

Community-Based Integrated Plastic Waste Management: A Case Study in Bali Province, Indonesia

Gede Sedana^{1*}

¹Department of Agribusiness, Faculty of Agriculture and Business
Dwijendra University, Bali Indonesia

¹Email: gedesedana@gmail.com

ABSTRACT

Plastics serve important functions in people's daily lives, but they often become waste, polluting the environment and posing a hazard if not managed properly. It's crucial to reduce the use of single-use plastics, recycle recyclable plastics, and choose more environmentally friendly alternatives to mitigate the negative impact on nature and health. This study aims to describe the principles of plastic waste management, the government policy framework, and the role of the government and stakeholders in waste management in Bali. The vast amount of plastic waste in Bali is a serious problem that must be addressed, as the increasing number of residents and visitors or tourists use plastic items in various activities. Plastic waste management is based on five principles: refuse, reduce, reuse, recover, and recycle. Three main pillars are needed in the policy and regulatory framework for plastic waste management in Indonesia, including in Bali Province: a primary legal basis, waste reduction policies, and waste management policies. The increased role of the government and various stakeholders, including universities, the private sector and industry, universities, environmental communities, villagers, and the media, in addressing the plastic waste problem in Bali will support the government in realizing a clean Bali. An integrated strategy is needed to comprehensively address plastic waste, encompassing interventions from upstream (producers) to downstream (processing), and involving three main pillars: policy, infrastructure, and stakeholder behavioural change.

Keywords: Plastic waste management, policy and regulatory frameworks, legal basis, waste reduction

*Corresponding Author:

E-mail: gedesedana@gmail.com (Gede Sedana)

Department of Agribusiness, Faculty of Agriculture and Business, Dwijendra University, Bali-Indonesia

1. INTRODUCTION

As we know, our society greatly needs and is highly dependent on plastic bags. This is because plastic bags are practical and very inexpensive. Almost every day when we shop at supermarkets, grocery stores, markets, or other places, the vendors always give us free plastic bags. We greatly benefit from this system, eliminating the need to carry shopping bags everywhere. This increases the demand for plastic bags and leads to an ever-increasing amount of plastic waste (Lestari & Trihadiningrum, 2019). Almost all food and snack

packaging currently available uses plastic. This increases the amount of plastic waste. Data shows that approximately 640 tons of plastic waste is generated annually from instant noodle packaging. This staggering amount does not include plastic from packaging bags, mineral water bottles, and other packaging. Data shows that Indonesia has the highest amount of urban solid waste in Southeast Asian countries, namely 0.68 kg of waste per capita per day (Jain A., 2017). The composition of this waste mostly comes from food waste, which amounts to 42%, plastic at 19%, and

paper waste, which amounts to 11% (Anonymous, 2023). In Indonesia, plastic is a very high percentage component of urban waste, 58% of which is still not collected (Zahrah et al., 2024). However, this plastic is difficult to decompose, taking hundreds of years to decompose. From the past to the present, waste has always been an unresolved problem. This could make pollution to the environment, from rivers to the ocean (Jambeck et al., 2015). The plastic waste problem is a significant threat to national tourism, particularly in Bali, an international tourist destination. Tourists experience discomfort from plastic waste both within and outside the tourism area. Plastic waste also has harmful health effects, including cancer, due to its microplastic content.

The growing population and increasing demands for living have resulted in an ever-increasing volume of waste (Putri, Fujimori, and Takaoka, 2018). This is exacerbated by a poorly managed and systematic waste disposal system. This is further compounded by a culture of littering. Waste management has not been implemented optimally due to the lack of awareness of waste separation at source, which burdens the operations of waste processing facilities. The operational capacity of waste processing facilities, particularly the Waste Management Sites (TPS3R) established in Bali, is not yet capable of processing all waste in regencies/cities due to the continued increase in community waste generation, unsorted waste, limited land and waste management facilities/infrastructure, limited operational and maintenance funding, a lack of human resource capacity to develop waste management systems at both the village and regencies/cities levels, and difficulties in securing off takers for

waste processing. Suboptimal waste management at facilities impacts waste handling, ultimately resulting in waste being sent to landfills.

Waste management requires a concrete, holistic, and simultaneous commitment to waste management from upstream to downstream, starting with processing and sorting at the source, along with support from all elements of society.

Although plastic has diverse and important functions in everyday life, it often ends up as waste that pollutes the environment if not managed properly. It is important to reduce the use of single-use plastics, recycle recyclable plastics, and choose more environmentally friendly alternatives to reduce the negative impact on the earth. Based on 2024 SIPSN data, the percentage of waste reduction in Bali Province has only reached 17.54% through plastic restriction programs and the use of recycled materials. Plastic can pollute the oceans, land, and air, and harm the health of humans and others, such as animal and trees (Meijer *et al.*, 2021). Plastic's threat to marine ecosystems arises from the oceans being used as a dumping ground for vast quantities of plastic waste (Brasika I.B.M. *et al.*, 2023)

Based on the study on the Analysis of Indonesia's Waste Flows, Value Chain, and Recycling conducted by Sustainable Waste Indonesia (SWI) in 2017 found that 60% of municipal waste in Indonesia was organic, 14% was plastic, 9% was paper, 4.3% was metal, and 12.7% was other waste such as glass, wood, and other materials (Kubontubuh, 2019). Plastic waste was the second largest component. Meanwhile, processed data from the Indonesian Bottled Drinking Water Companies Association (ASPADIN) and the research institute AC Nielsen indicates that bottled drinking

water products contributed 328,117 tons of the 11.6 million tons of plastic waste throughout 2021. The high volume of waste in Bali has prompted the government to implement several policies to reduce the amount of waste, including waste limitation, reuse, and recycling. In Bali, some villagers still dispose of their waste directly without processing it independently, for example, into rivers or burning it in their yards, due to a lack of awareness of the dangers posed by waste and a lack of adequate waste disposal facilities. This study aims to describe the principles of plastic waste management, the government policy framework, and the role of the government and stakeholders in waste management in Bali.

2. METHODS

This study was conducted in Bali Province, Indonesia, using purposive sampling. The primary consideration is that plastic waste has become a critical issue to address due

to its environmental impact. Furthermore, Bali Province is one of Indonesia's top international tourist destinations. Secondary data were collected from existing government documents and previous research findings. The collected data were analyzed using descriptive qualitative methods.

3. RESULT AND DISCUSSION

3.1 General conditions of waste in Bali

The Bali is a province in Indonesia, covering an area of 5.590,15 km² square kilometers and a population of 4.3 million. Bali is a small island that has become an international tourist destination. The location of Bali can be seen in Figure 1. As a tourist destination, the presence of waste is an important factor that must be considered in order to maintain a clean, comfortable and aesthetically pleasing environment.



Fig. 1 Location of Bali Island

Based on SIPSN data in 2024, waste generation in Bali Province in 2024 reached 1,254,235 ton/year or 3,436

tons/day. The population of Bali Province in 2024 was 4,375,263 people, so the average waste generation in Bali Province reached 0.8 kg/person/day. The volume waste in Bali is shown in Table 1.

Table. 1
Volume of waste in Bali (2024)

Regencies	Volume (ton)
Denpasar	366,806.75
Buleleng	150,779.68
Karangasem	102,643.48
Bangli	41,557.88
Klungkung	40,829.45
Gianyar	205,129.64
Badung	199,810.15
Tabanan	86,571.07
Jemberana	60,106.92
Total (Bali)	1,254,235.00

The composition of waste in Bali Province consists of organic waste from plants at 33.57%, food waste at 31.29%, and plastic waste at 17.25%, with the remainder being residual waste. The study results show that the characteristics of waste in Bali Province are different from those found in other regions in Indonesia, where the dominance of organic and wet waste in Bali is heavily influenced by Hindu religious rituals. Efforts to separate food waste have been carried out by communities in villages and several hotels, which use it for compost and animal feed. In villages, organic waste is managed at the 3R Waste Management Center to be used as plant fertilizer (compost or organic fertilizer), namely for personal use and for sale. Meanwhile, PET and HDPE plastic waste has been sorted and sold to the

informal sector to reduce the amount of plastic waste sent to landfills. However, plastic sheets and coated plastics, which have no economic value, are still transported to landfills and have the potential to pollute the environment (Nanda & Berruti, 2021).

Government policies and programs that have been implemented, such as through plastic restriction programs and the use of recycled materials in all regencies in Bali, have resulted in a reduction in waste in Bali Province of only 17.54%. The percentage of waste handled and processed in waste processing facilities has only reached 16.47%. Most of the waste is still dumped into the environment with a percentage of 23.2%, and transported to the Final Processing Site (landfill) 42.79% (see Figure 2)

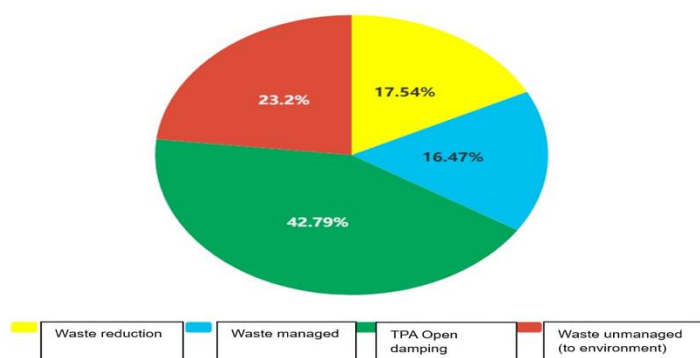


Figure 2 Waste treatment in Bali

3.2 Potential dangers of plastic waste

Plastic waste in Bali has become a serious problem due to the increasing number of

people involved in various activities and the increasing use of plastic-based goods. Bali produces thousands of tons of plastic waste per day, most of which originates from food and beverage packaging and other activities. Plastic waste also causes marine pollution, threatening marine ecosystems and coral reefs. Plastic pollution is persistent and takes a very long time to decompose (100 to 1,000 years). This pollution accumulates in the natural environment, altering habitats and processes. Microplastics are tiny plastic fragments that are widely distributed in water, soil, food, and air. It is formed from decomposing plastic, have now been found in various food and drinking water sources, including bottled water, sea salt, and other seafood. Even marine species are contaminated and pose a health risk to humans who consume them. Fish in Bali's waters have even been found contaminated with microplastics. Naturally, ocean currents also contribute to bringing waste from other provinces, exacerbating Bali's plastic waste problem. During certain months (December to April), the coastal areas of southern Bali receive significant amounts of waste from Java, which is located west of Bali.

The vast amount of waste in Bali has naturally caused numerous problems, including environmental (land, water, and air), health, and aesthetic issues. The burning of waste by the public has also caused air pollution, particularly when burned mixed with plastic, as it can trigger the formation of dioxins and furans, which are highly hazardous to health. These problems are further exacerbated by a lack of public awareness about proper waste management, particularly in landfills. The accumulation of waste in landfills creates new problems. In landfills, organic and

inorganic waste are not separated, resulting in adverse impacts, particularly for plastic waste, which is very difficult to decompose naturally.

Leachate from this waste seeps into the soil, causing problems because it contains toxic organic substances from the waste and inorganic substances from cans and other inorganic waste (He *et al*, 2019). The leachate absorbed into the soil changes the chemical, biological, and physical composition of the soil. Even plants grown in areas containing leachate will not thrive because the hazardous substances are absorbed by the roots. The consequence is that the products produced from plants that absorb the leachate will be dangerous for humans who consume them.

Plastic pollution harms wildlife, from invertebrates to marine mammals. This pollution reduces biodiversity and causes changes in ecological processes and ecosystems. Plastic pollution also affects organisms and reduces their ability to adapt to climate change. It also makes human health problems, in which microplastics enter the human body through food, drink, and inhaled air, and are often found in brain tissue and reproductive organs. The impacts of plastic pollution are of increasing concern to human health.

Plastic production contributes significantly to climate change by increasing greenhouse gas emissions, which accelerate global warming and negatively impact ecosystems and human life worldwide. Burning plastic releases toxins such as dioxins, furans, mercury, and polychlorinated biphenyls (PCBs), which can cause various human health problems, including cancer, immune system disorders, and respiratory disorders.

3.3 Principles on plastic waste management

There are five principles in plastic waste management: refuse, reduce, reuse, recover, and recycle. These principles are part of a strategy for managing plastic waste by preventing it, minimizing use, extending product life, converting waste into energy/materials, and reprocessing materials, forming a hierarchy for sustainability (Shaibur *et al.*, 2025). These 5 Rs aim to minimize landfill use and conserve resources as shown in Table 2. Waste prevention is a top priority, in which

preventing plastic waste in the first place is a highly effective approach, as are product choices and consumption habits (buying and using durable products, choosing specific packaging, supporting a circular economy). Extending the lifespan of a product through reuse or repair, and reducing waste in landfills. Refuse of plastic waste is concern to say "no" to single-use plastics (bags, straws, cutlery) at home and in public places, such as restaurants. Reduce: Reduce overall plastic consumption and packaging, starting at home.

Table 2.
5Rs principle as a hierarchy of waste management

No	Item	Description
1.	Refuse	Top Priority: Refusing single-use plastic products from the start. Examples: Refusing plastic straws, refusing plastic bags at the checkout, refusing bottled water when there's a refill option.
2.	Reduce	Reducing the consumption of items that potentially produce plastic waste. Examples: Buying products in bulk packaging instead of small sachets, bringing your own food containers when purchasing groceries.
3.	Reuse	Reusing existing plastic items for the same or different purposes before throwing them away. Examples: Reusing plastic water bottles as drinking vessels, reusing used jars to store spices or other items.
4.	Recover	In the context of plastics, this concept is often interpreted as looking for packaging alternatives that can decompose naturally (for example, packaging that is truly biodegradable and compostable in certain environments), so that the plastic does not end up in landfills or the environment.
5.	Recycle	The process of processing plastic waste into new materials or products. This is the final step after all preventative measures (refuse, reduce, and reuse) have been implemented. For example, separating PET bottles, HDPE gallon jugs, and other plastics to be handed over to waste banks or collectors to be processed into new plastic pellets.

3.4 Policy and Regulatory Framework

The policy and regulatory framework for plastic waste management in Indonesia including in Bali province can be divided into three main pillars based on the waste life cycle and jurisdictional level. This

framework aims to achieve the national target of reducing plastic waste.

3.4.1 Pillar 1: Primary Legal Basis (Regulatory Umbrella)

This is the highest legal basis governing waste management in

Indonesia in general, including plastic waste.

Table 3.
Level of regulation

Level of regulation	Nomor & Year	Main focus of policy
Law	Law No. 18/2008 about Waste Management	It is the primary legal basis. It shifts the paradigm from Collect-Transport-Dispose to environmentally conscious management based on the 3Rs (Reduce, Reuse, Recycle). It establishes the rights and obligations of producers, the government, and the community.
Government Regulation (GR)	GR No. 81/2012 on the Management about Household Waste and Household-Similar Waste	Explains in more detail the implementation of Law No. 18/2008, including the role of regional governments in formulating basic policies and strategies.
Government Regulation (GR)	GR No. 27/2020 about Management of Specific Waste	Regulating the types of waste that require special handling, which often includes certain types of plastic waste that contain B3 or that cannot yet be processed technologically.

The government has a high responsibility to ensure the reduction of waste, including plastic waste, through the creation of laws and regulations at both the national and provincial levels (Bali). The national strategy reduces plastic pollution through design innovation and improved waste management. This policy establishes a framework for responsible action. Some regulations concerning the waste management are: (i) Law Number 18 of 2008 concerning Waste Management; (ii) Presidential Regulation Number 97 of 2017 concerning National Policy and Strategy for the Management of Household Waste and Household-Like Waste; (iii) Government Regulation Number 81 of 2012 concerning the Management of Household Waste and Household-Like Waste; (iv) Regulation of the Minister of Environment and Forestry Number

P.10/MENLHK/SETJEN/PLB.0/4/2018 concerning Guidelines for the Preparation of Regional Policies and Strategies for the Management of Household Waste and Household-Like Waste; (v) Bali Provincial Regulation Number 5 of 2011 concerning Waste Management; (vi) Bali Governor Regulation Number 95 of 2018 concerning Regional Policies and Strategies for the Management of Household Waste and Household-Like Waste; (vii) Bali Governor Regulation Number 97 of 2018 concerning Limiting the Generation of Single-Use Plastic Waste; (viii) Bali Governor Regulation Number 47 of 2019 concerning Source-Based Waste Management.

Single-use plastic ban is one of the government regulations in Bali. The Bali Provincial Government has banned the use of single-use plastics (plastic bags, straws, styrofoam) in government offices, schools,

hotels, restaurants, and markets in accordance with Governor Regulation number 97/2018. The aim of the Bali Provincial Government in issuing a policy through Bali Governor Regulation Number 47 of 2019 concerning Source-Based Waste Management is to encourage waste management at the village/sub-district and customary village levels so that the volume of waste transported to final waste processing sites (landfill) is reduced. The government is trying to form a model of village/customary village areas that are able to manage their waste based on sources, including waste sorting activities from the source, the formation of village-level environmental cadres, operational optimization of waste processing facilities - reduce, reuse and recycle, and innovations related to the use of village-scale waste. In Bali Province, there are 293 Reduce, Reuse, Recycle Waste Processing Facilities (TPS3R), three compost houses, eight Integrated Waste Processing Facilities and Recycling Centers, spread across nine districts.

Waste processing activities at the TPS3R include waste sorting, composting, and packaging recycled materials for resale. Based on analysis of waste management data at the TPS3R, the average processing effectiveness for incoming waste is only 50.24%. This indicates that not all of the waste entering the TPS3R can be processed, and nearly 50% of it returns as residue and is transported to the landfill. Waste management at the waste processing facility at TPS3R has not been operating optimally due to the following reasons: (i) most of the waste entering the waste processing facility has not been sorted at the source (households), thus burdening the sorting work at the waste processing facility; (ii) the capacity of TPS3R is not capable of processing all the village waste whose volume exceeds capacity; (iii) limited budget for operational costs of TPS3R; and (iv) difficulties in distributing processed products (compost) to the community.

3.4.2 Pillar 2: Waste Reduction Policy (Upstream)

This regulation focuses on preventing plastic waste from its source (upstream), by involving producers and consumers.

a. Producer Responsibility (EPR)

This is the main principle that forces producers to take responsibility for the waste from their products and packaging. Presidential Regulation No. 83 of 2018 concerning Marine Debris Management: Establishes commitments and accelerated steps to reduce marine plastic waste. According to the Minister of Environment and Forestry Regulation No. P.75 of 2019 concerning the Waste Reduction Roadmap by Producers: (i) requires producers to develop a Waste Reduction Roadmap and achieve reduction targets; (ii) regulates bans or restrictions on the use of certain plastic materials/packaging (for example, PVC packaging, which is difficult to recycle); and (iii) encourages the use of recycled content in new products.

EPR policies hold producers accountable for the life cycle of their products, shifting the burden of waste management from local governments to industry. Regional governments have the authority to issue regulations for supermarkets, convenience stores, department stores, and other stores to prohibit the provision of free plastic bags. Therefore, plastic bags, which were previously provided free of charge, will no longer be permitted. Shoppers must purchase these bags at the place where they shop, for a slightly higher price, for example, one or two thousand rupiah. This regulation will force individuals to get into the habit of bringing shopping bags from home. Manufacturers of bottled water containers under 1 liter are also prohibited from producing and distributing them in Bali. The Bali Provincial Government has banned the production and distribution of drinking water in single-use plastic containers of less than 1 liter, based on Governor's Circular Letter No. 9 of 2025, as part of the Clean Bali Movement to

reduce plastic waste. This ban applies to offices, business premises (hotels, cafes, markets), educational institutions, and places of worship, effective from April 2025 and expected to be fully implemented by 2026. The government emphasized that these companies are only restricted in their use of environmentally damaging materials and are still permitted to use them if they innovate alternatives that are more environmentally friendly and do not damage the environment and guarantee human health.

Several hotels in Bali have made efforts to reduce single-use plastic restrictions and source-based waste management, including: (i) stopping the provision of plastic bottled drinking water and has successfully reduced around 500,000 plastic bottles a year, and reducing 60% of its waste disposal costs; (ii) implementing the Zero Waste to Landfill program, and reducing single-use plastic, in addition to processing non-recyclable plastic into fuel for hotel and resort operations; (iii) sorting food waste that is donated to TPS3R and livestock farmers for livestock feed around the hotel. Garden waste and other organic waste are processed into compost. In addition, there are several private parties or industries that produce and run composting services such as Urban Compost which serves hotels, restaurants and cafes.

b. End-Consumer Restrictions

Regulations are addressed to limit the use of single-use plastics by the public. Governor of Bali issued the Regulation Number 97 of 2018 concerning Limiting the Generation of Single-Use Plastic Waste; and Regulation Number 47 of 2019 concerning Source-Based Waste Management. These prohibit the use of single-use plastic shopping bags in shopping centers and modern stores, such as bags, straws, mineral water in bottles containing less than 1 liter, and Styrofoam. This regulation aims to establish a clean culture in Bali by managing waste directly at its source, namely households and other

locations. Key points of this regulation include:

3R Management: This regulation emphasizes systematic and sustainable waste management through the 3Rs: Reduce (limiting waste generation), Reuse (reusing), and/or Recycle (recycling). Furthermore, this regulation stipulates that communities, producers, traditional villages and villages/sub-districts are responsible for sorting and processing waste in their respective locations. Everyone is prohibited from disposing of waste inappropriately, burning waste that does not meet technical requirements, or engaging in open waste handling (open dumping).

3.4.3 Pillar 3: Waste Management Policy (Downstream)

This regulation focuses on how plastic waste that has already become waste is handled and processed (downstream).

a. Increasing Recycling and Circularity

Encourage waste sorting at source and recycling facilities through (i) waste banks were established and developed under the regional and technical regulations as community-scale waste management institutions that facilitate sorting and recycling; and (ii) waste management facilities constructed under the regulations related to technical standards and permits for the construction of recycling facilities.

b. Source-Based Waste Management

This regulates waste sorting starting at the household level in which requires communities to sort waste, including separating plastic waste from organic waste.

4.4 Roles of stakeholders

Figures In waste management, several stakeholders are involved in order to overcome the plastic waste problem in Bali, who help and support the government in realizing a clean Bali. Some of these

stakeholders are universities, private sector and industry, universities, environmental communities, villagers, and media.

1. The Role of the Government:

- a. Creating policies and drafting regulations related to waste management and the circular economy, which include objectives, philosophy, planning, implementation, monitoring and evaluation, incentives, sanctions, budgeting, and public participation in waste management;
- b. Monitoring and enforcing laws, ensuring policies are implemented properly, and imposing sanctions on violators; and
- c. Providing infrastructure such as landfills and recycling facilities, and encouraging innovation in waste management.

2. The Role of Producers/Business Actors:

- a. Producers develop product designs that are environmentally friendly, easily recycled, and based on sustainable materials;
- b. Recycling businesses reprocess waste into raw materials for industry; and
- c. Corporate Social Responsibility (CSR) supports sustainability programs in waste management and the circular economy.

Several hotels in Bali have implemented efforts to reduce single-use plastics and manage source-based waste, including: (i) they decided to stop providing plastic bottled water and successfully reduced approximately 500,000 (five hundred) plastic bottles per year. They reduced their waste by replacing drinking bottles with reusable glass bottles, which has reduced their waste disposal costs by 60%; (ii) they implemented a Zero Waste to Landfill program by reducing single-use plastics and processing non-recyclable plastic into fuel for hotel and resort operations; and (iii) several hotels and tourism areas have also made efforts to sort food

waste, which is donated to the Waste Management Waste Management System (TPS3R) and to livestock farmers for feed around the hotel. Garden waste and other organic waste are processed into compost. Furthermore, several private companies also operate composting services, such as Urban Compost, which serves the HORECA sector.

3. The Role of Universities:

- a. Conducting research to advance innovation and technology, develop new solutions in waste management and the implementation of the circular economy; and
- b. Educating and raising public and industry awareness regarding sustainable waste management.

4. The Role of Environmental Communities:

- a. Conducting campaigns and education to raise public awareness about the importance of waste management; and
- b. Community mentoring, encouraging community participation in reducing, reusing, and recycling, as well as the circular economy.

5. The Role of the Community:

- a. Reducing the use of single-use plastics, sorting waste at home, and supporting environmentally friendly products; and
- b. Participating in recycling programs, contributing to initiatives such as waste banks, composting, and household-scale recycling.

In Bali, plastic waste management has been done using the 3R concept (Reduce, Reuse, Recycle). Reducing the use of single-use plastics, reusing containers or packaging, and recycling plastic waste into new products or raw materials. This effort is supported by the government through programs such as "Indonesia Bebas Sampah 2025" (Indonesia Free of Waste, 2025) and collaboration with various parties to raise public awareness and develop

efficient recycling systems. In reducing the use of single-use plastics, the people avoid using plastic bags, straws, and disposable drinking bottles. They bring a shopping bag, use a reusable shopping bag or goodie bag when shopping. The people also reuse containers, repurpose plastic bottles and containers for stationery, storage, or other purposes. Recycling is done through the process of recycle into raw materials, in which the plastic waste is processed into plastic flakes or pellets, which then become raw materials for making new plastic products. Besides, it is also conducted the process of recycle into valuable products, wherein the plastic waste has been processed into various new products, such as boxes, tissue holders, or materials for road asphalt.

6. The Role of the Media:

- a. Disseminating information and educating the public about environmental issues, solutions, and related policies; and
- b. Encouraging accountability, monitoring, and reporting on the implementation of waste management policies by the government and industry.

4. CONCLUSIONS

The relatively high amount of plastic waste in Bali Province has become a serious problem that must be addressed, along with the increasing number of residents and visitors or tourists who use plastic-based items in various activities. There are five principles in plastic waste management: refuse, reduce, reuse, recover, and recycle. The policy and regulatory framework for plastic waste management in Indonesia including in Bali province can be divided into three main pillars based on the waste life cycle and jurisdictional level; namely primary legal basis, waste reduction policy, and waste management policy. Aside from

government, several stakeholders are involved in order to overcome the plastic waste problem in Bali to support the government in realizing a clean Bali, namely universities, private sector and industry, universities, environmental communities, villagers, and media.

To handle plastic waste comprehensively, an integrated strategy is needed, encompassing interventions from upstream (producers) to downstream (processing) and involving three main pillars: policy, infrastructure, and behavioural change of stakeholders.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to all parties who contributed to this study. We thank the local communities, village authorities, waste management groups, and environmental stakeholders in Bali Province for their active participation and valuable support during data collection and field activities. We also appreciate the constructive comments and suggestions provided by colleagues and reviewers, which helped improve the quality of this manuscript. Special thanks are extended to Dwijendra University for facilitating this research. Finally, we acknowledge the encouragement and support of our families and friends throughout the research and publication process.

REFERENCE

- Anonimous. (2023). National Waste Management Information System. Ministry of Environment and Forestry of Indonesia. <https://sipsn.menlhk.go.id/>
- Brasika I.B.M., Hendrawan, I. G., Karang,

- I. W. G. A., Pradnyaswari, I. G. A. I., Pratiwi, N. P. O. M. K., & Wiguna, I. G. M. (2023). Evaluating the collection and Composition of Plastic Waste in the Digital Waste Bank and The Reduction of Potential Leakage Into the ocean. *Waste Manag*, 41, 676–686.
- Jain A. (2017). Waste Management in ASEAN Countries. <https://www.unep.org/resources/report/wastemanagement-asean-countries-summary-report>
- Jambeck, J. R., R., G., C., W., T.R., S., M., P., A., A., R., N., & K.L., L. (2015). Plastic waste inputs from land into the ocean. *Science*, 347, 768–771.
- Kubontubuh, E. D. (2019). Bali Bebas Sampah Plastik (Clean and Green Island). *Bali Membangun Bali*, 2(1), 41–46.
- Lestari, P., & Trihadiningrum, Y. (2019). The impact of improper solid waste management to plastic pollution in Indonesian coast and marine environment. *Mar. Pollut. Bull*, 149, 110505.
- Meijer, L. J., Van Emmerik, T., Van Der Ent, R., Schmidt, C., & Lebreton, L. (2021). More than 1000 Rivers Account for 80% of Global Riverine Plastic Emissions into the Ocean. *Science Advances*, 7(17), 5803.
- Nanda, S., & Berruti, F. (2021). Municipal Solid Waste Management and Landfilling Technologies: A review. *Environ Chem Lett*, 19, 1433–1456.
- Putri, A. R., Fujimori, T., & Takaoka, M. (2018). Plastic waste management in Jakarta, Indonesia: Evaluation of material flow and recycling scheme. *J. Mater. Cycles Waste Manag*, 20, 2140–2149.
- Shaibur, M. R., Siddique, A. B., Nahar, N., Helal, A. S. A., Maruf, M. A. A., Arpon, S. H., Akter, S., & Ambade., B. (2025). Solid Waste Management in an Urban Community of a Developing Country: an Overview of 5Rs Strategies. Volume 7. 100254. *World Development Sustainability*, 7, 100254.
- Zahrah, Y., Yu, J., & Liu., X. (2024). How Indonesia's Cities Are Grappling with Plastic Waste: An Integrated Approach towards Sustainable Plastic Waste Management. *Sustainability*, 16, 3921.