

Recycling Program: Turning Waste into Useful and Valuable Products for Communities and Entrepreneurs

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Abstract

Waste recycling programs have become crucial due to the mounting waste problems that threaten the environment, public health, and the sustainability of natural resources. This program aims to transform the waste management paradigm from a linear system (disposal) to a circular economic cycle, converting waste into beneficial and economically valuable products. The main objectives include significantly reducing the volume of waste that ends up in Final Disposal Sites (TPA), increasing the availability of quality recycled raw materials, and fostering awareness and active community participation in recycling practices. The targeted outcomes include creating new jobs in the collection, processing, and marketing sectors of recycled products. Additionally, this program is expected to increase community income, particularly among entrepreneurs, through the sale of innovative and high-value recycled products. Thus, the recycling program is expected to create a sustainable ecosystem that benefits the environment, society, and the economy as a whole.

Keywords: Entrepreneurship, Environment, Recycling, Refuse, Waste.

1. Introduction

South Meruya Village, located in Kembangan District, West Jakarta, faces significant waste management challenges. With a continuously growing population, the volume of waste produced daily also increases. According to data from the Central Statistics Agency (BPS) of Kembangan District, each person in South Meruya Village generates approximately 0.4 kg of waste per day. When multiplied by the population, the total waste generated reaches about 30 tons per day. Most of this waste ends up in Final Processing Sites (TPA), which are becoming increasingly full and causing environmental problems such as soil, water, and air pollution. Improper waste management can cause various environmental problems, including serving as vectors for disease transmission and causing pollution to water, air, soil, and groundwater (Chow et al., 2017; Willis et al., 2018).

The waste problem, particularly plastic waste, has become one of the main challenges in sustainable development in various countries, including Indonesia. The continuously increasing volume of waste, accompanied by suboptimal management, results in environmental pollution and negatively impacts public health and ecosystems (Hajimi et al., 2024). Research data shows that waste management at Final Processing Sites (TPA) still faces various environmental risks such as greenhouse gas emissions, water pollution, and land limitations (Mughtar et al., 2022; Sulistyaningsih, 2020). Therefore, strategies for waste



reduction at the source and improving recycling have become increasingly important (Ummamah, Martono, & Iskandar, 2024).

South Meruya Village has several potentials and resources that can support the development of recycling programs, including the presence of a 3R Waste Processing Site (TPS): The West Jakarta Environmental Service has built a 3R TPS on government asset land covering 2,500 square meters in RW 01 South Meruya Village. This 3R TPS is equipped with a waste management system with a processing capacity of up to 35 tons of waste per day. Inorganic waste is processed into Refused Derived Fuel (RDF) or solid refuse-derived fuel, while organic waste is processed into compost and maggot breeding. Additionally, South Meruya Village has active and dedicated PKK cadres. PKK cadres can be involved in recycling programs to provide education to the community, conduct waste sorting, and create recycled products such as compost bags and ecobricks.

In Indonesia, the concept of waste banks and community-based waste management programs have shown positive results in increasing public awareness and creating new economic opportunities (Putra et al., 2020). These programs not only reduce the amount of waste but also promote job creation, social entrepreneurship, and local community empowerment (Desreza et al., 2022). Through collaboration between government, communities, and business actors, waste management can be directed toward a more productive and environmentally friendly system (Aryanti et al., 2023).

Despite having considerable potential and resources, South Meruya Village faces several challenges that must be addressed to develop effective recycling programs. One of the main issues is the lack of community awareness and participation. Many residents are still unaware of the importance of recycling, do not separate waste at the household level, and tend to dispose of waste carelessly, contributing to the high volume of waste sent to final disposal sites (TPA). In addition, there is a significant gap in knowledge and skills related to recycling techniques. Community members, including PKK cadres, often lack understanding of proper and efficient recycling methods as well as how to create quality, marketable recycled products. These issues are compounded by the lack of capital and necessary equipment such as waste shredders, composting tools, and ecobrick-making kits, which are essential for running a sustainable recycling program. Furthermore, insufficient support from both government and private sectors remains a key barrier. Support in the form of funding, training, mentoring, and assistance in marketing recycled products is critical to ensuring the long-term success and scalability of community-based recycling initiatives.

One of the most pressing issues is the use of single-use plastics that are difficult to decompose and cause long-term ecological problems. Several studies reveal that behavioral interventions, such as plastic reduction campaigns and single-use plastic ban policies, need to be complemented with effective recycling programs (Borg et al., 2022; Cowan et al., 2021). Additionally, consumer intention and behavior factors toward recycling become important aspects in supporting the success of community-based waste management (Jia et al., 2024).

The circular economy approach is now viewed as an innovative solution in addressing waste problems. In this approach, waste is viewed as a resource that can be reused through recycling processes, thus having added value for both communities and business actors (John & Das, 2024; Karim et al., 2025). The practice of turning waste into wealth has become a global focus in achieving sustainability through innovations in processing waste into economically valuable products, such as handicrafts, compost, and industrial raw materials (Moalem & Kerndrup, 2023).

However, behind these challenges, there is great potential to develop recycling programs that can transform waste into beneficial and valuable products. Recycling programs can not

only reduce the volume of waste disposed of in TPA but also create jobs, increase community income, and preserve the environment. This Community Service activity aligns with Mercu Buana University's Master Plan for Community Service (RIPkM), specifically the Featured Theme of Environmental Engineering and Technology and the Environmentally Friendly Ergonomic Product Design Theme because it relates to product design. This activity will create synergy between Product Design and Industrial Engineering Community Service groups. The Community Service roadmap is depicted as ergonomic product dimension training in the first year, followed by anthropometry and product usage fatigue training in the second year, ergonomic product design training based on anthropometry data in the third year, environmentally friendly product machine design training in the fourth year, and socialization of fatigue level analysis and waste generated in the fifth year. Based on the background above, an effort is needed to enhance student creativity through introduction to industrial product design processes.

This Community Service (PkM) activity aims to empower communities and entrepreneurs in waste management through innovative and sustainable recycling programs. The main objective is to increase community awareness and participation in sorting and processing waste into economically valuable products, while reducing the volume of waste that ends up in TPA. This PkM also aims to train community and entrepreneur skills in creating creative recycled products that have market competitiveness.

This activity aligns with the concept of Independent Learning-Independent Campus (MBKM), particularly in providing learning experiences outside campus that are relevant to community needs. Students can be directly involved in applying knowledge and technology learned in lectures while developing soft skills such as communication, teamwork, and problem-solving. This PkM serves as a platform for students to make real contributions to improving community quality of life and supporting sustainable development, in line with the MBKM spirit to produce adaptive, innovative, and globally competitive graduates.

The "Waste Recycling Program" PkM activity contributes significantly to achieving Key Performance Indicators (KPI) of higher education institutions. Increased community participation in recycling (KPI 2: Students gain experience outside campus) is reflected in the training and mentoring provided. Recycled products produced (KPI 3: Faculty work used by society) demonstrate the application of faculty research results that benefit communities and entrepreneurs. Partnerships with external parties (KPI 5: Partnerships with strategic partners) are established through collaboration with local government, communities, and SMEs. Thus, this PkM supports KPIs related to educational relevance, research contribution, and strategic cooperation of higher education institutions. The following is the roadmap for the Community Service (PkM) program. This roadmap is designed to achieve long-term goals in educating communities and entrepreneurs.

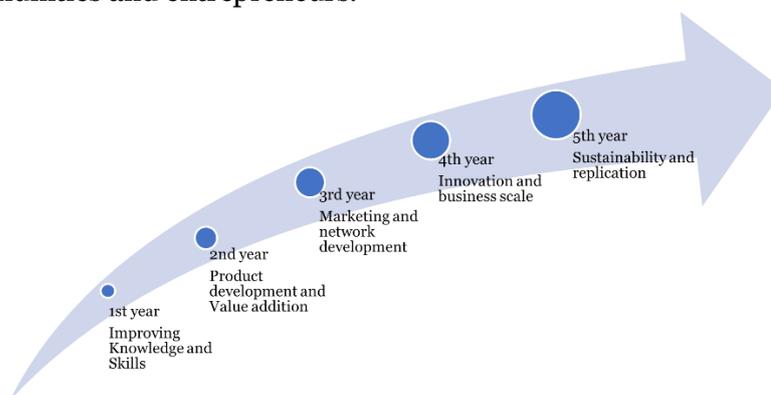


Figure 1. 5-Year PkM Roadmap

Description:

- a. 1st year: Foundation Building and Community Capacity. Focus on forming community groups, improving basic recycling knowledge and skills.
- b. 2nd year: Product Development and Value Addition. Focus on improving skills in processing waste into marketable products, product design development.
- c. 3rd year: Marketing and Network Development. Focus on marketing recycled products, building networks with business actors and markets.
- d. 4th year: Innovation and Business Scale. Focus on developing recycled product innovations, increasing production scale and business management.
- e. 5th year: Sustainability and Replication. Focus on sustainability of recycling programs, replicating successful models to other areas.

2. Methods

The implementation method of "Waste Recycling Program: Converting Waste into Beneficial and Valuable Products for Communities and Entrepreneurs" PkM is designed with a participatory and sustainable approach, involving communities, entrepreneurs, and other related parties in every stage of activities (Challcharoenwattana & Pharino, 2015; Memarista et al., 2024). This method emphasizes knowledge transfer, skills improvement, intensive mentoring, and collaborative network development to ensure program success and sustainability. The following are details of the PkM implementation method.

2.1. Preparation Stage

- a. Survey and potential mapping: conducting surveys to identify potential and problems related to waste management in target areas. Potential mapping includes identifying dominant waste types, waste sources, waste management actors, and market potential for recycled products.
- b. Coordination with related parties: Coordinating with local government, community leaders, RT/RW administrators, and other community groups to gain support and active participation in the program.
- c. Training module preparation: Preparing comprehensive and easily understood training modules, including materials on waste hazards, recycling techniques, entrepreneurship, product marketing, and others.
- d. Formation of implementation team: forming a PkM implementation team consisting of lecturers, students, and volunteers who have competence in waste management, entrepreneurship, and communication.

2.2. Implementation Stage

- 1) Socialization and group formation: conducting program socialization to communities to increase awareness and motivate participation. Forming community groups that will become active participants in training and mentoring activities.
- 2) Recycling training: Conducting intensive training on recycling techniques to community groups. Training includes:
 - a. Waste Sorting: providing understanding of how to properly sort organic, inorganic, and residual waste.
 - b. Composting: training how to make compost from organic waste using various methods, such as takakura, stacked buckets, and vermicomposting.
 - c. Inorganic waste processing: training how to process inorganic waste into valuable products, such as ecobricks, plastic handicrafts, and alternative building materials.

- d. High-value waste processing: training how to process waste that has high selling value such as plastic, paper, and metal.
- 3) Entrepreneurship Training: Conducting entrepreneurship training for communities interested in developing businesses in recycling. Training includes:
 - a. Business Opportunity Identification: Helping participants identify business opportunities from waste available in the surrounding environment.
 - b. Business Plan Preparation: Training participants to prepare simple business plans covering production, marketing, finance, and management aspects.
 - c. Product Marketing: Providing knowledge about recycled product marketing strategies, both offline and online.
 - d. Capital Access: Providing information about available capital sources, such as loans from banks, cooperatives, or government programs.
 - e. Product Marketing Facilitation: Facilitating marketing of recycled products through various media, such as exhibitions, bazaars, online stores, cooperation with supermarkets, and others.

2.3. Evaluation and Monitoring Stage

- a. Continuous monitoring: conducting periodic monitoring of program implementation, identifying constraints, and providing appropriate solutions.
- b. Impact evaluation: conducting impact evaluation of programs on community income improvement, waste volume reduction, behavior change, and environmental awareness.
- c. Report preparation: preparing periodic reports that document all PkM activities, achievements, constraints, and recommendations for future improvements.

2.4. Sustainability Stage

- a. Formation of Community Self-Help Groups: forming community self-help groups tasked with continuing recycling programs independently.
- b. Network Development: building cooperative networks with various parties, such as local government, private sector, communities, and media, to support program sustainability.
- c. Results Dissemination: Disseminating PkM results through scientific publications, seminars, workshops, and mass media to inspire and motivate other parties to conduct similar activities.

The PkM implementation method is designed to be flexible and adaptive to local conditions, always considering community needs and aspirations (Bakri & Hasyim, 2024). With a participatory and sustainable approach, this recycling program is expected to provide optimal benefits for communities, the environment, and the local economy.

3. Results and Discussion

3.1. Participants

The results of activity implementation in the community service activity themed "Converting Waste into Beneficial and Valuable Products for Communities and Entrepreneurs" show that the majority of participants (61.5%) have a final education level of high school/vocational school. The rest consists of S1 graduates (19.2%), D3 (11.5%), and junior high school (7.7%) as shown in Figure 3. This composition indicates that the activity approach needs to be designed with communicative and applicative methods, considering most participants come from secondary education levels. The dominance of high school/vocational graduates also shows great potential in developing practical skills-based

entrepreneurship, especially in processing waste into valuable products such as handicrafts, compost, or other functional goods.

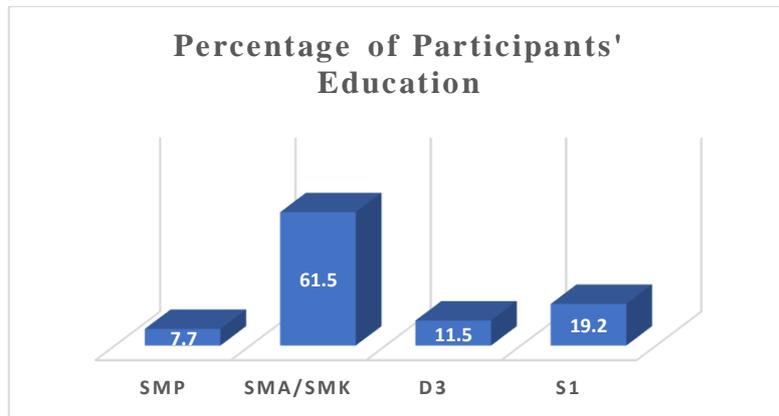


Figure 2. Percentage of Participants' Education in PkM Activities

Based on data in Figure 2, the majority of community service activity participants have work experience of less than 5 years (53.8%). Meanwhile, 23.1% have experience between 5 to 9 years, 19.2% have experience of 10 to 15 years, and only 3.8% have work experience of 16 to 20 years. This finding shows that most participants are in the early stages of their careers, which is very relevant for providing practice-based training and entrepreneurship innovation, such as processing waste into valuable products. Low work experience also reflects the need for continuous development so they can improve capacity and independence in environment-based entrepreneurship. This activity is expected to become a learning and motivation platform for participants to start creating business opportunities from existing environmental problems, especially household or small-scale industrial waste management.

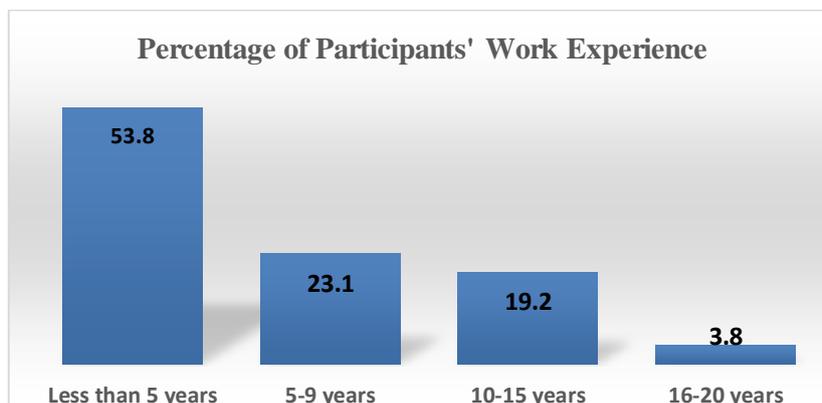


Figure 3. Percentage of Participants' Work Experience in PkM Activities

Based on the diagram below (Figure 3), the majority of respondents in community service activities have their own business at 88.5%, while only 3.8% run family businesses and 7.7% are involved in joint ventures. This fact indicates that most business actors have full autonomy in decision-making and business management. This condition becomes a strategic opportunity in implementing the "Converting Waste into Beneficial and Valuable Products" program, because decisions to innovate and adopt waste processing technology can be directly implemented by individual business actors without structural barriers. Personal approaches

in training and mentoring are very appropriate for improving program effectiveness, because they target business actors with full control over assets and business direction.

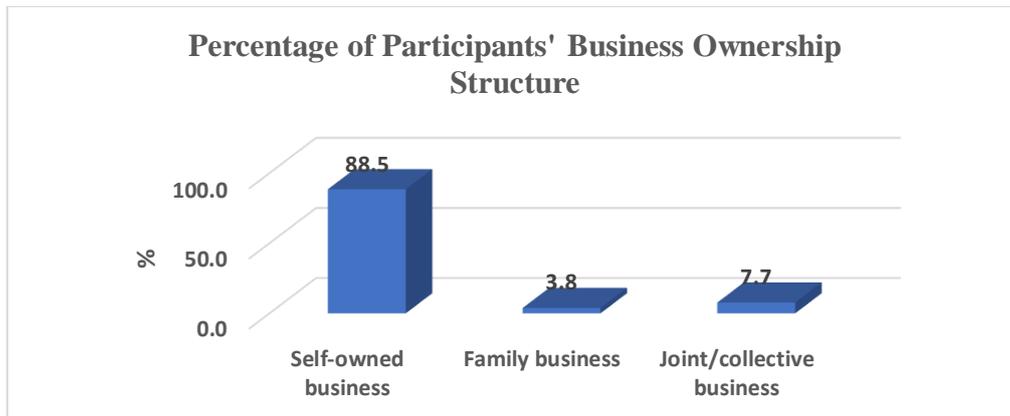


Figure 4. Percentage of Participants' Business Ownership Structure

Based on the business type percentage graph shown in Figure 4, it can be seen that the food sector dominates respondents' economic activities with a percentage of 73.1%. This shows that the majority of the community is involved in businesses related to food processing or sales, both household and small scale. Meanwhile, other types of businesses contribute 23.1% and general entrepreneurship only 3.8%. This data strengthens the relevance of the community service program themed "Converting Waste into Beneficial and Valuable Products," especially with a focus on kitchen waste, food packaging, or organic waste. The potential for utilizing waste into creative products is very large, because it directly intersects with respondents' main activities.

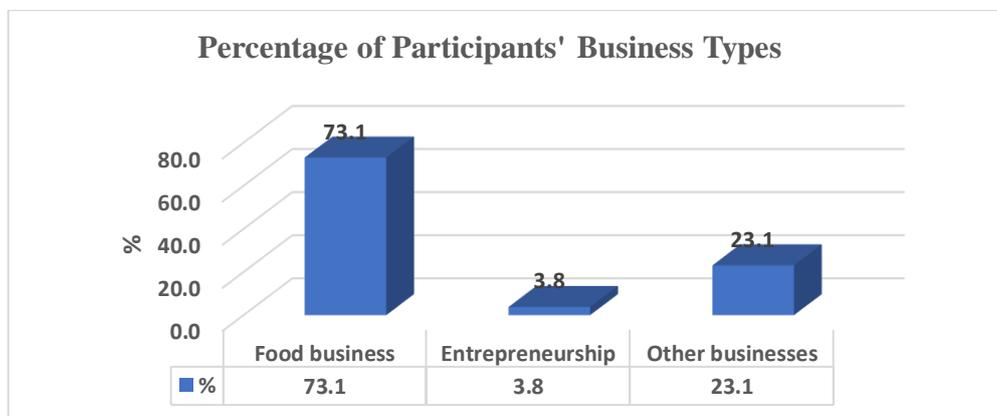


Figure 5. Percentage of Participants' Business Types

Based on the monthly business income percentage graph (Figure 5), the majority of respondents (84.6%) have income below Rp5 million, showing that most business actors are still on a micro scale. Only 11.5% have income between Rp5-9 million, and very few (3.8%) can achieve income between Rp10-15 million per month. This data reflects the economic challenges faced by local business actors, while also providing opportunities to increase economic value through waste utilization-based entrepreneurship training. Programs like "Converting Waste into Beneficial Products" can become innovative solutions to gradually increase business income and community welfare.

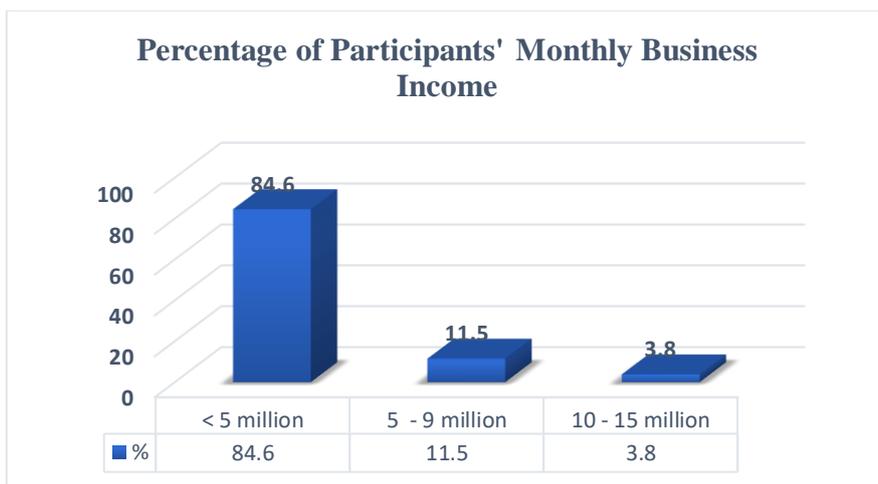


Figure 6. Percentage of Participants' Monthly Business Income

Figure 6 shows that 73.1% of respondents do not have access to business funding, while only 26.9% successfully obtain funding. This condition indicates limited access to financing sources for local business actors, which potentially hinders their business development. Low funding levels can be caused by minimal information, limited collateral, or complicated capital procedures. Therefore, in the community service activity titled "Converting Waste into Beneficial and Valuable Products," financial management and funding access training needs to be designed, so that recycling-based businesses can grow more sustainably and inclusively.

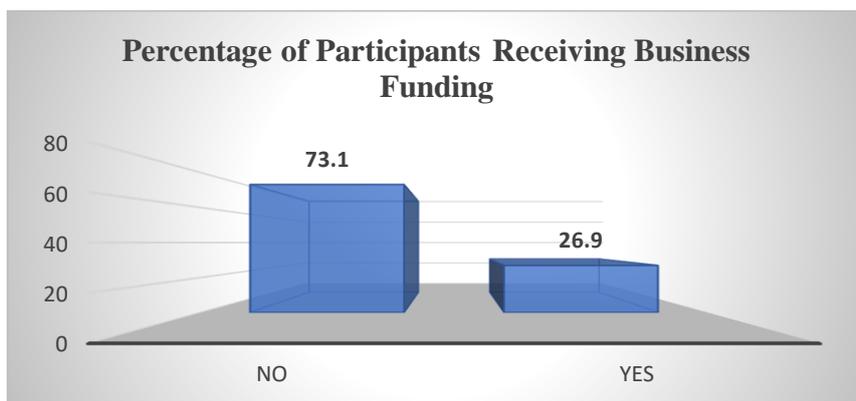


Figure 7. Percentage of Participants Receiving Business Funding

Based on Figure 7, the results of participant assessment analysis of Community Service (PkM) activities show that the majority of participants gave very positive responses to all aspects of the activity. On the "Activity Material" indicator, 61.5% of participants stated agree and 38.5% strongly agree, showing that the content delivered was considered relevant and beneficial.

Table 1. Results of Participant Assessment Analysis of PkM Activities

| Participant Statements on Activity Materials | Assessment Percentage | | | | |
|--|-----------------------|---|---|------|------|
| | 1 | 2 | 3 | 4 | 5 |
| Activity Material | 0 | 0 | 0 | 61.5 | 38.5 |
| Activity is beneficial | 0 | 0 | 0 | 23.1 | 76.9 |
| Material delivery | 0 | 0 | 0 | 57.7 | 42.3 |
| Material delivery time | 0 | 0 | 0 | 53.8 | 46.2 |
| Comfortable activity venue | 0 | 0 | 0 | 50.0 | 50.0 |
| Easily accessible location | 0 | 0 | 0 | 42.3 | 57.7 |

| Participant Statements on Activity Materials | Assessment Percentage | | | | |
|--|-----------------------|-----|-----|------|------|
| | 1 | 2 | 3 | 4 | 5 |
| Food facilities | 0 | 0 | 7.7 | 57.7 | 34.6 |
| Material facilities | 0 | 3.8 | 0 | 53.8 | 42.3 |
| Overall activity | 0 | 0 | 0 | 34.6 | 65.4 |
| Goodybag | 3.8 | 0 | 7.7 | 61.5 | 26.9 |

Description:

(1) Strongly disagree, (2) Disagree, (3) Neutral, (4) Agree, (5) Strongly agree

The beneficial activity aspect even obtained the highest strongly agree level at 76.9%. Material delivery was also rated well with 57.7% agree and 42.3% strongly agree, indicating that the method and delivery style were easy to understand. Supporting facilities such as food and materials received fairly good ratings, although there were slight neutral ratings (7.7%) and disagree (3.8%) on material facilities. Meanwhile, the "goodybag" aspect showed slight dissatisfaction (3.8% strongly disagree and 7.7% neutral), which can be material for evaluation. Overall, "overall activity" received 65.4% strongly agree and 34.6% agree, showing the success of the PkM program in meeting participant expectations. This comprehensive evaluation shows that the activity has run effectively and had a positive impact, although there are some minor aspects that can be improved in future implementations.

3.2. Problem, Solution, and Constraints of the Activity Implementation

3.2.1. Problem

The priority problem that urgently needs to be addressed in the context of "Waste Recycling Program: Converting Waste into Beneficial and Valuable Products for Communities and Entrepreneurs" is the low level of active community participation and minimal knowledge and skills in effective waste management. This condition is exacerbated by several crucial interrelated factors.

- 1) Lack of collective awareness regarding the negative impacts of waste accumulation on the environment, health, and economy. Communities tend to neglect waste sorting practices from the source (households), causing mixing of organic and inorganic waste, which complicates the recycling process.
- 2) Limited access to information and comprehensive education regarding proper recycling techniques, business opportunities from waste, and the importance of sustainable waste management. This results in low community initiative to actively participate in recycling programs.
- 3) Lack of adequate supporting infrastructure and facilities, such as easily accessible sorted waste bins, recycling centers close to settlements, and efficient waste transportation systems.
- 4) Minimal economic incentives and regulatory support that motivate communities and entrepreneurs to participate in recycling programs. This includes providing rewards for individuals or groups actively recycling, as well as implementing sanctions for illegal waste disposal.

By comprehensively addressing these priority problems, recycling programs can run effectively, transforming waste into valuable resources, improving community welfare, and preserving the environment.

3.2.2. Solution

Solutions to problems in the "Waste Recycling Program: Converting Waste into Beneficial and Valuable Products for Communities and Entrepreneurs" PkM program are designed comprehensively and integrated, covering aspects of education, skills training, infrastructure provision, and continuous mentoring. The following are details of the solutions offered.

- 1) Community Awareness and Education Enhancement
 - a. Intensive Educational Campaigns: Conducting continuous educational campaigns through various media, including social media, websites, banners, posters, and leaflets. Educational materials focus on negative impacts of waste, benefits of recycling, proper waste sorting methods, and success stories of recycling entrepreneurs.
 - b. Socialization and Workshops: Conducting socialization at RT/RW levels, schools, and other community groups. Interactive workshops will be held to provide deep understanding of recycling principles, good waste management practices, and economic potential from waste.
 - c. Involvement of Community Leaders and Influencers: Engaging community leaders, religious leaders, and local influencers to become agents of change and provide positive examples in waste management. Testimonials and inspirational stories from these figures will increase community trust and motivation to participate.
 - d. Recycling Education in Schools: Integrating recycling materials into school curricula, from elementary to secondary levels. Students will be invited to practice directly sorting waste, making compost, and recycling waste into creative products.
- 2) Skills Training and Entrepreneurship Development
 - a. Recycling Technique Training: Providing intensive training to communities, especially SMEs, PKK mothers, and youth groups, on effective and innovative recycling techniques. Training includes material on processing waste into beneficial products such as compost making, ecobricks, handicrafts from plastic waste, processing organic waste into liquid fertilizer, and others.
 - b. Entrepreneurship Training: Conducting entrepreneurship training for communities interested in developing businesses in recycling. Training includes business plan preparation, financial management, product marketing, and access to capital.
 - c. Business Mentoring: Providing continuous mentoring to recycling entrepreneurs, from initial business formation to business development. Mentoring includes consultation, mentoring, and facilitating market access.
 - d. Comparative Studies: Conducting comparative studies to successful recycling centers or SMEs engaged in waste processing. Comparative studies aim to provide inspiration and motivation to participants, as well as learn best practices in waste management.

3.2.3. Constraints

Difficulties or obstacles faced during Community Service implementation are as follows:

- a. Participants who are SME actors with majority secondary education levels experienced difficulties in applying digital systems during training related to promotional systems, understanding halal certification, how to obtain funds through financial institutions, and handling waste from SME operational activities.
- b. Understanding of business management conducted by SME participants is still mostly traditional in nature.
- c. Future improvements should involve institutions related to SMEs, such as financial institutions, halal certification institutions, or institutions related to digital systems, such as the Ministry of Communication and Information.

Training materials for future implementation should focus on direct practice and strengthening entrepreneurship motivation, so that participants can more easily understand and apply the knowledge gained into sustainable productive activities.

4. Conclusion

The implementation of this community service program has proven to be both timely and relevant, especially for participants with backgrounds in secondary education and early career stages. The data show a strong inclination among participants toward micro-scale, food-related businesses with limited access to capital and financial literacy. These characteristics highlight the strategic need for practical, contextual, and easily applicable training in recycling and entrepreneurship. The high percentage of business owners who have full autonomy in their operations also provides a favorable environment for the direct implementation of waste processing innovations, making the intervention more impactful in the short and long term.

Despite the overall positive feedback from participants regarding the program's materials, delivery, and benefits, several key challenges were identified. These include limited digital literacy, traditional business management practices, and minimal access to institutional support such as financial or halal certification bodies. Therefore, future iterations of the program must not only continue enhancing awareness and recycling skills but also build stronger institutional collaborations. More hands-on practice, mentorship, and integration with digital and regulatory frameworks will be crucial to empower community members toward achieving sustainable, waste-based entrepreneurship that contributes to environmental preservation and economic resilience.

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