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Optimizing Plastic Waste Management Based on the 3R Principles through the Utilization of Plastic Shredding Machines: A Study of the Anugrah Agro Farmers Group in Lalolang Urban Village, Tanete Rilau District, Barru Regency

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ABSTRACT

This study examines plastic waste management based on the principles of Reduce, Reuse, and Recycle (3R) through a plastic shredding machine used by the Anugrah Agro Farmers Group in Lalolang Urban Village, Tanete Rilau District, Barru Regency, Indonesia. It focuses on the role of shredding technology, group participation, implementation practices, and factors influencing community-based waste management. A qualitative descriptive approach was employed. Participants comprised five individuals: Alamsyah Rahim, the group chairperson, and four members, namely Supu', Ami', Jumriah, and Ahmad. Data were collected through semi-structured interviews, direct observation, and documentation, and analyzed through data reduction, data display, and conclusion drawing and verification. The findings indicate that the machine provides the group with a facility to process collected plastic materials into smaller fragments. Photographic documentation shows the chairperson demonstrating the machine, alongside collected plastic bottles and a container of shredded plastic. The machine primarily supports the recycling component of the 3R approach by reducing material size before further processing. However, shredding alone does not complete recycling, because the resulting plastic flakes require appropriate handling and subsequent utilization. The sustainability of this initiative depends on member participation, technical skills, equipment maintenance, consistent supplies of sorted plastic, institutional support, and access to recycling markets. The study concludes that integrating appropriate technology with organizational capacity, waste prevention, and reuse practices is essential for strengthening community-based plastic waste management. Further assessment of processing volume, machine productivity, operating costs, and material sales is needed to establish the initiative's actual environmental and economic benefits for the group.

Keywords: Plastic Waste Management; 3R Principles; Plastic Shredding Machine; Community Participation; Recycling Technology.

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A. INTRODUCTION

Plastic waste management has become an important environmental issue due to the widespread use of plastic materials in household, agricultural, commercial, and industrial activities. Plastic products are widely used because they are lightweight, durable, inexpensive, and convenient for various purposes. However, these characteristics also make plastic waste difficult to decompose naturally and create long-term environmental challenges when it is not properly managed. The increasing accumulation of plastic waste can contribute to land and water pollution, disrupt ecosystems, and reduce environmental quality. Geyer et al. (2017) estimated that approximately 6,300 million metric tons of plastic waste had been generated globally by 2015, with only around 9% recycled.

This situation demonstrates that plastic waste management cannot rely solely on collection and final disposal but requires systematic efforts to reduce waste generation and recover materials. One approach that has gained increasing attention is the application of the 3R principles, namely Reduce, Reuse, and Recycle, as a foundation for more sustainable waste management. Through these principles, plastic waste can be viewed not merely as an environmental burden but also as a resource that can potentially be processed and returned to productive use.

At the global level, plastic pollution has become a major concern in discussions on sustainable development, circular economy, and environmental protection. The Organisation for Economic Co-operation and Development (OECD, 2022) reported that global plastic waste reached approximately 353 million tonnes in 2019, while only 9% was ultimately recycled.These figures indicate a substantial gap between plastic consumption and the capacity of existing waste management systems to recover discarded materials. The United Nations Environment Programme (UNEP, 2023) emphasizes that addressing plastic pollution requires systemic transformation through reducing unnecessary plastic consumption, expanding reuse systems, and improving recycling practices.

Such transformation requires the involvement of governments, businesses, communities, and local organizations in developing practical and inclusive waste management initiatives. In addition, the World Bank highlights that increasing waste generation requires improvements in

collection, sorting, recycling infrastructure, financing, and community participation (Kaza et al., 2018).Therefore, the development of accessible recycling technologies at the community level is relevant to broader efforts to establish circular material flows and reduce the environmental impacts of plastic waste.

In Indonesia, plastic waste management is an important component of national environmental policy and community-based development. Law of the Republic of Indonesia Number 18 of 2008 concerning Waste Management establishes a comprehensive framework for waste management and emphasizes the shared responsibilities of central government, local governments, communities, and businesses.

This framework is further supported by Government Regulation Number 81 of 2012 concerning the Management of Household Waste and Similar Household Waste, which provides direction for waste reduction and handling activities.Presidential Regulation Number 97 of 2017 also establishes the National Policy and Strategy for the Management of Household Waste and Similar Household Waste, including national targets for waste reduction and handling. Data presented through Indonesia's National Waste Management Information System (SIPSN) identify plastic as one of the significant components of the national waste stream, although the reported composition varies by region and reporting year.

This national context highlights the importance of translating waste management policies into practical activities at the village and community levels. In Lalolang Urban Village, Tanete Rilau District, Barru Regency, the Anugrah Agro Farmers Group provides a relevant community setting for examining how appropriate technology can support local plastic waste management initiatives.Despite the existence of national policies promoting waste reduction and recycling, implementing these principles at the community level may encounter practical and institutional challenges. Plastic waste needs to be separated according to material type, cleaned, stored, and processed before it can be used as a recyclable resource. Without adequate facilities and processing equipment, collected plastic waste may remain in storage, be disposed of through inappropriate methods, or have limited economic value. The availability of a plastic shredding machine can help address one of these challenges by reducing plastic materials into smaller pieces that are easier to handle, store, transport, and supply to subsequent recycling processes. Nevertheless, the presence

of machinery alone does not automatically ensure effective waste management because its operation requires technical knowledge, maintenance, electricity, appropriate sorting procedures, and a consistent supply of recyclable materials. Community groups also need organizational arrangements to distribute responsibilities, maintain equipment, and identify potential markets or partners for processed plastic. In this context, the central research problem concerns how the Anugrah Agro Farmers Group can utilize a plastic shredding machine to support the implementation of the 3R principles and what factors influence the effectiveness of this initiative. This issue is important because technology-based waste management needs to be understood not only from its technical operation but also from the perspectives of community participation, institutional capacity, and environmental sustainability.

Previous studies have demonstrated that plastic recycling requires an integrated process involving material identification, sorting, cleaning, size reduction, and further processing. Hopewell et al. (2009) explain that recycling can reduce the environmental burden associated with plastic disposal while recovering materials for productive applications, although technical and economic barriers remain.Similarly, Al-Salem et al. (2009) identify mechanical recycling as one of the principal routes for recovering plastic solid waste and emphasize the importance of selecting appropriate treatment methods according to material characteristics. Ragaert et al. (2017) further explain that mechanical recycling involves several processing stages, including sorting and size reduction, while the quality of recycled materials is influenced by contamination, polymer compatibility, and material degradation. More recent research by Jiang and Bateer (2025) reviews different plastic recycling technologies and highlights the continuing challenges associated with sorting efficiency, cleaning processes, energy consumption, and economic feasibility.

These studies provide an important foundation for understanding the technical role of plastic shredding machines within the mechanical recycling process. However, the effectiveness of such equipment also depends on the capacity of local organizations to manage operations and connect processed materials with appropriate recycling activities. Consequently, examining the utilization of shredding technology within a community-based organization can contribute to understanding the relationship between technological intervention and local waste management practices.

Although previous studies have extensively discussed plastic recycling technologies and the environmental benefits of material recovery, further attention is needed to understand how these technologies are adopted and managed by small community organizations. Much of the existing literature focuses on industrial recycling processes, material characteristics, technological efficiency, and the environmental performance of recycling systems. Comparatively, the organizational and practical dimensions of operating plastic shredding machines within local community groups require further examination. In particular, the relationship between the use of shredding equipment and the implementation of the three 3R principles needs to be explored in a specific local context. The Anugrah Agro Farmers Group offers an opportunity to examine this relationship through the involvement of its chairperson, Alamsyah Rahim, and its members, Supu', Ami', Jumriah, and Arsi. The novelty of this study lies in its focus on the utilization of plastic shredding technology as part of community-based waste management, rather than treating the machine solely as a technical instrument. It also considers the organizational roles, participation, operational challenges, and potential environmental and economic benefits associated with the application of the 3R principles. Thus, the study seeks to connect technological utilization with community empowerment and the development of more practical waste management practices at the local level.

Based on the background and research gap, this study aims to analyze the optimization of plastic waste management based on the 3R principles through the utilization of a plastic shredding machine by the Anugrah Agro Farmers Group in Lalolang Urban Village, Tanete Rilau District, Barru Regency. Specifically, it examines how the group implements the principles of Reduce, Reuse, and Recycle in its plastic waste management activities. It also investigates the role of the plastic shredding machine in supporting the processing of collected plastic materials into smaller and more manageable forms. Furthermore, the study explores the participation and responsibilities of the group chairperson and members in operating and managing the equipment. Another objective is to identify the supporting and inhibiting factors affecting the implementation of technology-based plastic waste management. The study also examines the potential environmental and economic benefits that may arise from the recycling process, without assuming that such benefits have already been achieved. Through these objectives, the research is expected to provide

an empirical understanding of the interaction between appropriate technology, community participation, and local waste management practices.

This study is expected to contribute to the development of community-based plastic waste management by providing insights into the practical application of shredding technology within a local farmers' organization. From an academic perspective, it may enrich discussions on environmental management, community empowerment, appropriate technology, and the implementation of the circular economy at the local level. From a practical perspective, the findings may provide useful information for the Anugrah Agro Farmers Group in improving equipment operation, organizing member participation, and strengthening the management of recyclable plastic materials. The study may also offer considerations for village governments and related institutions in supporting community initiatives through training, infrastructure, technical assistance, and partnerships with recycling businesses. Its scope is limited to the activities and experiences of the Anugrah Agro Farmers Group in Lalolang Urban Village, particularly those related to the use of a plastic shredding machine and the implementation of the 3R principles. The analysis therefore focuses on the group's management practices, technological utilization, participation, and perceived or documented outcomes, depending on the evidence collected during the research. By examining these aspects, the study seeks to identify opportunities for strengthening the role of community organizations in reducing plastic waste and supporting more sustainable local environmental management. Ultimately, the research is expected to provide a context-specific reference for developing practical, participatory, and technology-supported plastic waste management initiatives in rural and urban communities.

B.RESEARCH METHODS

This study employed a qualitative descriptive approach to examine the optimization of plastic waste management based on the 3R principles through the utilization of a plastic shredding machine. The research was conducted at the Anugrah Agro Farmers Group, located in Lalolang Urban Village, Tanete Rilau District, Barru Regency, South Sulawesi, Indonesia. A qualitative approach was selected to obtain an in-depth understanding of the group's practices, experiences, and challenges in implementing plastic waste management activities. The research focused on the application of the Reduce, Reuse, and Recycle principles, the utilization of plastic shredding

technology, community participation, and the potential environmental and economic benefits of the initiative. The research participants consisted of the group chairperson, Alamsyah Rahim, and four members, namely Supu', Ami', Jumriah, and Ahmad. These participants were selected purposively because of their direct involvement in the group's activities and their knowledge of plastic waste management practices.

Data were collected through semi-structured interviews, direct observation, and documentation. Interviews were conducted with the chairperson and members of the Anugrah Agro Farmers Group to explore their understanding of the 3R principles, experiences in operating the plastic shredding machine, distribution of responsibilities, and challenges encountered during implementation. Direct observation was used to examine the operational process of the machine, including plastic waste collection, sorting, preparation, shredding, and the handling of processed materials. Documentation included relevant photographs, activity records, and other available documents related to the group's plastic waste management activities. Data triangulation was applied by comparing information obtained from interviews, observations, and documentation to improve the credibility of the research findings. This process also helped identify differences between participants' statements and the actual practices observed in the field.

Data were analyzed using an interactive qualitative analysis process consisting of data reduction, data display, and conclusion drawing and verification. During data reduction, information from interviews, observations, and documentation was selected, organized, and categorized according to the research objectives. The data were then displayed descriptively to identify patterns related to the implementation of the 3R principles, the utilization of plastic shredding technology, member participation, and supporting and inhibiting factors. The analysis also examined the relationship between technological utilization and the group's efforts to improve the management of recyclable plastic materials. Conclusions were developed by interpreting the identified patterns and verifying them against the collected evidence. Through this process, the study aimed to provide a comprehensive understanding of how the Anugrah Agro Farmers Group utilizes plastic shredding technology to support community-based plastic waste management.

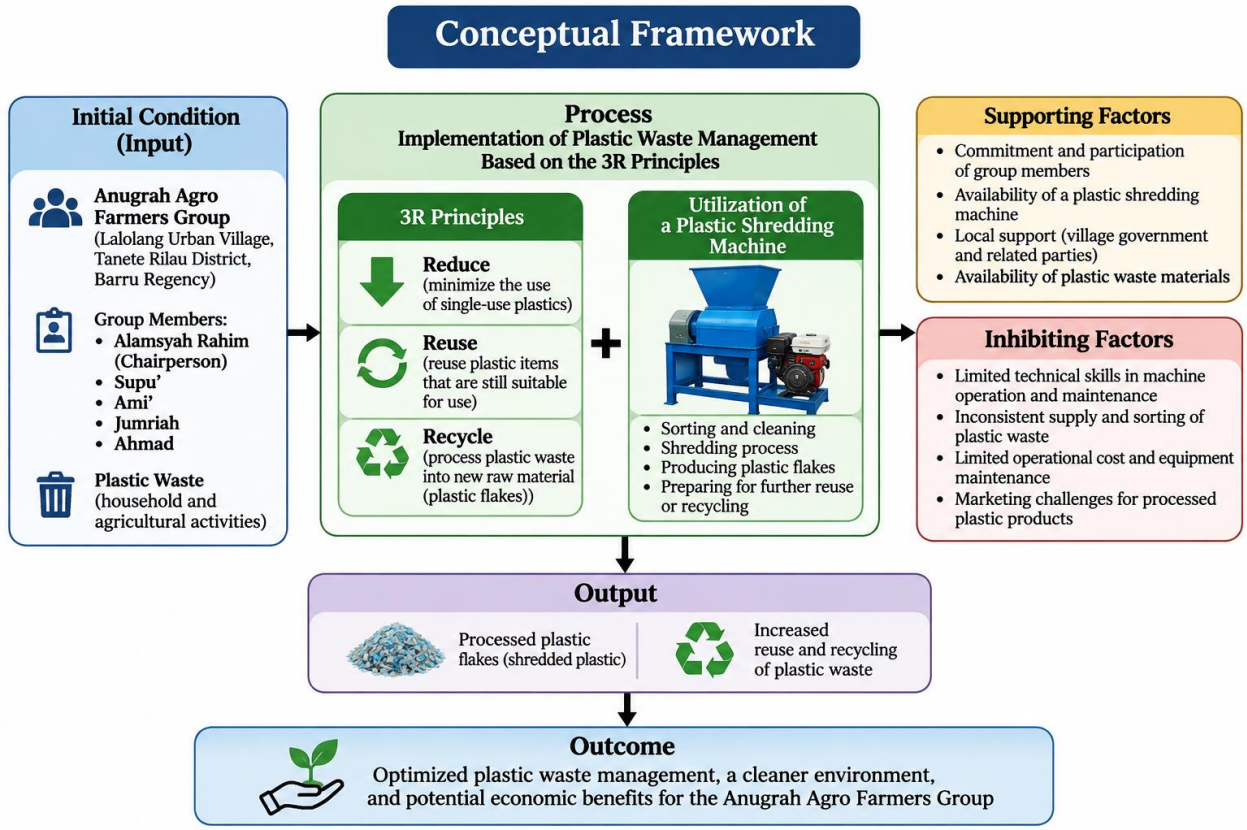


Figure 1 Conceptual Framework for Optimizing Plastic Waste Management Based on the 3R Principles through the Utilization of Plastic Shredding Machines.

The conceptual framework illustrates the relationship between the initial conditions, implementation process, supporting and inhibiting factors, and expected outcomes of plastic waste management in the Anugrah Agro Farmers Group, located in Lalolang Urban Village, Tanete Rilau District, Barru Regency. The process begins with the availability of plastic waste and the participation of group members, followed by the implementation of the three principles of Reduce, Reuse, and Recycle, supported by the utilization of a plastic shredding machine. The machine facilitates the sorting, cleaning, and shredding of plastic materials into smaller flakes that can be prepared for further reuse or recycling. The implementation process is influenced by supporting factors, such as member commitment, equipment availability, and local institutional support, as well as inhibiting factors, including limited technical skills, operational costs, equipment maintenance, and marketing challenges. These processes are expected to generate processed plastic materials and increase recycling activities, ultimately contributing to more effective plastic

waste management, a cleaner environment, and potential economic benefits for the Anugrah Agro Farmers Group.

C.RESEARCH RESULTS AND DISCUSSION

- Results

The research was conducted at the Anugrah Agro Farmers Group, located in Lalolang Urban Village, Tanete Rilau District, Barru Regency, South Sulawesi, Indonesia. The group represents a community-based initiative focusing on the utilization of plastic waste through the application of the 3R principles: Reduce, Reuse, and Recycle. The research participants consisted of five individuals: Alamsyah Rahim as the group chairperson and four members, namely Supu', Ami', Jumriah, and Ahmad. Their involvement provides an opportunity to examine how community members participate in managing plastic waste through the use of appropriate technology. The research focuses particularly on the utilization of a plastic shredding machine as a tool for processing collected plastic materials. This initiative is relevant to local environmental management because plastic waste requires appropriate handling to prevent accumulation and environmental pollution. The group's activities also reflect an effort to connect environmental awareness with the productive utilization of recyclable materials. Therefore, the Anugrah Agro Farmers Group provides a relevant setting for examining community-based plastic waste management.

The initial conditions of plastic waste management in the research location can be examined through the availability of plastic waste materials and the group's capacity to process them. The photographic documentation shows several used plastic bottles collected and placed near the plastic shredding machine. These materials represent potential recyclable resources that can be processed further rather than being immediately discarded. The presence of collected plastic bottles also illustrates the importance of sorting and preparing waste before it enters the recycling process. In this context, plastic waste management requires not only collection activities but also appropriate equipment and operational procedures. The use of a shredding machine provides an alternative for reducing the size of plastic materials and facilitating their subsequent handling. However, the volume of plastic waste generated and the group's collection capacity require further

examination through field records and interviews. This initial condition establishes the basis for analyzing the role of technology in supporting the group's waste management activities.

The utilization of a plastic shredding machine represents an important component of the group's efforts to improve plastic waste processing. As shown in Figure 2, the machine consists of a feeding hopper, a shredding unit, a supporting frame, and a motor-driven operating mechanism. The machine is designed to receive plastic materials through its upper opening and process them into smaller pieces. The photographic documentation shows Alamsyah Rahim, the chairperson of the Anugrah Agro Farmers Group, demonstrating the equipment. This demonstration provides visual evidence of the group's access to plastic shredding technology and the chairperson's involvement in introducing or presenting the equipment. The machine is expected to facilitate the processing of collected plastic materials and prepare them for further recycling activities. Nevertheless, its actual processing capacity, operating speed, and energy consumption need to be established through direct technical measurements. Thus, the equipment's utilization should be assessed not only through its physical availability but also through its operational performance and contribution to the recycling process.



Figure 2 The Head of the Anugrah Agro Farmers Group, Mr. Alamsyah Rahim, Demonstrates the Use of a Plastic Shredding Machine

The Reduce principle emphasizes efforts to minimize the generation of plastic waste, particularly through reducing the use of unnecessary single-use plastic products. In the context of the Anugrah Agro Farmers Group, this principle is relevant to developing awareness among members and the surrounding community regarding responsible plastic consumption. Reducing plastic waste begins with changes in consumption behavior, including limiting unnecessary plastic packaging and choosing reusable alternatives whenever possible. The availability of a plastic shredding machine does not directly implement the reduction principle because the machine primarily processes plastic waste that has already been generated. Therefore, the application of Reduce needs to be supported by preventive activities before plastic materials become waste. Community education and the involvement of group members can provide a foundation for encouraging more responsible consumption practices. The integration of waste reduction activities with recycling technology can create a more comprehensive approach to plastic waste management. Consequently, the implementation of this principle needs to be evaluated through the group's actual waste reduction activities and changes in member behavior.

The Reuse principle focuses on extending the useful life of plastic products by using them again without necessarily undergoing a major processing procedure. Within the activities of the Anugrah Agro Farmers Group, this principle can be implemented by identifying plastic materials that remain suitable for reuse before deciding to process them through the shredding machine. Plastic containers, bottles, and other materials that are still functional may be separated and utilized for appropriate purposes. This approach is important because not all collected plastic waste needs to be immediately shredded or recycled. Sorting materials according to their condition and potential use can help prevent unnecessary processing and improve the efficiency of waste management activities. The reuse principle also encourages group members to develop practical solutions for reducing the amount of plastic waste requiring further treatment. Its implementation therefore requires awareness, material identification skills, and cooperation among members. The extent to which the group has implemented these activities should be established through interviews and observations of its actual practices.

The Recycle principle is the most directly connected to the utilization of the plastic shredding machine because it involves processing discarded plastic materials into forms that can be used in subsequent recycling activities. The machine provides a mechanical process for

reducing the size of selected plastic materials, particularly used plastic bottles and other suitable plastic products. Before shredding, the materials need to be sorted and cleaned to reduce contamination and improve the quality of the resulting plastic flakes. The shredding process then produces smaller plastic pieces that can be collected, stored, and prepared for further processing. These flakes may become raw materials for other recycling activities, depending on their polymer type, cleanliness, and the availability of appropriate processing partners. The machine therefore serves as an intermediate processing facility rather than a complete recycling system. Further processing and the availability of recycling markets are necessary to ensure that the shredded materials are actually converted into new products. Accordingly, the effectiveness of the recycling process depends on the integration of collection, sorting, shredding, storage, and subsequent material recovery.

Community participation is an important factor in the implementation of technology-based plastic waste management. In the Anugrah Agro Farmers Group, Alamsyah Rahim serves as the chairperson, while Supu', Ami', Jumriah, and Ahmad are members involved in the group's activities. The chairperson has an important organizational role in coordinating activities, facilitating communication, and encouraging members to participate in the management of plastic waste. Meanwhile, members can contribute through activities such as collecting plastic materials, sorting waste, preparing materials for processing, assisting machine operations, and managing the resulting plastic flakes. The distribution of responsibilities is necessary to ensure that the equipment can be utilized effectively and safely. In addition, participation should extend beyond machine operation to include planning, maintenance, monitoring, and the development of recycling partnerships. The involvement of all members can support the continuity of the group's activities and strengthen collective responsibility for environmental management. However, the specific roles and participation levels of each member need to be confirmed through individual

The implementation of plastic waste management through shredding technology may be influenced by several supporting and inhibiting factors. Supporting factors include the availability of the plastic shredding machine, the commitment of group members, access to recyclable plastic materials, and potential support from the local government and other relevant institutions. The photographic documentation indicates that the group has access to shredding equipment and has collected plastic bottles as materials for processing. These conditions provide an initial foundation

for implementing community-based recycling activities. However, several challenges may arise, including limited technical knowledge, difficulties in maintaining the machine, operational costs, inconsistent supplies of recyclable materials, and limited access to recycling markets. Equipment availability alone cannot guarantee sustainable implementation without adequate technical assistance and organizational management. Training in machine operation, safety procedures, material sorting, and equipment maintenance may therefore be necessary. Identifying these factors through interviews with Alamsyah Rahim and the four group members is important for developing strategies that correspond to the group's actual needs.

The utilization of a plastic shredding machine has the potential to generate environmental and economic benefits for the Anugrah Agro Farmers Group. From an environmental perspective, processing plastic waste can support efforts to reduce the accumulation of discarded plastic materials and encourage more responsible waste management practices. Shredding can also make selected plastic materials easier to store and transport for further recycling. From an economic perspective, plastic flakes may have potential market value if they meet the requirements of recycling businesses or other processing industries. This creates an opportunity for the group to develop productive activities based on recyclable materials. Nevertheless, these potential benefits depend on the quality and quantity of processed plastic, operating costs, transportation expenses, and the availability of buyers. The economic feasibility of the activity should therefore be assessed by comparing processing costs with the actual selling price of the resulting materials. In addition, environmental benefits need to be evaluated through evidence of waste reduction and the proper management of residual materials. Consequently, the expected benefits should be distinguished from outcomes that have already been demonstrated through field measurements and financial records.

Optimizing plastic waste management within the Anugrah Agro Farmers Group requires an integrated approach that combines the 3R principles, appropriate technology, and active community participation. The plastic shredding machine provides an important facility for supporting the recycling component of the group's activities, but its effectiveness depends on the availability of recyclable materials, the technical capacity of operators, and proper equipment maintenance. The group also needs clear operational procedures covering waste collection, sorting, cleaning, shredding, storage, and the distribution or sale of processed plastic materials.

Furthermore, strengthening the Reduce and Reuse principles is necessary to ensure that plastic waste management does not depend exclusively on mechanical processing. Cooperation with village government institutions, environmental organizations, and recycling businesses may also help improve technical support and market access. Regular monitoring should be conducted to assess the volume of plastic collected, the quantity processed, machine performance, operating costs, and the utilization of the resulting plastic flakes. Through these measures, the Anugrah Agro Farmers Group has the opportunity to develop a more organized and sustainable community-based plastic waste management system. The overall success of this initiative should ultimately be evaluated using documented environmental, operational, and economic outcomes.

- Discussion

The findings highlight the potential role of plastic shredding technology in strengthening community-based waste management through the application of the Reduce, Reuse, and Recycle (3R) principles within the Anugrah Agro Farmers Group in Lalolang Urban Village, Tanete Rilau District, Barru Regency. The availability of a plastic shredding machine, as illustrated in Figure 2, demonstrates an initial technological capacity to support the mechanical processing of collected plastic materials. The machine can facilitate the reduction of plastic waste into smaller fragments, making the materials easier to handle, store, transport, and prepare for subsequent recycling processes. This finding is consistent with Ragaert et al. (2017), who explain that mechanical recycling involves several interconnected stages, including sorting, size reduction, washing, and further material processing. However, plastic shredding should not be interpreted as a complete recycling process because shredded materials require additional treatment before they can be transformed into new products. Within the 3R framework, the machine primarily supports the Recycle component, while Reduce and Reuse require complementary activities aimed at preventing waste generation and extending the useful life of plastic products. Therefore, optimizing plastic waste management requires the integration of technological utilization with waste prevention, material separation, and responsible consumption practices.

The implementation of plastic shredding technology also highlights the importance of organizational capacity and community participation in sustaining environmental management initiatives. The Anugrah Agro Farmers Group, chaired by Alamsyah Rahim and comprising Supu',

Ami', Jumriah, and Ahmad as research participants, provides an organizational setting for examining the relationship between technology and collective action. The photographic documentation of Alamsyah Rahim demonstrating the plastic shredding machine illustrates the chairperson's involvement in presenting the equipment as part of the group's waste management initiative. Nevertheless, the sustainability of machine utilization depends on more than leadership involvement, as effective operations require member participation, technical competencies, equipment maintenance, and clearly defined responsibilities. Hopewell et al. (2009) emphasize that plastic recycling faces technical and economic challenges, including material contamination, collection efficiency, and the quality of recyclable materials. These considerations suggest that community-based recycling activities should be supported by appropriate training, operational procedures, and reliable arrangements for collecting and sorting plastic waste. Strengthening organizational coordination among group members may also improve the continuity of activities and facilitate partnerships with recycling businesses and relevant government institutions. Consequently, the effectiveness of technology-based waste management should be evaluated through both technical performance and the capacity of the community organization to maintain its operations.

The potential environmental and economic contributions of plastic shredding technology should be understood within the broader framework of sustainable resource management and the circular economy. The collected plastic bottles shown in the research documentation represent materials that could be diverted from disposal and prepared for further recycling through mechanical size reduction. However, the environmental benefits of this activity depend on whether the shredded plastic is subsequently recovered and used as a secondary raw material rather than being discarded. Similarly, the potential economic value of plastic flakes depends on material quality, processing costs, transportation expenses, market demand, and access to recycling businesses. The United Nations Environment Programme (UNEP, 2023) emphasizes that reducing plastic pollution requires systemic changes that integrate waste prevention, reuse, recycling, and the development of viable circular business models.

This perspective suggests that the Anugrah Agro Farmers Group could strengthen its waste management initiative by establishing partnerships with recycling businesses and developing a more organized system for collecting and processing plastic materials. Nevertheless, the available

research documentation does not provide quantitative evidence regarding the amount of plastic processed, operational efficiency, or income generated from recycling activities. Therefore, the environmental and economic contributions of the initiative should be interpreted as potential benefits requiring further verification through operational records and economic assessment.

Overall, the discussion indicates that optimizing plastic waste management through shredding technology requires an integrated strategy involving technological capacity, organizational participation, institutional support, and consistent implementation of the 3R principles. The availability of a plastic shredding machine provides an important foundation for strengthening the recycling component of waste management within the Anugrah Agro Farmers Group. However, the long-term sustainability of this initiative depends on the group's ability to establish clear operational procedures, improve technical skills, maintain equipment, and ensure the availability of suitable plastic materials. The involvement of Alamsyah Rahim as chairperson and Supu', Ami', Jumriah, and Ahmad as members provides an organizational basis for examining how responsibilities can be distributed and collective participation strengthened. Collaboration with local government institutions, environmental agencies, and recycling businesses could further support technical assistance, capacity development, and access to markets for processed materials. Regular evaluation should include indicators such as the quantity of collected and shredded plastic, machine operating costs, equipment maintenance, member participation, and the actual utilization of processed materials. These indicators would enable a more objective assessment of the initiative's effectiveness and help distinguish demonstrated achievements from expected outcomes. Accordingly, the study highlights the potential contribution of appropriate technology to community-based environmental management while emphasizing that sustainable results depend on the integration of technical, organizational, environmental, and economic considerations.

D. CONCLUSION AND RECOMMENDATIONS

- Conclusion

This study highlights the potential of plastic shredding technology in supporting the optimization of community-based plastic waste management through the implementation of the 3R principles within the Anugrah Agro Farmers Group in Lalolang Urban Village, Tanete Rilau

District, Barru Regency. The availability of a plastic shredding machine provides an important facility for processing collected plastic waste into smaller fragments, making the materials easier to handle, store, and prepare for further recycling. The involvement of Alamsyah Rahim as the group chairperson, together with Supu', Ami', Jumriah, and Ahmad as members, represents an organizational foundation for implementing technology-based environmental management activities. In this context, the utilization of the machine primarily supports the Recycle principle, while the implementation of Reduce and Reuse requires complementary efforts through waste prevention, responsible consumption, and the reuse of suitable plastic materials.

The sustainability of plastic waste management activities depends not only on the availability of shredding equipment but also on technical capacity, active member participation, equipment maintenance, institutional support, and access to recycling markets. The resulting plastic flakes have the potential to become secondary raw materials for further processing, although their actual environmental and economic benefits depend on the quality, quantity, and subsequent utilization of the materials. Therefore, the optimization of plastic waste management requires an integrated approach that connects appropriate technology with organizational strengthening and sustainable recycling practices. This study emphasizes that community-based plastic waste management can become more effective when technological facilities are accompanied by continuous capacity development, collective responsibility, and cooperation with relevant stakeholders.

- Recommendations

The Anugrah Agro Farmers Group should strengthen its operational management by developing standard procedures for plastic collection, sorting, cleaning, shredding, storage, and equipment maintenance. Regular technical training should be provided to improve members' skills in operating the machine safely and efficiently, while clear task distribution should encourage active participation among all group members. The local government and relevant institutions are also expected to provide continuous technical assistance, institutional support, and opportunities for collaboration with plastic recycling businesses. Furthermore, the group should establish partnerships with potential buyers of shredded plastic materials to improve the economic feasibility of its activities. Future research should measure the volume of plastic waste processed,

machine productivity, operational costs, and potential revenue to provide more comprehensive evidence of the environmental and economic contributions of this initiative.

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