



Green Innovation For Coastal Sustainability Through Plastic Waste Recycling

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Info Article Received : 20 Juni 2026 Revised : 11 Juli 2026 Accepted : 25 Juli 2026 Publication : 31 Juli 2026	Abstract: Plastic waste has become a major environmental challenge in the coastal areas of Kendari City due to increasing community activities and the widespread use of single-use plastics. This community service program aimed to improve public knowledge and awareness of circular economy-based plastic waste management while providing recycled products as educational media and waste management facilities. The program consisted of a preliminary survey, community outreach and education, production of recycled products, and distribution to partner institutions, including the Bungkutoko Village Office, Bungkutoko TPS3R, SD Negeri 89 Kendari, and the Faculty of Economics and Business, Halu Oleo University. Recycled products included trash bins made from wire frames and plastic bottles, flower pots from plastic bottles, and handicrafts from bottle caps. The program increased community knowledge and awareness of waste sorting and reuse, while strengthening community-based waste management facilities and supporting the implementation of circular economy principles in coastal areas.
Keywords: Plastic Bottle Waste; Circular Economy; Community Awareness; Coastal Areas.	
Kata Kunci: Limbah Botol Plastik; Circular Economy; Kesadaran Masyarakat; Pesisir.	
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	Abstrak: Permasalahan sampah plastik di wilayah pesisir Kota Kendari semakin meningkat akibat tingginya aktivitas masyarakat dan penggunaan plastik sekali pakai. Kegiatan pengabdian kepada masyarakat ini bertujuan meningkatkan pengetahuan dan kesadaran masyarakat tentang pengelolaan sampah plastik berbasis circular economy serta menyediakan produk daur ulang sebagai media edukasi dan sarana pengelolaan sampah. Kegiatan dilaksanakan melalui survei awal, sosialisasi dan edukasi, pembuatan produk daur ulang, serta penyerahan produk kepada mitra, yaitu Kantor Lurah Bungkutoko, TPS3R Bungkutoko, SD Negeri 89 Kendari, dan Fakultas Ekonomi dan Bisnis Universitas Halu Oleo. Produk yang dihasilkan meliputi keranjang sampah dari kawat dan botol plastik, pot tanaman dari botol plastik, serta kerajinan dari tutup botol plastik. Hasil kegiatan menunjukkan peningkatan pengetahuan dan kesadaran masyarakat dalam memilah serta memanfaatkan kembali sampah plastik, sekaligus memperkuat sarana pengelolaan sampah berbasis circular economy di wilayah pesisir.

INTRODUCTION

Plastic waste problems in Indonesia remain an environmental challenge that has yet to find a comprehensive solution. Indonesia generates approximately 3.22 million tons of plastic waste annually, with 0.48–1.29 million tons polluting the ocean, making plastic waste the second-largest contributor to national waste after organic waste (Syukur et al., 2025). However, only about 9% of this amount is successfully recycled by the community, while the remainder ends up in landfills or pollutes the open environment (Manalu et al., 2025).

The characteristics of plastic, which are difficult to decompose naturally, cause long-term accumulation that disrupts ecosystem balance (Cahyani et al., 2024). Recent studies indicate that microplastics have significantly polluted Indonesian coastal waters. Suryandari et al. (2025) found that microplastic abundance in the coastal waters of the North Coast of Central Java (83 particles/L) was significantly higher than plankton abundance (57 individuals/L), with microplastics sized ≤ 1 mm dominating (98% of total microplastics). Another study in Kaliratu waters, Kebumen, showed microplastic concentrations in sediments ranging from 25 to 57.5 particles/kg, with types found including fibers, fragments, films, and pellets (Endrawati et al., 2026). This emphasizes that plastic pollution is not just a waste accumulation problem but also a serious threat to marine ecosystems and food chains.

Recent studies have reported microplastic contamination in Indonesian coastal areas, indicating that plastic pollution has entered marine ecosystems and potentially the food chain (Mohd Fadil et al., 2026; Pratama et al., 2026). These findings highlight the urgent need for improved plastic waste management and community awareness, particularly in coastal areas such as Kendari City.

At the local level, Kendari City faces similar waste problems. Based on data from the Kendari City Environmental Agency, the city generates an average of 300 tons of waste daily, with only 190–200 tons transported to the Final Disposal Site (TPA), leaving approximately 100 tons of waste stored at Temporary Disposal Sites or around residential areas every day (Jaelani, 2026). This condition indicates that waste management in Kendari is still far from adequate and requires serious attention from various parties.

The factor exacerbating this situation is the low level of public awareness in sorting and managing waste, especially in densely populated urban areas. Education on waste management is still rarely conducted and has not become part of daily living habits (Sari et al., 2019). A community service program in Bengkulu City showed that public legal

knowledge about waste management was still low, increasing from 57% to 80% after education was provided (Fitri et al., 2025). Similarly, a study in Sinjai revealed that the root causes of low plastic waste utilization by poor households include low education levels, lack of skills, weak social networks, no access to financial institutions, and lack of collective awareness (Syukur et al., 2025).

One approach currently being widely developed in waste management is the circular economy concept. The circular economy is an economic system model that aims to minimize waste through the reuse of existing resources so that the cycle of material use can last longer (Geissdoerfer et al., 2017). A community service program in Manukan Wetan Urban Village, Surabaya, proved that the ecocraft approach through training in making recycled-based crafts is effective as an environmental education tool and an initial strategy in building a circular economy at the local level (Manalu et al., 2025). Similar results were also reported by Natsir et al. (2026) in Makassar City, where training in recycling plastic waste into craft products successfully increased community knowledge and skills and fostered motivation to develop environmentally-based creative economy businesses.

Previous community service programs have demonstrated the potential of plastic waste management to increase community participation and produce useful and economically valuable products (Fitri et al., 2025; Mulyati et al., 2025; Rante et al., 2026). However, these programs primarily focused on product development or waste bank management, while integrated efforts combining plastic waste utilization, environmental education, and behavioral change in coastal communities remain limited. Therefore, this program addresses this gap by promoting circular economy-based plastic waste management through community education and the development of recycled products in the coastal area of Kendari City.

The implementation of this community service program aligns with the Sustainable Development Goals (SDGs), particularly SDG 12 (Responsible Consumption and Production) on sustainable waste management (Fitri et al., 2025), SDG 13 (Climate Action) through efforts to reduce plastic pollution, and SDG 17 (Partnerships for the Goals) through collaboration between universities, local governments, and communities in sustainable environmental management (United Nations, 2015).

Based on these problems, this community service activity aims to enhance public knowledge and awareness of circular economy-based plastic waste management while providing recycled products as educational tools and waste management facilities.

METHOD

The implementation method of this community service activity was systematically designed to address plastic waste problems in the coastal area of Kendari City. The activity was conducted at four strategic locations: Bungkutoko Urban Village Office, TPS3R Bungkutoko, SD Negeri 89 Kendari, and the Faculty of Economics and Business, Halu Oleo University. The selection of these four locations was based on situational analysis results indicating that plastic waste problems occur in various areas and involve different community groups.

1. *Implementation Stages*

The activity was conducted through several stages as follows:

a. Preliminary Survey and Problem Identification Stage

This stage was conducted through field observations, direct interviews with the community, and coordination with village officials, TPS3R managers, school principals, and faculty leaders. This activity aimed to obtain a comprehensive overview of environmental conditions, the potential availability of plastic bottle waste, and the real needs of the community.

b. Socialization and Education Stage

Socialization was conducted at each location involving different target groups. A total of 66 participants participated, consisting of 15 participants at Bungkutoko Village Office, 1 TPS3R managers, 35 students and teachers at SD Negeri 89 Kendari, and 10 students at FEB UHO. The materials presented included: (1) the negative impacts of plastic waste on coastal environments and public health; (2) the circular economy concept and the principles of reduce, reuse, recycle; and (3) opportunities for utilizing plastic bottle waste and plastic bottle caps into environmentally friendly and economically valuable products. The socialization was conducted interactively through lectures, discussions, and question-and-answer sessions.

c. Recycled Product Production Stage

Recycled products were produced by the service team consisting of lecturers and students on campus. The products produced included:

1. Waste baskets from wire and plastic bottles (6 units)
2. Plant pots from plastic bottles (30 units)
3. Crafts from plastic bottle caps (1 units)

The production process began with the collection of plastic bottle waste and plastic bottle caps from various sources, followed by sorting, cleaning, and processing into finished products.

d. Product Handover Stage

Product handover was conducted at the four locations simultaneously with the socialization activities. These products were placed at strategic points as waste management facilities and environmental education media.

e. Evaluation Stage

Evaluation was conducted to assess the achievement of the program objectives through participant observation, interactive discussions, participant feedback, and observation of recycled product utilization. An observation checklist was used to assess community participation, including attendance, involvement in discussions, and participation in waste-sorting and recycling activities. Participant feedback obtained through discussions and question-and-answer sessions was used to assess changes in understanding of plastic waste management and the circular economy. The utilization of recycled products was evaluated through direct observation of their use as waste management, greening, and educational facilities. The evaluation results were assessed descriptively based on participation, understanding, and utilization indicators. Evaluation included the level of community participation, increased knowledge through discussions and participant feedback, and the utilization of recycled products.

2. *Approach Method*

The approach used in this program was a participatory approach based on community empowerment, involving community members according to their roles and capacities at each stage of the program. During the initial stage, community representatives participated in identifying local plastic waste management problems and determining the needs of each partner location. During the socialization stage, participants actively engaged in discussions, question-and-answer sessions, and sharing their experiences regarding plastic waste management. In the production stage, the community was introduced to the recycled products and provided input regarding their design, function, and suitability for local needs, while the technical production was carried out primarily by the community service team consisting of lecturers and students. Following product distribution, community members participated by using, maintaining,

and utilizing the recycled products as waste management and educational facilities. This approach encouraged community involvement not only as recipients of the program but also as partners in identifying problems, providing feedback, and sustaining the benefits of the activities. Schultz (2014) emphasized that behavioral change in environmental management can be supported through sustainable environmental education and active community participation.

3. Program Evaluation and Sustainability

Evaluation was conducted by assessing the level of community participation, changes in community knowledge, production results, and the utilization of recycled products. Program sustainability is planned through the establishment of community environmental care groups, continued assistance in developing plastic waste-based products, and strengthened collaboration with local governments and community organizations. These activities are proposed as follow-up initiatives to ensure the continuity of plastic waste management and circular economy practices beyond the implementation period of the current program.

RESULTS AND DISCUSSION

1. Results of the Initial Survey and Problem Identification

The survey results indicated that plastic waste was present at all four program locations. In the Bungkutoko coastal area, plastic bottle waste was observed along the coastline and in residential areas. Some unmanaged plastic waste was found in the surrounding environment, potentially affecting environmental quality and coastal ecosystems. Bergmann et al. (2015) showed that plastic waste in coastal tourism areas can reduce their attractiveness and potentially affect community income.

At SD Negeri 89 Kendari, plastic waste, especially mineral water plastic bottles, is largely generated from student activities consuming single-use packaged drinks. The lack of waste management facilities and low student understanding of the importance of waste management mean that plastic bottle waste is not yet reused. In the Faculty of Economics and Business, Halu Oleo University environment, the volume of plastic bottle waste is also quite high due to high academic activity. TPS3R Bungkutoko has potential as a waste collection center, but its processing capacity is still limited.



Figure 1. Documentation of the Initial Survey at the Activity Location

2. *Results of Socialization and Increased Public Knowledge*

The socialization activities involved 66 participants across the program locations, consisting of students, community members, and other partner representatives. Participant engagement was observed through active participation in discussions and question-and-answer sessions. The sessions covered plastic waste management, waste utilization, and practical ways to reduce plastic waste. At SD Negeri 89 Kendari, the socialization was specifically designed as an early environmental education activity, introducing students to plastic waste sorting, reuse, and recycling practices.



Figure 2. Documentation of Socialization at Bungkutoko Urban Village Office and SD Negeri 89 Kendari

The evaluation results indicated that participants reported an improved understanding of plastic waste management and the circular economy. During the discussions and question-and-answer sessions, participants demonstrated an understanding that plastic bottles and bottle caps could be reused to create value-added products. Participants also expressed their intention to sort plastic waste and reduce the use of single-use plastics. These findings suggest an increased awareness of plastic waste management following the socialization activities; however, sustained behavioral

changes could not be confirmed because no follow-up assessment was conducted after the program.

3. *Results of Recycled Product Production by the Service Team*

The service team consisting of lecturers and students carried out recycled product production activities on campus. The production process began with collecting plastic bottle waste and plastic bottle caps from various sources, then sorting, cleaning, and processing into finished products.

Figure 3 shows that students and lecturers of the service team produced waste baskets by utilizing wire as a frame and plastic bottles as decorative elements. Additionally, the process of making plant pots from plastic bottles involved students in cutting and decorating activities. Plastic bottle caps were also assembled into various craft products such as wall decorations.



Figure 3. Documentation of the Production Process of Waste Baskets from Wire and Plastic Bottles

The service team successfully produced three types of recycled products from plastic bottle waste and plastic bottle caps: waste baskets from wire and plastic bottles, plant pots from plastic bottles, and crafts from plastic bottle caps. Details of the products produced are presented in Table 1.

Table 1. Products Produced by the Service Team

No	Product Type	Quantity	Handover Location
1	Waste Basket	1 unit	Bungkutoko Urban Village Office
2	Waste Basket	1 unit	TPS3R Bungkutoko
3	Waste Basket	2 units	SD Negeri 89 Kendari
4	Waste Basket	2 units	Faculty of Economics and Business UHO
5	Plant Pots from Plastic Bottles	15 units	Bungkutoko Urban Village Office
6	Plant Pots from Plastic Bottles	15 units	Faculty of Economics and Business UHO
7	Crafts from Plastic Bottle Caps	1 unit	SD Negeri 89 Kendari

Source: Research data, 2026

Waste baskets were made using wire as the main frame and used plastic bottles as decorative elements. This combination produced baskets that are sturdy, attractive, and environmentally friendly. Plant pots were made by cutting the top of plastic bottles and decorating them to increase aesthetic value. Crafts from plastic bottle caps were assembled into various products such as tablecloths, key chains, and wall decorations.

4. Results of Product Handover to Partners

Product handover was conducted at the four locations simultaneously with the socialization activities. These products were placed at strategic points as waste management facilities and environmental education media.



Figure 4. Documentation of Product Handover at Bungkutoko Urban Village Office



Figure 5. Documentation of Product Handover at TPS3R Bungkutoko and SD Negeri 89 Kendari

The recycled products were handed over to partners at the four program locations and were subsequently utilized as waste management, greening, and visual educational facilities. Based on direct observation during the handover and subsequent use of the products, the partners accepted and utilized the products according to their intended functions. The products also provided visible examples of plastic waste reuse, helping demonstrate the practical application of circular economy principles in the community. This aligns with the research by Worm et al. (2017) which shows that visual and hands-on approaches are effective in increasing community environmental awareness.



Figure 6. Documentation of Product Handover at the Faculty of Economics and Business UHO

5. *Observed Outputs and Potential Impacts*

The implementation of the program resulted in several observable outputs and potential impacts at the four program locations:

a. Improved Understanding of Plastic Waste Management

Participants engaged in discussions and question-and-answer sessions on the circular economy, the environmental impacts of plastic waste, and the principles of reduce, reuse, and recycle. Participants also reported an improved understanding of plastic waste utilization. However, the extent of knowledge improvement was not quantitatively measured through pre-test and post-test assessments.

b. Availability of Waste Management Facilities

Six waste baskets made from wire frames and plastic bottles were produced and handed over to partners at the program locations. The facilities are intended to support proper waste disposal and plastic waste sorting and provide accessible points for community-based waste management.

c. Increased Environmental Awareness as an Initial Indication

During the socialization activities, participants expressed awareness of the importance of responsible plastic waste management and interest in reducing and reusing plastic waste. However, sustained changes in environmental behavior could not be confirmed because no follow-up monitoring was conducted.

d. Availability of Greening Facilities

Thirty plant pots made from used plastic bottles were produced and distributed to partner locations. The pots were utilized as greening facilities and visual educational media demonstrating the potential reuse of plastic waste.

Demonstration of Creative Plastic Waste Utilization

One craft product made from plastic bottle caps was produced as an example of transforming plastic waste into a value-added product. This product serves as a practical demonstration of creative reuse and the application of circular economy principles.

6. *Supporting Factors and Constraints*

Supporting Factors:

- a. **Abundant Waste Availability:** The four locations produce a fairly large volume of plastic bottle waste, serving as the basic capital for program development.
- b. **Community Participation:** A total of 66 participants attended the socialization activities across the four program locations, consisting of community members,

students, teachers, and partner representatives. The participation demonstrated community engagement in the plastic waste management program.

- c. Partner Support: Good cooperation with village government, TPS3R managers, schools, and faculty leaders facilitated activity coordination.
- d. Team Collaboration: The synergy between lecturers and students in producing recycled products went well.

Constraints:

- a. Limited Socialization Time: The limited time restricted the depth of material delivery and discussion.
- b. Limited Number of Products: The production capacity of the service team has not fully met the needs at the four locations.
- c. Need for Ongoing Assistance: The community still requires continuous assistance to ensure the utilization of products and sustainable behavioral change.

CONCLUSION

Based on the implementation of community service activities at four locations in Kendari City, participants showed positive responses and reported improved understanding of circular economy-based plastic waste management. The program also produced six waste baskets, thirty plant pots, and one craft item made from plastic bottle caps, which were handed over to partners as waste management and environmental education facilities. The activities provided an initial contribution to increasing community awareness and encouraging the reuse and sorting of plastic waste; however, sustained behavioral changes could not be confirmed due to the absence of systematic pre-test and post-test assessments and follow-up monitoring. Therefore, future programs should include more systematic evaluation and longer-term monitoring to assess changes in knowledge and behavior.

The program should be continued through training on processing plastic waste into economically valuable products, developing more diverse recycled products, forming community environmental care groups, and strengthening collaboration with local governments and other stakeholders. Future activities should also incorporate structured pre-test and post-test assessments and follow-up monitoring to evaluate the sustainability of knowledge and behavioral changes.

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