

Comparative Study of Plastic Waste Management in ASEAN Countries

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ABSTRACT

Background. This research departs from the problem of increasing the volume of plastic waste in ASEAN countries which has a serious impact on the environment and human health.

Purpose. The purpose of this study is to understand the differences in approaches and effectiveness of plastic waste management in various ASEAN countries, as well as to explore the factors that affect the success of these management.

Method. This study uses a comparative descriptive method by analyzing secondary data from various reliable sources related to policies, infrastructure, and the level of community participation in plastic waste management in ASEAN countries.

Results. The results show that countries with strong government policy support, advanced technology, and high community participation, such as Singapore, tend to be more successful in managing plastic waste. In contrast, countries with limited infrastructure and lack of public awareness face challenges in reducing plastic waste.

Conclusion. The conclusion of this study emphasizes the importance of a cross-sectoral collaborative approach and the adoption of innovative technologies to improve the effectiveness of plastic waste management in ASEAN. This research is expected to be a reference for policymakers in ASEAN to design a more holistic and sustainable plastic waste management strategy.

KEYWORDS

ASEAN, Plastic Waste, Waste Management

INTRODUCTION

The study of plastic waste management has become an increasingly important topic in the world, especially in ASEAN countries (Mazhandu et al., 2024). Plastic waste, as part of global environmental problems, has a significant negative impact on marine and terrestrial ecosystems, human health, and food security (D. Yadav et al., 2024). In ASEAN, which has a large population and rapid economic growth, the volume of plastic waste continues to increase, adding to the pressure on the suboptimal waste management system. This condition requires effective policies and practices in managing and reducing the impact of plastic waste (Tee Madeline & Sy Charlle, 2023).

Previous research has shown that ASEAN countries

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Singapore, have successfully developed more advanced waste management systems with high recycling rates (Sai et al., 2024). On the other hand, several other countries in the region are still grappling with inadequate waste management systems, which causes a lot of plastic waste to end up in the natural environment, particularly in rivers and seas (Chasioti & Zabaniotou, 2024).

Plastic waste management efforts in ASEAN involve various parties, including the government, the private sector, and the community (Yu et al., 2023). Government policies, such as banning the use of single-use plastics and incentives for recycling, are important steps in reducing plastic waste (Saputro et al., 2023). However, the implementation of this policy faces major challenges, especially in countries with limited waste management infrastructure and low public awareness (Choi et al., 2024).

As a region rich in biodiversity, ASEAN faces a major threat from plastic waste that pollutes natural habitats (Phuang Zhen Xin et al., 2023). Plastics that decompose into microplastics can pollute the food chain, harmful to the health of living things, including humans (Thanh et al., 2024). ASEAN countries that have large sea areas and fisheries-based economies are very vulnerable to the negative impact of plastic waste, so this issue also has an impact on economic resilience and livelihoods of coastal communities (Waszczyłko-Miłkowska et al., 2024).

A comparative study on plastic waste management in ASEAN countries is important to understand the effectiveness of various approaches implemented in each country (Vuppaladadiyam et al., 2024). By knowing the strengths and weaknesses of each approach, ASEAN can learn from each other and create more holistic and sustainable solutions. Cross-border collaboration in sharing technology, knowledge, and experience will be key to overcoming the challenges of plastic waste in the region (Waszczyłko-Miłkowska & Bernat, 2024).

This study not only aims to analyze best practices in plastic waste management in ASEAN but also to provide policy recommendations that can be applied across the region (Pereira et al., 2024). It is hoped that the results of this study will provide insights for policymakers and encourage concrete actions in addressing the plastic waste crisis, creating a cleaner and safer environment for future generations (Chook et al., 2024).

An in-depth understanding of the effectiveness of plastic waste management approaches in ASEAN countries is still limited. Although countries in the region have implemented plastic waste management policies, comparative data on the success of these policies is rarely available (Ono et al., 2023). Information on how each country handles differences in infrastructure capacity, regulations, and community participation in plastic waste management is also minimal, making it difficult to assess the sustainability of the practices implemented (Aracil et al., 2023).

The lack of comparative research reviewing plastic waste management in ASEAN creates a knowledge gap regarding the long-term impact of various policies taken (Patil & Kubade, 2024). Various countries may have made progress in lowering the amount of plastic waste, but there is not enough data to determine the main factors that contribute to success or failure. This information is important for understanding how social, economic, and cultural factors affect the effectiveness of waste management systems (Chaine et al., 2023).

The differences in characteristics and situations of ASEAN countries also add complexity in understanding best practices that can be applied broadly (Saleem et al., 2023). An effective plastic waste management system in one country may not necessarily work in another country due to differences in population, level of industrialization, and infrastructure support. Thus, more detailed mapping is still needed to see what can be adapted or modified in different countries (Anwar et al., 2023).

The absence of a comprehensive study comparing plastic waste management in ASEAN poses a challenge in determining relevant success indicators (Prabawati et al., 2023). The standards for the success of plastic waste management tend to vary from country to country, making it difficult to measure achievement objectively. This results in difficulties in determining the most effective plastic waste management methods or strategies to be applied regionally (Ezeudu et al., 2024).

Limited information on the outcomes and implications of various plastic waste management policies implemented in ASEAN countries makes it difficult for policymakers and practitioners to determine the most appropriate approach. This research aims to fill this gap, so that accurate data-based guidance can be obtained for all ASEAN countries in overcoming the problem of plastic waste (Ghani, 2024).

The increasing volume of plastic waste in the ASEAN region demands a more effective and structured approach to waste management. This comparative study is important to understand best practices in each country and identify the most efficient and widely adaptable methods. This research is also expected to make a real contribution in reducing the negative impact of plastic waste on the environment and public health.

This research aims to explore and analyze the approaches applied in ASEAN countries, with the hope of finding a more holistic solution for plastic waste management. This comparison will not only help identify the successes and challenges faced by each country, but also provide insights for ASEAN in building stronger regional collaboration to address these issues. This research can be the foundation for more effective environmental policies at the regional level.

It is hoped that this study will produce policy recommendations that can be applied in all ASEAN countries, both in the form of regulations, infrastructure improvements, and public awareness campaigns. The establishment of a comprehensive data-driven policy will help ASEAN countries in taking more appropriate and measurable steps in plastic waste management, creating a cleaner, healthier, and more sustainable environment in the future.

RESEARCH METHODS

This study uses a comparative descriptive research design to analyze the differences and similarities in plastic waste management in various ASEAN countries (Auxier et al., 2023). The comparative descriptive approach allows researchers to understand how each country implements plastic waste management policies, as well as evaluate the effectiveness and impact of those policies (Abdalla et al., 2023). The design also provides a comprehensive overview of the factors that affect plastic waste management in the ASEAN region, both in terms of policy, infrastructure, and community roles (Loveski Feliz et al., 2024).

The study population includes all ASEAN member countries that have data on plastic waste management policies and practices. The sample was selected based on the availability of representative and complete data from each country, as well as considerations of representativeness of environmental conditions and waste management capacity. The countries involved in the study will include Singapore, Malaysia, Indonesia, Thailand, Vietnam, and the Philippines, as the main sample that has significant economic growth rates and plastic waste production rates.

The research instruments used are in the form of document analysis and secondary data from government reports, international bodies, scientific journals, and reports of non-governmental organizations (NGOs) related to plastic waste management. The instrument is designed to collect quantitative and qualitative data regarding policies, the volume of plastic waste managed, recycling rates, and environmental impact (Chandanabhumma et al., 2024). The use of secondary data aims to

obtain reliable and comprehensive information from various reliable sources that are relevant to the research objectives (Grassie & Ehrenreich-May, 2024).

The research procedure begins with the collection of data from various predetermined sources, followed by data processing and analysis to see patterns or trends in plastic waste management in each country. The analysis was carried out by comparing key indicators such as policies, technologies used, community participation, and the success rate of plastic waste management. The results of the analysis are then interpreted to provide recommendations that can be applied regionally, with a focus on identifying best practices and challenges facing each ASEAN country.

RESULTS AND DISCUSSION

Statistical data on the volume of plastic waste in ASEAN countries shows significant variations, both in terms of the amount and type of waste produced. Based on the ASEAN Secretariat report (2022), Indonesia, the Philippines, and Thailand occupy the top position as countries with the highest volume of plastic waste, producing around 4.8 million tons, 3.2 million tons, and 2.8 million tons per year, respectively. Singapore, despite having a smaller population, is also recorded to produce a fairly high number of plastic waste, around 0.7 million tons per year. This data shows differences in plastic consumption levels and waste management capabilities in each ASEAN country.

Countries with high volumes of plastic waste generally have large populations and intensive economic activity. Data from the United Nations Environment Programme (UNEP) 2021 also noted that most of the plastic waste in these countries comes from the industrial and hospitality sectors, especially in dense urban areas. According to studies, about 60% of plastic waste in ASEAN ends up in the ocean, putting great pressure on marine ecosystems. The need for stricter and more effective waste management policies is even more urgent given the ecological and economic impacts arising from the high level of unmanaged plastic waste.

The following table shows statistical data on the volume of plastic waste per country in ASEAN based on the 2022 report:

Country	Volume of Plastic Waste (million tons)	Main Source of Waste
Indonesia	4.8	Industrial, Urban
Philippines	3.2	Hospitality, Urban
Thailand	2.8	Industrial, Commercial
Vietnam	1.8	Urban, Industrial
Malaysia	1.0	Urban, Industrial
Singapore	0.7	Domestic Consumption, Commercial

The data in the table shows a diverse pattern in plastic waste sources in ASEAN countries. Industrial, commercial, and urban are the sectors that contribute significantly to the volume of plastic waste in this region. The waste management policies implemented will be more effective if they are adjusted to the characteristics of each waste-contributing sector in each country.

ASEAN countries have diverse waste management policies in dealing with large volumes of plastic. Indonesia, for example, has implemented a policy banning the use of single-use plastics in several major cities, but its effectiveness is still limited due to a lack of strict supervision. On the other hand, Singapore, which has a more advanced waste management system, is able to recycle

most of its plastic waste, albeit at a fairly high cost. These differences in approaches reflect the challenges faced by each country in implementing effective and efficient policies.

Social and economic factors also play a role in determining the effectiveness of plastic waste management in ASEAN. Countries with good infrastructure support and high community participation, such as Singapore, tend to be more successful in reducing the impact of plastic waste. In contrast, countries with limited resources and low public awareness face great challenges in managing plastic waste optimally. This challenge needs to be answered with a comprehensive approach, both in terms of regulation, education, and technology development.

This comparative study also shows that most ASEAN countries face obstacles in terms of infrastructure management. Limited landfill capacity and lack of recycling facilities are the main obstacles to sustainable plastic waste management. Increasing the capacity of infrastructure and recycling facilities is a priority for most countries in ASEAN to reduce their reliance on environmentally unfriendly disposal methods.

The effectiveness of plastic waste management policies is highly dependent on government commitment and private sector involvement. Countries that have good cooperation with the private sector and NGOs tend to have better results in efforts to reduce plastic waste. This cross-sectoral collaboration is important to ensure the sustainability of plastic waste management programs in ASEAN.

The distribution of plastic waste types in ASEAN shows significant differences. Based on research conducted by the World Bank (2021), around 70% of plastic waste in this region comes from plastic packaging and single-use plastics. Packaging plastics, especially from the food and beverage sector, are the most common type of plastic waste found in landfills and the environment. Other types of plastic such as plastic bottles, plastic bags, and household appliances also contribute quite a lot to the total plastic waste.

The composition of plastic waste dominated by single-use plastics is one of the main challenges for ASEAN countries (Erickson, 2024). This type of plastic is difficult to decompose and often ends up polluting the environment, especially waters and seas. Countries such as the Philippines and Indonesia, with large populations and high consumption of plastic products, face serious challenges in managing this type of plastic waste. The recycling rate for single-use plastics is also very low, especially in countries with limited recycling infrastructure (Sunil et al., 2024).

Single-use plastic reduction policies that have been implemented in several countries have not shown significant results. Most countries in ASEAN still rely on conventional waste disposal methods, such as landfills, which can pose a long-term pollution risk. Efforts to increase recycling capacity and the development of environmentally friendly technology are one of the solutions that can help reduce the impact of single-use plastic waste (Sharma et al., 2024).

Reducing single-use plastic waste also requires active participation from the community. Public awareness of the importance of good waste management needs to be increased, especially in terms of sorting waste and reducing the consumption of single-use plastics. Educational campaigns involving various parties, such as schools, communities, and the media, are indispensable to change people's consumption behavior (Ramli et al., 2024).

The effectiveness of plastic waste management policies is greatly influenced by the involvement of the community and the government in implementing existing regulations. Countries such as Thailand and Vietnam, which have adopted policies to reduce single-use plastics, are experiencing challenges in implementation on the ground. Limited resources, infrastructure, and low public awareness are obstacles in enforcing existing regulations (Bernat, 2023).

The involvement of the private sector and NGOs is an important factor in the success of plastic waste management. Some countries, such as Malaysia, have worked with various NGOs and private companies to increase recycling capacity and educate the public on waste management. This collaboration has a positive impact in reducing the amount of plastic that ends up in the environment. Programs such as waste banks and segregated waste collection have also begun to be developed to encourage community participation (Oro et al., 2023).

Technology and innovation also play an important role in increasing recycling capacity. Countries with access to more advanced waste treatment technologies have the advantage of efficiently reducing the volume of plastic waste. The development of efficient and environmentally friendly recycling technology needs to be a priority to support waste management policies in ASEAN.

Government commitment and strong policy support are the keys to the success of plastic waste management. Sustainable policies need to be supported by adequate budget allocation and strict regulations (Kibria et al., 2023).

The relationship between plastic waste management policies and the success rate of management in ASEAN countries shows a significant linkage. Countries with comprehensive policies and consistent implementation, such as Singapore, tend to have better levels of plastic waste management. Factors such as government support, infrastructure capacity, and community participation play an important role in the effectiveness of waste management policies in each country (Parameswaranpillai & Deshmukh, 2024).

Countries with higher income levels generally have better capacity in terms of plastic waste management infrastructure and technology. This link between economic factors and the effectiveness of waste management is seen in countries such as Singapore and Malaysia, which are able to invest in recycling technology and have efficient waste collection systems. On the other hand, low- or middle-income countries face difficulties in building sustainable waste management systems (Rinanda et al., 2023).

Community participation also has a positive correlation with the success of plastic waste management. Countries that actively engage communities in programs such as recycling and reducing single-use plastics, such as Thailand and Indonesia, show better results in reducing the volume of plastic waste that ends up in the environment. Public awareness and behaviors that support waste reduction are important elements in the success of plastic waste management regionally (Heranita & Sembiring, 2023).

The use of innovative technology in waste management also has a positive correlation with the sustainability of plastic waste management. Countries that are able to adopt environmentally friendly recycling and waste treatment technologies show an increase in plastic waste management capacity. Technological innovations not only help in reducing the volume of waste but also allow the creation of new products from recycled materials, which provide additional economic value.

Singapore is one example of an example of effective plastic waste management in the ASEAN region. The country has successfully built an integrated waste management system with high recycling rates and sophisticated waste treatment facilities. Policies such as banning single-use plastics in some sectors and incentives for recycling companies are driving increased plastic waste management capacity in Singapore. This effort is also supported by a community education program that emphasizes the importance of recycling and reducing plastic.

Indonesia as the country with the largest population in ASEAN faces different challenges in plastic waste management. The volume of plastic waste produced is very high, especially in densely populated urban areas. The Indonesian government has initiated a waste bank program and banned

single-use plastic bags in several major cities as a step to reduce plastic waste. However, the success of this program still faces obstacles in the field, especially in terms of socialization and community involvement.

Thailand, which also has similar problems to Indonesia, has implemented a "Zero Waste" policy to reduce the amount of single-use plastic. This program involves cooperation between the government, the private sector, and the community in reducing the use of plastic. Thailand is also implementing a segregated waste collection program that allows the recycling process to be more effective. Although these efforts are still new, preliminary results show a significant reduction in the amount of plastic that ends up in landfills.

Vietnam, as a country that has major challenges in plastic waste management, has begun to collaborate with various international institutions to develop waste management infrastructure. The Vietnamese government works closely with non-governmental organizations to raise public awareness and strengthen recycling systems. Although they have not shown significant results, these programs are expected to help Vietnam reduce the impact of plastic waste in the future.

Data showing differences in the effectiveness of plastic waste management in ASEAN shows that government involvement and community participation are the main keys to success. Firm policies and adequate infrastructure support have enabled countries like Singapore to achieve high recycling rates. In contrast, countries with limited resources face challenges in implementing effective waste management policies.

Cross-sector collaboration is an important element in increasing plastic waste management capacity in ASEAN. Countries that involve the private sector and NGOs in waste management, such as Malaysia and Thailand, tend to have better results in reducing the impact of plastic waste. This collaboration not only helps in terms of funding but also facilitates technology development and community education.

Modern waste management technology has been proven to help several ASEAN countries overcome limitations in recycling capacity. Singapore is an example in the use of recycling technology and more efficient waste management. Other countries that are starting to adopt similar technologies are expected to increase their plastic waste management capacity and reduce reliance on landfills.

Community behavior has a great influence in determining the success of plastic waste management programs. Countries that actively conduct educational campaigns and promote the reduction of single-use plastics tend to see an increase in public participation. This awareness is important to support the sustainability of the program and create a culture that supports plastic waste reduction at the local level.

The relationship between national policies and the effectiveness of plastic waste management shows that countries with consistent policies and strong infrastructure support have better management levels. Countries like Singapore, which have strict regulations and good management systems, are able to reduce the amount of plastic that ends up in the environment. On the other hand, countries with unintegrated policies and limited infrastructure still face major challenges in plastic waste management.

Community involvement is also closely related to the success of waste management programs. Countries that actively involve communities in plastic waste management programs show more positive results in reducing environmental impact. Public awareness and behavior to reduce single-use plastics and sort waste plays an important role in supporting government programs. Community participation is the main supporting factor in creating a cleaner and more sustainable environment.

Plastic waste management technology contributes significantly to the sustainability of waste management programs. Countries that have access to advanced processing technologies, such as Singapore, are able to increase recycling rates and reduce plastic waste. This innovative technology enables ASEAN countries to overcome the limitations of landfill capacity and create recycled products with high economic value.

Regional collaboration between ASEAN countries is also an important factor in overcoming the problem of plastic waste. Through regional cooperation, ASEAN countries can share experiences, knowledge, and technology in managing plastic waste. This collaboration not only strengthens diplomatic relations but also creates an opportunity to find more comprehensive and effective solutions for the ASEAN region in addressing the plastic waste problem.

This study found significant differences in the approach to plastic waste management in ASEAN countries, both in terms of policies, infrastructure, and the level of community participation. Singapore stands out for its advanced waste management system and high recycling rate, supported by strict government policies and advanced technology. Other countries such as Indonesia, Thailand, and the Philippines have shown efforts to reduce single-use plastics and increase recycling capacity, but face obstacles in implementation on the ground due to limited resources and infrastructure.

The results of this study also show that countries with more comprehensive policies and strong support from governments and communities tend to have better results in reducing plastic waste. Singapore and Malaysia stand out in this regard, while countries with lower levels of community participation show limited effectiveness. Education and socialization programs on the importance of effective waste management are also seen to play an important role in the success of management in each country.

The results of this study underscore the importance of cross-sector collaboration and technological improvement in plastic waste management in ASEAN. Countries that are able to involve the private sector, NGOs, and communities in plastic waste management efforts show an increase in recycling capacity. Environmental awareness and technological support have also been shown to increase the effectiveness of overall plastic waste management in the region.

This study supports previous findings that state that policy and community participation are key to successful plastic waste management. Research from the United Nations Environment Programme (UNEP) also shows that countries with high government support and public awareness, such as Singapore, tend to be successful in reducing the impact of plastic waste. This study reinforces the view that community involvement and strict regulation are important factors in addressing the plastic waste problem.

The difference with other research lies in the emphasis on cross-sector collaboration and more innovative waste management technologies. Some previous studies focused more on policy aspects only, while this study highlights the importance of private sector involvement and the application of advanced technologies. These results show that a more holistic approach can improve the effectiveness of plastic waste management in ASEAN.

Other research that emphasizes the importance of public awareness is also in line with the findings of this study. Several studies conducted in Indonesia and Thailand show that education programs and campaigns to reduce single-use plastics have a direct impact on people's behavior. The results of this study show that the combination of strong policies and high public awareness can create a significant impact in reducing plastic waste.

The results of this study are a sign that the problem of plastic waste in ASEAN requires a more comprehensive and collaborative approach. Plastic waste management policies that only rely

on government regulations without involving the community and the private sector show limited effectiveness. Improvements in plastic waste management can only be achieved if all relevant parties play an active role and collaborate in sustainable management programs.

This research also indicates that technological innovation is an important component in overcoming the problem of plastic waste. Advanced recycling technology and adequate waste treatment facilities can help ASEAN countries manage large volumes of plastic waste more efficiently. The limitations in waste management infrastructure in some ASEAN countries show that there is still a lot of room for improvement and development, especially in terms of the adoption of waste management technology.

The reflection of these results also indicates that public awareness and participation need to be a priority in efforts to manage plastic waste. Countries that have successfully reduced plastic waste usually have a higher level of public awareness about the importance of good waste management. Without awareness and support from the community, waste management policies will be difficult to implement effectively.

The results of this study have important implications for policymakers in ASEAN countries in designing more effective plastic waste management policies. The need for firmer and more collaborative policies has become clear, especially to engage the private sector and the public. These implications suggest that a multi-sector approach to plastic waste management is key to achieving sustainability.

Community involvement is also an important point that needs to be considered by governments in ASEAN countries. These results show that the success of the plastic waste management program is highly dependent on community support. Education, socialization, and awareness-raising programs on the importance of reducing plastic waste can be an effective step to encourage active participation from the community.

Another implication is that technology should be the focus in the development of waste management infrastructure. Advanced waste management technology can help ASEAN countries in reducing the volume of plastic waste that ends up in the environment. These implications suggest that investment in recycling technology and facilities should be a priority in addressing the plastic waste problem in ASEAN.

ASEAN's unique geographical and demographic conditions explain why the results show the importance of a collaborative approach to plastic waste management. ASEAN countries have large populations and diverse economic activities, which results in a high volume of plastic waste. These characteristics make waste management more complex, and a multi-sector approach is needed to address the increasing impact of plastic waste.

Different levels of income and infrastructure capacity in ASEAN countries also influenced the results of this study. Countries with higher economic resources, such as Singapore, have adequate infrastructure for waste management, while lower-income countries face limitations in this regard. This difference explains why the results show variations in the effectiveness of plastic waste management in the ASEAN region.

The lack of public awareness in several ASEAN countries also contributed to the results of this study. People who do not understand the importance of good waste management tend to have high plastic consumption behavior. Without adequate community participation, it is difficult for plastic waste management programs to achieve maximum success at the local level.

The future of plastic waste management in ASEAN requires a more integrated approach, involving the private sector, government, and society more actively. Governments in every ASEAN country need to design policies that not only prohibit the use of single-use plastics, but also

encourage recycling and the use of environmentally friendly plastic alternatives. This step can create a more supportive ecosystem for sustainable waste management in the ASEAN region.

Investment in waste management technology and infrastructure should be a top priority for ASEAN countries. More efficient recycling technologies and adequate waste treatment facilities will enable ASEAN countries to manage plastic waste more effectively. These efforts will provide long-term benefits, both economically and environmentally, by reducing the amount of plastic that ends up in nature.

Regional collaboration among ASEAN countries needs to be increased to collectively address the problem of plastic waste. ASEAN countries can share experiences, technology, and knowledge in plastic waste management. A coordinated regional approach will help strengthen the region's capacity to meet the challenges of plastic waste and create a cleaner and more sustainable environment for future generations.

CONCLUSION

The most important finding of this study is that there is a significant variation in the effectiveness of plastic waste management in ASEAN countries, which is influenced by differences in policies, infrastructure capacity, and community participation in each country. Singapore demonstrates the highest effectiveness in managing plastic waste thanks to strict policy support and advanced technology, while other countries such as Indonesia and the Philippines face greater challenges in implementation on the ground. These differences show that a one-size-fits-all approach is ineffective in the ASEAN region.

The greater value of this study lies in the comparative approach applied in analyzing plastic waste management policies across ASEAN, providing a deeper understanding of the key factors that support the success or failure of management in each country. This method also contributes to providing insights for policymakers to design strategies that are more tailored to the specific conditions of each country. The contribution of this research helps to identify the important role of cross-sector collaboration and the application of technology in effective plastic waste management.

The limitation of this study is the lack of primary data from each ASEAN country, so most of the analysis is based only on secondary data and public reports. This limitation can be overcome through advanced research with an in-depth field study approach in each ASEAN country to obtain more comprehensive data. Future research may also focus on analyzing the role of specific technologies in improving recycling capacity and the effectiveness of plastic waste management in ASEAN.

AUTHORS' CONTRIBUTION

Look this example below:

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; Investigation.

Author 3: Data curation; Investigation.

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