by experts. Participants from Karang Taruna Kelurahan Gumuruh then explored product ideas, such as furniture and accessories, through brainstorming and sketching. Experts guided them in refining their concepts, focusing on both design and market potential. The workshop aimed to enhance design skills and instill an entrepreneurial mindset, helping participants view their creations as artistic and commercially viable.

(a) (b) (c)

Figure 5. Theories Presentation for Ideation Process in Creative Workshop (Source: Private Documentation, 2024).

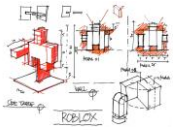
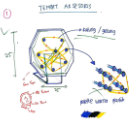
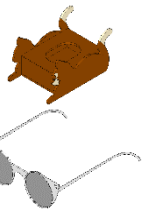
On July 21, 2024, Phase 2 began with a presentation on color theory to enhance the aesthetics of recycled plastic slabs. Participants learned about blending colors using Munsell's theory—hue, value, and chroma—to create vibrant and appealing hues, ensuring the final products were both functional and commercially viable.

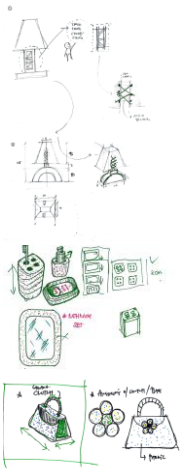
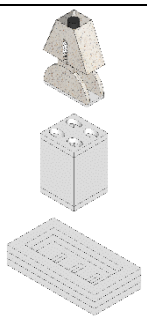
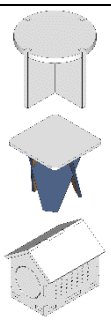
(a) (b) (c) (d)

Figure 6. Group Discussion for Ideation Process in Creative Workshop. (a) Assistance Process by Lecturer. (b) Discussion Process by Alumni. (c) Ideation Process by Students and Participants. (d) Sketching Assistance by Lecturers. (Source: Private Documentation, 2024).

Phase 2 features a creative workshop centered on designing product prototypes. Participants start by learning color theory, which guides the creation of plastic slabs that align with product designs. The workshop covers color perception and its role in commercial products, applying principles such as complementary, analogous, and triadic color schemes, as shown in Table 1. The goal is to ensure that the colors in the prototypes meet the desired aesthetic and emotional impact, including warm, soft, cool, and bold colors, ultimately enhancing the final product's appeal and usability.

Table 1. Participant' Ideation Results.
Source: Private Documentation, 2024.

Groups	Ideation Results			
	Quantities	Objects	Sketchs	Modelings
Group 1	1	Table Lamp		
Group 2	1	Mirror		
Group 3	2	Tissue Box Glasses		
Group 4	5	Coasters Hat Pins		

Group 5	3	Table Lamp Toiletries Bag		
Group 6	3	Stools Bird House		

[a,b] Significant ($p > 0.05$).

The ideation results from the various groups yielded a diverse range of objects. Group 1 proposed a single table lamp, while Group 2 designed one mirror. Group 3 developed two items: a tissue box and glasses. Group 4 had the highest output, with five items, including coasters and hat pins. Group 5 also contributed two items, which were a table lamp and toiletries. Lastly, Group 6 came up with three products: stools and a birdhouse. This variety highlights the creative potential and range of functional products generated through the ideation process.

3. Phase 3 : Prototyping Phase in Upcycling Plastic Waste

After the exploration and sketching phase of the creative workshop, the top 15 product designs were processed further. This involved sorting plastic waste by color to ensure uniformity and aesthetics in the final products. The sorted plastics were then shredded into small pieces and melted

to a thickness of 5mm to 1cm, ensuring even distribution and no air bubbles. The melted plastic was cast into uniform slabs, which were then cut to match the initial design specifications. The slabs were assembled into various furniture and commercial products, paying close attention to detail and quality. The final products were tested for strength and quality before mass production, resulting in 15 innovative items ready for exhibition and commercial production. This structured process transformed previously worthless plastic waste into valuable, aesthetically pleasing products, creating new economic opportunities for the Karang Taruna Kelurahan Gumuruh participants.

Figure 7. The results of melting and printing plastic slabs (Source: Private Documentation, 2024).

4. Phase 4: Exhibition and Publication.

After progressing through stages of material collection, creative design, and production, all curated products will be showcased at IFFINA 2024. This exhibition highlights the work of Karang Taruna Kelurahan Gumuruh participants, presenting plastic waste transformed into valuable items. The event provides a platform for publicizing these products and raising awareness about recycling and creativity in commercial design. Successful prototypes will be mass-produced with local artisans and manufacturers, ensuring high quality. Market testing through bazaars will offer consumer feedback and potential for new collaborations. Overall, this program demonstrates how creativity and innovation can convert environmental challenges into economic and ecological benefits, with the IFFINA 2024 exhibition marking a significant achievement.

D. CONCLUSION

The community empowerment activities in Gumuruh Village successfully addressed local needs and challenges by engaging the community in practical recycling workshops, which enhanced their understanding of plastic waste management and its environmental benefits. The initiative effectively transformed plastic waste into reusable products, tackling issues like waste accumulation and offering solutions for sustainable living. The program met the community's needs by improving waste management practices and creating economic opportunities through upcycling. Participants gained valuable knowledge and engaged in creative work, contributing to local environmental goals. The activities significantly raised recycling awareness, demonstrated the ability to convert waste into valuable products, and provided economic benefits through potential commercialization. For future efforts, it is recommended to expand educational initiatives, strengthen collaboration with local stakeholders, and explore additional markets for recycled products, while increasing community involvement and diversifying recycling materials to further enhance sustainability and economic impact.

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