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INDULA Initiative: Advancing Sustainable Development in Mekarwangi Village, Tangerang

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Abstract The INDULA (*Inovasi Daur Ulang Sampah*/Waste Recycling Innovation) program for sustainable development in Mekarwangi Village was initiated to address the growing volume of waste and the community's limited knowledge of waste management. These challenges negatively impacted the environment and public health, necessitating efforts to educate residents on the importance of recycling. The program employed a structured methodology encompassing preparation, implementation, and evaluation stages. Participants were selected using purposive sampling, focusing on individuals directly affected by the waste management issues. Data collection utilized pre-test and post-test instruments to assess program impact. The analysis revealed significant changes before and after program implementation. Initially, 75% of household waste in the village underwent no sorting, and only 20% of respondents had basic knowledge of recycling. The community also lacked recycling skills and access to markets for recycled products. Following the program, at least 80% of participants understood the importance of recycling and its practical applications. Housewives and youth began creating innovative products from waste, with 50 individuals trained to produce items of economic value. Recycled products were introduced to local markets and e-commerce platforms, leading to a 20% increase in local economic income within three months of training. Additionally, the village established a more structured waste management system, reducing landfill waste by up to 50%. This program demonstrated a measurable positive impact on community awareness, skill development, and local economic growth.

1. INTRODUCTION

Mekarwangi Village, like many rural areas in Indonesia, faces major challenges in waste management. Rapid population growth and increasing consumption of household goods have resulted in a significant increase in the amount of waste, both organic and inorganic. Based on data Badan Pusat Statistik (2022), villages in Indonesia produce an average of 0.68 kg of waste per capita per day, with around 40-50% of it being recyclable waste. However, the main challenge is the lack of public awareness and knowledge in managing waste effectively, so that the majority of waste is simply thrown away without going through a recycling process that can provide added economic value (Nofiyanti et al., 2020; Rahim et al., 2023).

This phenomenon not only has a negative impact on the environment, such as water and soil pollution, but also reduces people's quality of life (Ferrara & Missios, 2024). Based on the report Kementerian Lingkungan Hidup dan Kehutanan (2021), only 15% of total waste in Indonesia is recycled, while the rest is dumped in landfills (TPA) or burned. In addition, many landfills in rural areas have reached maximum capacity, resulting in uncontrolled waste accumulation and adversely affecting the health of the

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Table 1 . Problem identification

No.	Identification of problems	Solution to Problem	Target Achievement
1.	Lack of public awareness about the importance of waste recycling	1. Knowledge sharing about the negative impacts of waste on the environment and the benefits of recycling. 2. Environmental campaigns through local media and village meetings.	1. Increasing public knowledge about the importance of waste recycling, with at least 80% of the community understanding and being involved in recycling activities.
2.	Limited community skills in processing waste into value-added products	1. Training in recycling waste skills into creative economic products (crafts, decorations, etc.). 2. Ongoing technical assistance and mentoring.	1. The availability of creative recycled products from waste that are ready to be marketed by community business groups. 2. At least 25 people are trained and actively processing waste into products.
3.	Lack of market access for recycled products	1. Opening access to local and digital markets through collaboration with MSMEs or e-commerce platforms. 2. Providing digital marketing training to promote recycled products.	1. Establishment of local and online marketing networks for recycled products.
4.	The absence of a structured waste management system in the village	1. Formation of a village waste management working group tasked with collecting, sorting and recycling waste.	1. Creation of a community-based waste management system.

surrounding environment.

On the other hand, the development of the creative economy in rural areas, especially involving local communities, is very important to improve their welfare and economic independence (Sulistyowati et al., 2022). According to Kementerian Pariwisata dan Kementerian Ekonomi Kreatif (2020), the contribution of the creative economy sector to the national Gross Domestic Product (GDP) reached 7.44%, but the participation of rural communities in this sector is still low. In fact, waste can be used as a resource for the creative economy through recycling innovations that produce new products with economic value, such as handicrafts, home decorations, and other commercial products (Anggela et al., 2020; Oktaviani et al., 2024; Sun et al., 2024).

Analysis of the conditions seen from the results of measured observations and validated by the Village Head shows that the majority of Mekarwangi Village residents do not have the habit of managing waste properly and 75% of household waste does not have a sorting process. This waste recycling innovation program aims to increase the creativity of the Mekarwangi Village community by providing training and assistance in processing waste into value-added products (Table 1). Through this program, the community is expected to be able to utilize waste as a resource for the development of a sustainable creative economy, while reducing the negative impact of waste on the environment (Rahman, 2024; Ramandei et al., 2023).

Developing creativity in utilizing waste for economic purposes not only contributes to a cleaner environment, but also supports sustainable development (Wang et al., 2024; Zhou et al., 2024). The UN Sustainable Development Goals (SDGs), especially goal 12 on responsible production and consumption, encourage the reduction of waste production and the reuse of resources (United Nations, 2015). By combining environmental conservation efforts and improving economic welfare through recycling innovation, Mekarwangi Village can be a model for other villages in creating a sustainable and inclusive ecosystem (Azzahra & Pujianto, 2023; Li & Li, 2024; Rizki et al., 2023).

2. METHOD

To address the challenges and achieve the objectives of the INDULA program in Mekarwangi Village, a structured methodology was employed, encompassing distinct stages of program preparation, implementation, and evaluation. This process involved systematic techniques for data collection, data analysis, and monitoring of conditions both before and after program execution, as detailed below.

2.1 Data collection techniques

The sample selection was carried out using the purposive sampling method, namely selecting program participants who have a direct relationship with the problems faced. The main target was the Mekarwangi Village community consisting of: (1) a group of housewives responsible for household waste management, (2) village youth who have potential in developing innovation and creativity, (3) local MSMEs can utilize recycled products as part of their business. The minimum sample target is 30 residents, this number was chosen because it was

representative to describe the involvement of various social groups in the village.

Data collection techniques used in this activity include direct observation, semi-structured questionnaires and interviews, Focus group discussions, and documentation study. Direct observation involved observing the initial conditions related to community waste management patterns before the program begins. This includes seeing how waste is generated, collected, and disposed of. Semi-structured questionnaires and interviews were conducted to understand the community's initial knowledge about recycling and their interest in recycling product innovation. Questionnaires were given before and after the program implementation to measure changes in knowledge and behavior. Focus group discussions were used to explore creative ideas related to waste utilization and the obstacles faced by the community in waste management with the village head, community leaders and community representatives. Additionally, a documentation study was conducted to collect secondary data from village reports, environmental cleanliness reports, and other sources relevant to the social and economic conditions of the community.

2.2 Data analysis techniques

The collected data were analyzed using several approaches, including descriptive, comparative, and qualitative analysis. Descriptive analysis was used to understand the initial conditions of the community regarding waste management. Data from the questionnaire and initial observations were analyzed descriptively to provide an overview of community awareness and actions before the program began. Comparative analysis was conducted to compare the condition of the community before and after the program. Changes in knowledge, attitudes, and behavior are measured by comparing the pretest and posttest results of the questionnaire and the results of interviews before and after the training. Additionally, the results of the FGDs and interviews were analyzed qualitatively to gain insights into the main issues and challenges faced by the community, as well as potential creative solutions that emerged during the program.

2.3 Location and time

This activity was carried out in Mekarwangi Village, which was an area with a population of around 1,828 people (Pemerintah Kabupaten Tangerang, 2023). This village became the destination location because of the significant level of waste accumulation. Implementation Time: The program lasts for 6 months, from January to June 2024. The preparation stage, initial data collection, and knowledge sharing take about 2 months, while training and program implementation last for 3 months, and ends with an evaluation in the last month.

2.4 Conditions before program implementation

Before the program was implemented, most of the Mekarwangi Village community did not have the habit of managing waste properly. Based on initial data, 75% of household waste was directly disposed of in landfills without a sorting process. Community knowledge about the importance of recycling is very low, with only about 20% of them understanding that waste can be turned into products with economic value. The community also does not yet have the skills to recycle waste into creative products, and there is no access to markets for these products.

2.5 Conditions after program implementation

After the program completed, it was expected that there would be significant improvements in several areas, including:

1. Public knowledge and awareness: At least 80% of participants understand the importance of recycling and how to utilize it.

2. Community skills: The community, especially housewives and youth, are able to produce creative products from waste. At least 50 people are trained to produce products of economic value, such as handicrafts and home decorations.

3. Market access: Recycled products have begun to be marketed through local markets and e-commerce platforms, with local economic income increasing by up to 20% in the first three months after training.

4. Waste management system: There is a more structured waste management system in the village, with a reduction in the volume of waste sent to landfill by up to 50%.

3. RESULT AND DISCUSSION

3.1 Implementation of activities

The first phase is knowledge sharing and education (1 week). This phase was conducted in the village hall and involved all residents. In this session, the lecturer team gave an explanation about the negative impacts of waste on the environment and the importance of recycling. Students acted as facilitators who helped residents understand the material using visual and interactive media. After the knowledge sharing, the community was divided into small groups to discuss the problem of waste management in households. Students led this discussion to explore insights and creative ideas from the community.

The second phase is recycling skills training (2 months). Skills training was carried out in stages, involving participants who had been selected based on an initial survey. Inorganic waste recycling training was conducted by a team of lecturers, offering technical training on how to recycle plastic, wood, and fabric scraps into creative products such as handicrafts and household appliances. Students accompany participants in hands-on practice sessions, helping them apply the techniques they have learned. Additionally, marketing and entrepreneurship training was offered by a team of lecturers from the Faculty of Economics, focusing on how to market recycled

products, both in local markets and online through e-commerce. Students assisted the community in accessing digital platforms and creating simple promotional materials. Ongoing mentoring took place after the training was completed, with students conducting weekly field visits to provide direct mentoring to the community in producing and marketing recycled products.

The third phase is implementation of waste management system (1 month). After the basic skills had been mastered by the community, the team of lecturers and students worked together with village officials to build a sustainable waste management system.

a. Establishment of waste management working group: The teaching team assisted in the establishment of a working group responsible for managing waste at the household and community levels. Students facilitated discussions on task allocation and operational mechanisms.

b. Provision of recycling facilities: Lecturers provide guidance on the arrangement of waste collection facilities, while students assist in installing collection points and sorting waste according to category (organic, inorganic, and recyclable).

The last phase is evaluation and monitoring (1 month). At the end of the program, an evaluation was conducted to assess the achievements and impact of activities.

a. Questionnaire evaluation: Students collect post-program data using the same questionnaire as the initial survey to measure changes in community behavior and knowledge. The results of this questionnaire are analyzed by the lecturer to assess the success of the training.

b. Product marketing monitoring: Students accompany residents to monitor the development of recycled product sales, both in local markets and through digital platforms.

c. Presentation of results and recommendations: Lecturers and students hold a final meeting with village officials and the community to present program results, provide recommendations, and plan any follow-up actions that may be needed.

3.2 Evaluation of conditions before and after

Pretest and posttest are important evaluation instruments used to measure the effectiveness of community service activities in the INDULA (Waste Recycling Innovation) Program in Mekarwangi Village. These two tests have a very crucial function in assessing changes in community knowledge, skills, and attitudes before and after the program is implemented. The lecturer team gave a pretest on February 12 2024 to 30 registered participants, before the knowledge sharing and education intervention were carried out and distributed a posttest when the activities were completed, namely in May 2024 after the ongoing mentoring activity stage was completed. The following are the evaluation results of the questions given.

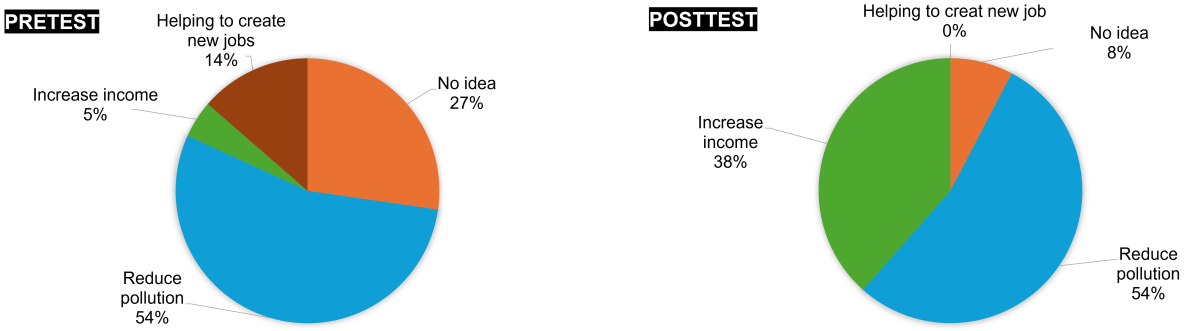

Figure 1 . Pretest and posttest about the negative impact of waste on the environment

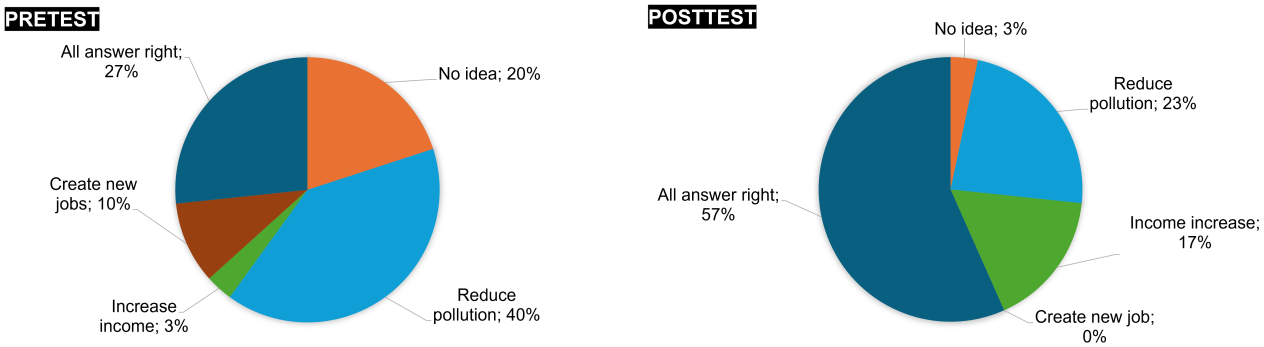

Figure 2 . Pretest and posttest about the benefits of waste recycling for society and the environment

The first point is knowledge about the negative impact of waste on the environment. The results of respondents' answers to the pretest and posttest were obtained, as shown in Figure 1. The negative impact of waste on the environment is increasing pollution (50% of respondents to 54% of respondents), increasing income (5% of respondents to 38% of respondents), creating new jobs (14% of respondents to 0% of respondents), the answer of participants who don't know (27% of respondents to 8% of respondents). It can be concluded that understanding of the negative impact of waste on the environment has significantly increased because the number of participants who do not understand its value has decreased, as well described by Anggela et al. (2020) and Azzahra & Pujianto (2023).

The second point is knowledge about the benefits of waste recycling for society and the environment. The results of respondents' answers in the pretest and posttest were obtained, as shown in Figure 2. Waste recycling reduces pollution (40% of respondents to 23% of respondents), increases income (3% of respondents to 17% of respondents), creates new jobs (10% of respondents to 0% of respondents), all alternative answers are correct (27% respondents became 57% of respondents). It can be concluded that the participants understand that recycling waste has many benefits for society and the environment.

The third point is knowledge about how to recycle plastic waste into useful products. The results of respondents' answers to the pretest and posttest were obtained, as shown in Figure 3. The participants who know and can practice (7% of respondents to 80% of respondents), participants who know but never practice (13% of respondents to 3% of respondents), only know a little (27% of respondents to 17% of respondents), participants who did not know at all (53% of respondents versus 3% of respondents). It can be concluded that understanding of how to recycle plastic waste into useful products has significantly increased because the number of participants who understand waste recycling techniques is increasing (Sun et al., 2024).

The fourth point is knowledge about how to market recycled products. The results of respondents' answers to the pretest and posttest were obtained, as shown in Figure 4. The participants who know and have a market for recycled goods (3% of respondents to 7% of respondents), participants who know marketing concepts but have never practiced them (17% of respondents to 93% of respondents), only know a little about marketing (23% of respondents to 0% respondents). respondents), participants did not know at all (57% of respondents versus 0% of respondents). It can be concluded that participants who understand knowledge about how to market recycled products have increased significantly because the number of participants who understand marketing concepts is increasing, as highlighted by Zhou et al. (2024).

The fifth point is knowledge about how often to sort waste at home based on type. The results of respondents' answers to the pretest and posttest were obtained, as shown in Figure 5. The participants who always sort waste (0% of respondents to 27% of respondents), participants who often sort waste (3% of respondents to 17% of respondents), participants who sometimes sort waste (13% of respondents

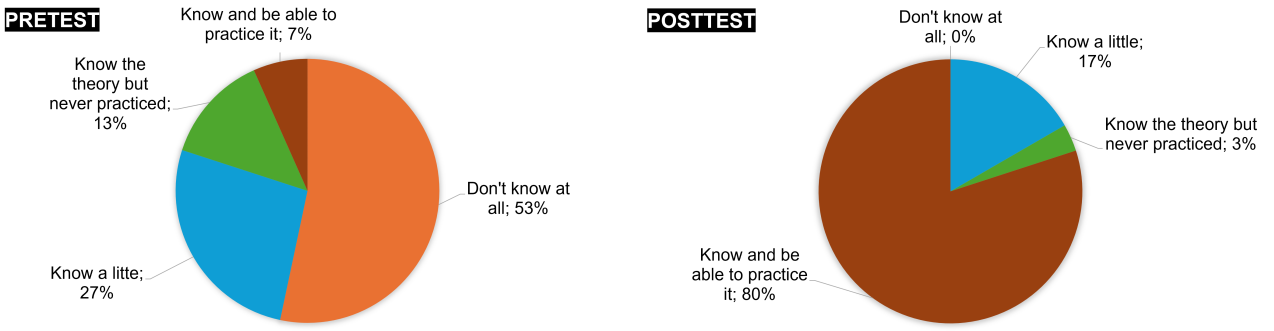

Figure 3 . Pretest and posttest about how to recycle plastic waste into useful products

Figure 4 . Pretest and posttest about how to market recycled products

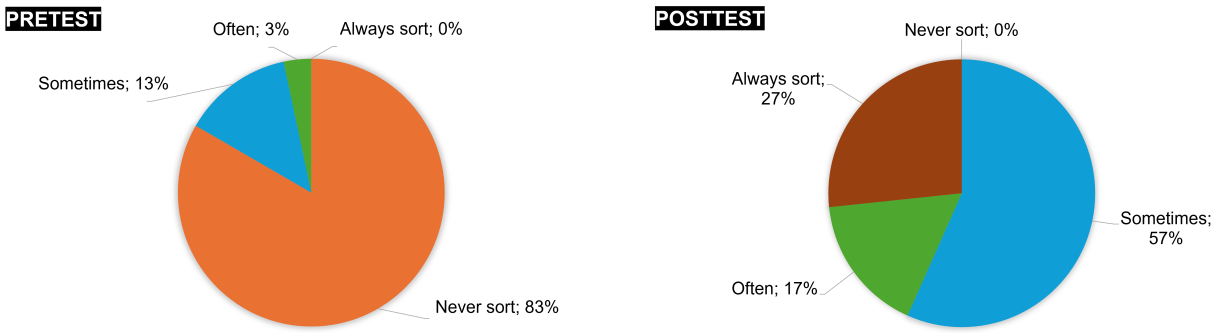

Figure 5 . Pretest and posttest about how often to sort waste at home based on type

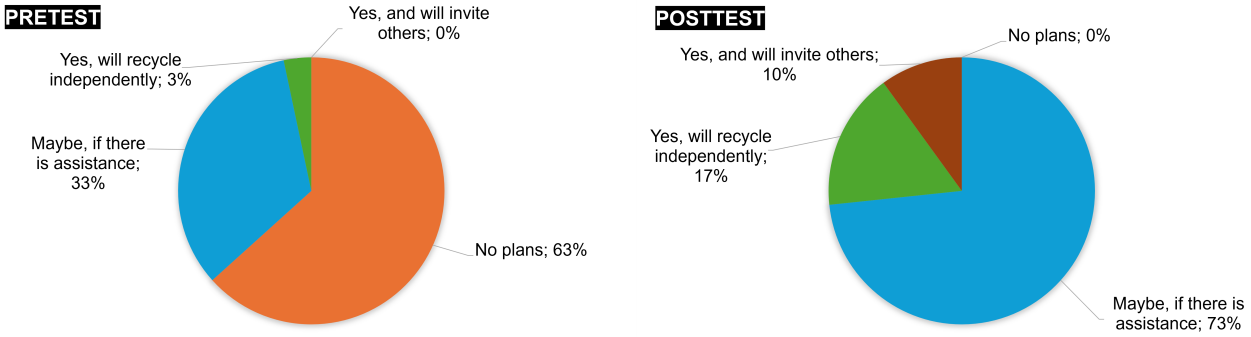

Figure 6 . Pretest and posttest about continuing recycling waste after this program ends

to 57% of respondents), participants who never sort waste at all (83% of respondents compared to 0% of respondents). It can be concluded that participants who sort waste have increased significantly because the number of participants who sort waste is increasing.

The sixth point is a plan to continue recycling waste after this program ends. The results of respondents' answers to the pretest and posttest were obtained, as shown in Figure 6. The participants plan to continue recycling waste after the program ends and will invite other people (0% of respondents compared to 10% of respondents), participants plan to continue recycling waste after the program ends (3% of respondents compared to 17% of respondents), participants are likely to continue recycling waste after the program ends if someone helps (33% of respondents compared to 73% of respondents), participants do not plan to continue recycling waste after the program ends (63% of respondents compared to 0% respondents). It can be concluded that participants who plan to continue recycling waste after the program ends have experienced a significant increase because the number of participants who plan to continue recycling waste after the program ends has increased.

Based on the results of the pretest and posttest conducted during the INDULA (Waste Recycling Innovation) program for Sustainable Development in Mekarwangi Village, a significant increase in community knowledge about waste management and recycling practices was observed. The data revealed an increase in the average response percentage of participants, indicating an improved understanding of the concepts and techniques of waste recycling after participating in the program. These findings demonstrated the program's effectiveness in delivering valuable education and training while enhancing community awareness of the importance of waste management for both environmental and economic sustainability (Rahim et al., 2023).

4. CONCLUSION

The results of this program demonstrated that community empowerment through waste recycling had significant potential to enhance economic welfare and environmental awareness. The program successfully improved community knowledge and skills in waste management while creating new economic opportunities through the production of recycled products. With the support of the UBL lecturer team and students, the Mekarwangi Village community implemented sustainable recycling practices, contributing to the achievement of sustainable development goals. However, the program's long-term success depended heavily on sustained efforts to maintain community motivation and expand market access for recycled products. Therefore, the community empowerment team was encouraged to continue mentoring and collaborating with various stakeholders to ensure that the program had a broader and more lasting impact on the community.

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CONFLICT OF INTERESTS

The authors declare there is no conflict of interest.

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