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(RESEARCH ARTICLE)

Transition to a circular economy-inspired waste management system

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Abstract

Waste management is a challenging topic that requires constant attention. In order to successfully eradicate waste, all relevant parties must work together. Desa Pahlawan's Sustainable Development Goals (SDGs) for 2030 are just one example of the many cross-cutting issues being addressed by communities. The research presented here aims to explain how to implement a green recovery stimulus by analyzing circularity-based waste management. Doing so is important for a number of reasons, including preventing damage to the environment, economy, communities, and quality of life of rural areas, and enjoying the benefits that follow. This is due, in part, to the fact that garbage collection services in rural areas receive inadequate budgets from the government, even for the modern category of garbage. Waste management can be optimized by empowering the community, so that the system created can be carried out in a sustainable manner.

Keywords: Environment; Communities; Waste; Sustainable; Circularity; Benefits

1. Introduction

This issue has far-reaching consequences for the environment and society due to a lack of comprehensive waste management skills, a lack of available human resources, and a lack of sufficient landfills. Before any region can begin to solve its inefficient waste management and achieve progress towards the Sustainable Development Goals (SDGs), its residents must first determine what is causing the problem. Both the composition and the volume of a country's municipal solid trash are dramatically affected by its socioeconomic status. Countries with higher per capita income tend to be the world's top producers overall. These countries also tend to manufacture more paper, plastic, and other inorganic materials. However, the organic proportion of waste streams in nations with lower and middle incomes is greater [1]; [2]. Several factors, such as culture and institutions, might affect the extent to which people are open to change or resistant to it. [3]. Reviving rural communities requires a focus on improving residents' quality of life [4]. One of the most pressing concerns in the modern economic era, which places a premium on the application of cutting-edge technology, especially in rural regions, is the achievement of sustainable development [5]. Various strategies for rural community development exist, including community development, participatory methods, and community empowerment [6]. Therefore, development strategies are put into place with the aim of generating high economic growth by making the most of the potentials and resources already available in each region while taking into account the distinctive features of those regions [7]. Humans produce 300,000,000 tons of plastic annually, roughly half of which is used to make single-use items like shopping bags, throwaway cups, and plastic straws [8]. Even while there is still a sizable threat to the safety of tens of millions of young people, a solution is in reach [9]. The concept of equilibrium is intimately tied to the future usage of natural resources. [10]. There will be consequences for both human beings and the environment as a result of development activities [11]. Trash collection and proper disposal services are lacking in rural areas. [12]. Garbage from rural homes falls under the category of solid trash, which includes both non-recyclable items (such as plastic bags, glass, and metal) and recyclable ones (including paper, plastic bottles, metal, and fabric). The

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majority of the trash produced by rural homes is food scraps and cooking squander [13]. Decomposing garbage emits a smell that is both unpleasant and potentially harmful to human health. [14].

The environmental impact of trash accumulation is becoming an urgent problem in many parts of the world. The increasing amount of trash people generate every day is one of the most visible results of the yearly population increase. Waste management inefficiency has been singled out as the most pressing environmental and economic challenge facing governments worldwide. The fact that improper garbage disposal affects both people and the natural world lends credence to this view. Long-term and considerable informal dumping practices, like open dumping and ditching, have led to the accumulation of large volumes of rural residential garbage. The negative effects of these practices are far-reaching, and they threaten not just the future of civilization but also human health. Problems with reallocating production factors are another consequence of structural changes in the economy [15]. It will become increasingly difficult for people living in rural areas to obtain the most basic necessities as the population increases, putting a pressure on already overburdened infrastructure. [16]. There is both a static and a dynamic interplay between the factors that affect the economy, society, and the environment. The increasing volume of waste demands ever more vigilant attention from those responsible for its disposal. The health of the people as a whole is at risk, as are natural ecosystems including forests, rice fields, rivers, and oceans, if waste is not handled in a way that does not cause damage to them. Rural areas are sometimes found on the outskirts of larger cities, where residents may escape the noise and traffic. The generation of a substantial quantity of trash, however, cannot be ruled out. It's also important to remember that governments typically avoid delivering services in outlying areas due to the challenges inherent in doing so. Even though it is the least sustainable portion of modern waste management, garbage disposal is nevertheless commonly done, especially in peri-urban and rural areas. Growing populations and higher rates of waste generation and consumption are starting to make people in rural areas more mindful of waste management. There are numerous production activities involved in the manufacture of goods and services. [17]. The importance of consumer behavior varies greatly from one sort of service or user to the next [18]. They are expected to make numerous choices despite the fact that they lack a comprehensive understanding of the topic [19]. This is a huge burden to bear. Without careful management, negative effects on human and environmental health are inevitable [20].

Research conducted in the year 2020 [21] indicates that progress is currently being made in the direction of a higher quality of life, in the broadest possible sense. Dedication and activity are essential stimuli for creative economic growth [22]. The rise of the productive economic sector is indicative of the increasing significance of the people's economy [23] and impacts numerous stages of the manufacturing process [24]. The idea of establishing a new community in the shape of a village is encountering resistance because such settlements are typically seen as growth hotspots [25].

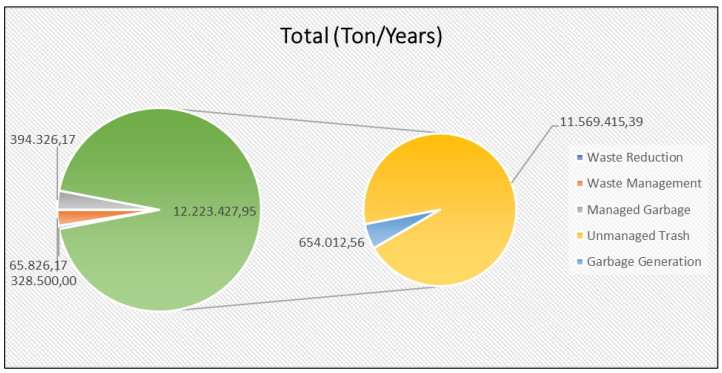

Figure 1 Waste Management Achievements in 2022 in 290 Regencies / Cities throughout Indonesia

The amount of waste cut was 65,826.17 tons per year (10.21%), while the amount of rubbish handled was 328,500 tons per year (50.93%), according to data collected on waste management successes in 290 cities and districts. As the population rises, more strain will be placed on existing infrastructure, making it more difficult for rural residents to access essential services.

2. Methods

Since the focus here is on the relationships between factors, we can classify this research as causal research, and it can be used in experimental studies in which one variable is manipulated to determine its impact on another. The purpose of this research is to learn more about the effectiveness of a circular economy approach to waste management in Pahlawan Village, Tanjung Tiram District. Data analysis is fine-tuned by employing a quantitative approach. This

research is confined to the topic of circularity-based sustainable waste management practices. Descriptive qualitative and quantitative approaches of data analysis were employed in this study to examine waste management.

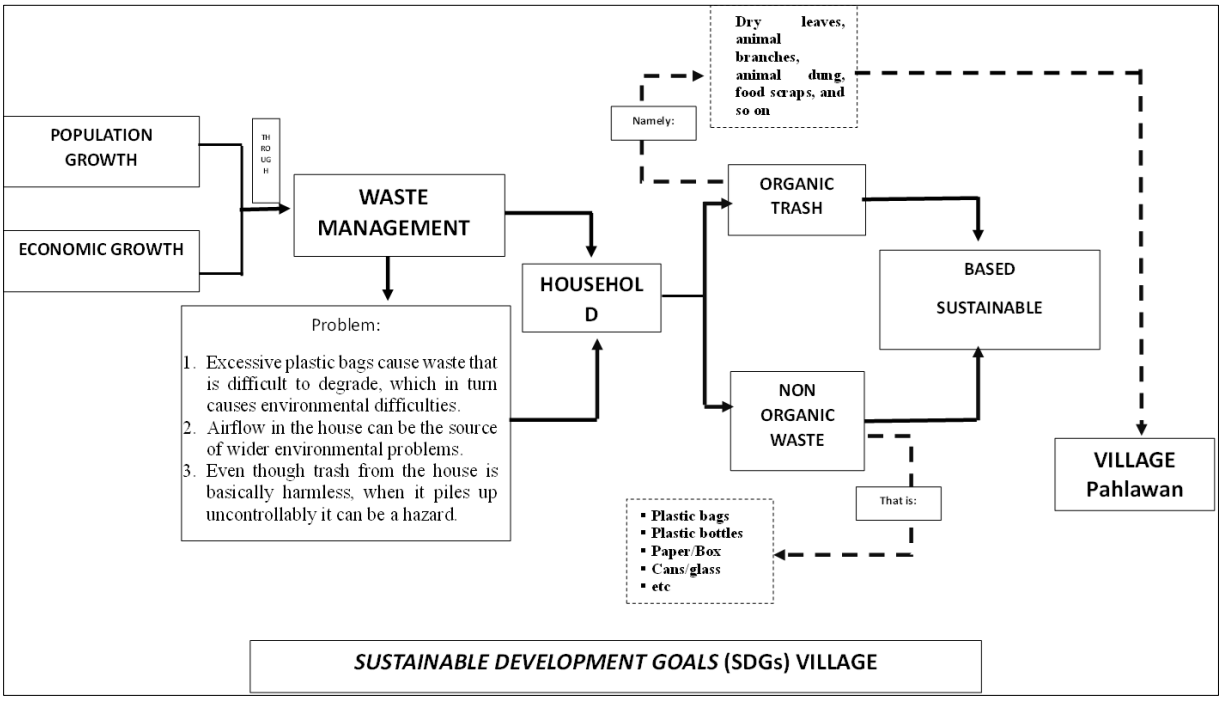

Figure 2 A conceptual framework for future studies (Researcher, 2023)

Researchers are believed to be able to solve the issues that arise from garbage in rural areas, as depicted in the image above. Questionnaire distribution and Focus Group Discussions are examples of data collection methods being used.n

3. Results and Ddiscussion

Descriptive analysis yielded frequency tables, which will be explained further below, that characterize the research respondents. There are a total of 18 questions based on the following statement items in the Desa Pahlawan Tanjung Tiram District.

Table 1 Waste Management Statistics, Tabulated

No.	Information	Option Answers	Frequency	Percentage
1	Satisfaction of basic needs: the main contributor to waste	a. Yes	60	82,19
		b. No	13	17,81
	Total		73	100.00
2	Different types of waste have their own designated disposal sites	a. Yes	8	10.95
		b. No	65	89.05
	Total		73	100.00
3	Knowing about types of waste such as paper, plastic, glass, metal, rubber, cloth, and B3 (Hazardous and Toxic Materials)	a. Yes	13	17,81
		b. No	60	82,19
	Total		73	100.00
4	Realize what is meant by proper waste management	a. Yes	35	47.95
		b. No	38	52.05
	Total		73	100.00
5	Should waste be managed	a. Yes	73	100.00
		b. No	-	-
	Total		73	100.00
6	Know the impact on the environment if waste is disposed of carelessly	a. Yes	73	100.00
		b. No	-	-
	Total		73	100.00

The 2023 Survey Processing Results

Table 1 shows that 82.19 percent of those who said they were satisfied with their fundamental needs were also major trash producers, while 17.81 percent of those who said they were not were. Of those asked whether or not they have

designated disposal sites for various sorts of waste, 65 (or 89.05%) responded with a no, while 8 (10.95%) responded with a yes. Sixty people (82.19%) said "yes" when asked whether they were familiar with various forms of garbage, including paper, plastic, glass, metal, rubber, cloth, and B3 (Hazardous and Toxic Materials), whereas thirteen people (17.81%) did not provide a response. Of the respondents, 35 (or 47.95%) said they practiced "proper waste management," while just 38 (52.05%) said they did. There were 73 total yes votes, making up 100% of the community's respondents. Despite the fact that the answer is yes, there are as many as 73 persons, or 100%, who are unaware of the consequences of improper trash disposal on the environment.

Table 2 A Statistical Analysis of Agricultural Waste Management Training

No.	Information	Option Answers	Frequency	Percentage
7	Have received socialization or education related to good waste management	a. Yes	60	82.19
		b. No	13	17.81
	Total		73	100.00
8	Have received waste management training from village officials	a. Yes	40	54.80
		b. No	33	45.20
	Total		73	100.00
9	Dispose of waste directly at the nearest TPA	a. Yes	13	17.81
		b. No	60	82.19
	Total		73	100.00
10	Knowing the concept of 3R (reuse, reduce, recycle) in waste management	a. Yes	20	27.40
		b. No	53	72.60
	Total		73	100.00
11	Knowing organic waste can be processed into compost	a. Yes	73	100.00
		b. No	-	-
	Total		73	100.00
12	Knowing that slums have a negative impact on the environment and are harmful to your health	a. Yes	73	100.00
		b. No	-	-
	Total		73	100.00

The 2023 Survey Processing Results

As many as 60 respondents, or 82.19%, indicated that the community had received socialisation or education linked to effective waste management. On the other hand, as many as 13 people, or 17.81%, indicated that they had not. There were 40 respondents who answered yes ever had waste management instruction from village officials, which is equivalent to a percentage of 54.80%. The remaining 33 participants answered never, which corresponds to a percentage of 45.20%. The majority of respondents (60 out of 79), or 82.19%, agreed that rubbish should not be thrown straight into the nearest landfill, while only 13 respondents, or 17.81%, gave the affirmative response. There are 53 members of society, which accounts for 72.60% of the total, who are unaware of the concept of "3R" in trash management, which stands for "reuse, reduction, and recycling." The remaining 20 members account for 27.40% of the total. On the other hand, the community is aware that compost may be made from organic waste and that slum settlements have a negative effect on the environment as well as a negative influence on the health of as many as 73 persons or 100% of the population.

Table 3 Waste Management Knowledge

No	Information	Option Answers	Frequency	Percentage
13	Households produce a lot of waste every day	a. <1.0 kg/day	-	-
		b. >1.0 kg/day	73	100.00
	Total		73	100.00
14	There is a certain treatment before the waste is disposed of	a. Once	-	54,80
		b. Never	73	100.00
	Total		73	100.00
15	There are social institutions that carry out socialization regarding waste management	a. Once	48	65.75
		b. Never	25	34,25
	Total		73	100.00
16	Who does socialization?	a. Resident	28	38.35
		b. NGOs/ Experts/ Waste Experts	25	34,25
		c. Government	20	27,40
	Total		73	100.00
17	There is a trash can available at your residence	a. Yes	50	68,49
		b. No.	23	31.51
	Total		73	100.00
18	Still use plastic bags when shopping at the market or supermarket	a. Yes	73	100.00
		b. No.	-	-
	Total		73	100.00

A total of 73 persons, or 100%, in the Hero Village report never having given any thought to how their garbage is handled before throwing it out. There was once a social organisation that reached out to as many as 48 people (65.75%), while the other organisations never reached out to more than 25 people (34.25%). 28 people (or 38.35%) of residents, 25 people (34.25%) from NGOs/experts/waste experts, and 20 people (or 27.80%) from the rest of the government carry out outreach in trash management.Fifty people (or 68.49%) of people in each neighbourhood had garbage cans in their homes, compared to only 23 people (or 31.51%). One hundred percent (73 of 73) of those surveyed said they still use plastic bags when they go grocery shopping.

There are still individuals in our society who would rather not pay for waste transportation services and would rather find a more convenient place to dispose of their trash. The majority of the neighbourhood did not accept the previous explanation. Every day's garbage, for instance, is burned on the grass in front of his house. There will be a lot of problems in the future if we keep littering the ground. These effects frequently prove fatal to the human being who experiences them. We lose our sense of smell and sight when trash piles up and isn't removed, and we also have to deal with the unpleasant odours it creates.

4. Conclusion

Poor waste management in rural areas has a devastating impact on people's living conditions and the quality of their rivers. No matter how crowded the area is, this is true. A number of other communities in Batu Bara Pahlawan Regency have experienced something similar to what happened in the hamlet of Tanjung Tiram Palawan District. The River Stream is polluted with biological and inorganic waste all the time. Rural communities face unique challenges, one of which is waste management. Every day, Indonesia generates at least 175,000 metric tons of waste. The national goal for waste reduction is 30% by 2025. A demanding objective with little chance of success. This is not an impossible goal, though, if all parties are included in the process. These days, garbage is a major issue that must be addressed for the sake of the environment's survival and well-being. Unsafe waste disposal adds to environmental degradation by damaging the surrounding area. Most rural areas still employ traditional methods of garbage management, such as landfilling, burying, and incineration, or the collection and transportation of trash to a central landfill. Effective waste management can begin with individual home management, such as sorting trash. We can separate waste into two

categories for disposal and recycling purposes. At this early stage, the movement's focus is on education and awareness-raising to equip the community to begin waste management on its own.

It's not as simple as flipping your hand to get the attention of the locals. To do this, it will be necessary to enlist the help of citizens, governments, and other interested parties. Consistency in samples, models, and design is essential for this labor-intensive activity. Rural communities might benefit from increased participation in garbage management if they host social activities. There are also many community events that help spread the word. Household garbage classification is an essential first step towards efficient municipal waste management. Sorting trash into usable and non-use piles is one method of waste management. One of the early objectives was to teach people how to recycle their own trash and raise public awareness of the issue. In order to create the knowledge behind trash management and inspire economic potential, it is essential to socialise how waste is categorised in a sustainable manner through group networking. Coal Trusteeship Regulation (PERBUP) No. 40 of 2021, requiring alignment of APBDes objectives and operations with the provincial budget for FY2018. Each community needs its own facility for disposing of garbage. According to PERBUP, village budgets should allocate revenue budget money for garbage banks or separate collection of households. At the very least, every settlement needs one. The establishment of a temporary landfill is an activity undertaken by the village waste management team and supported financially by the village.

Despite Parabap's best efforts, the village's garbage system continues to have problems. Because many rural communities still lack designated dump sites. This is because managing itself is a difficult endeavour. The situation becomes considerably more difficult if a hamlet does not have its own WMS, meaning that its citizens do not have access to a WMS. Participating in is not an easy chore that will reduce garbage in landfills and turn it into something of worth.

Table 3 Conclusions drawn from 2023 interviews with members of Pahlawan Village's various communities

No	Group Description	Targeted Aspect	Results
1	Household	Interest in Waste Management	1. Most housewives want to manage their waste but dont know how 2. Know the dangers of waste that is not managed properly. 3. Recyclable waste is not optimized to reduce the amount of residual waste. 4. Knowing your waste brings additional economic and environmental value. 5. Recognizing the important role in cultivating the habit of sorting waste in the home environment as the beginning of the household waste management chain
		Knowledge of waste management practices	1. They practically manage their daily waste by burning it and throwing it in the river 2. Segregation of waste reduces the influx of insects like flies and the area needs to be cleaned and less planted 3. Knowing the types of organic kitchen waste and plastic packaging waste 4. Effects of plastic waste causing disease 5. If it is burnt it can cause air pollution.
		infrastructure and equipment	1. The waste bank in Pahlawan Village is not running optimally in waste management 2. Optimizing APBDes to organize solid waste infrastructure and facilities 3. Handling waste in rural areas is carried out in the simplest way possible by taking into account local wisdom, meaning that the village government can adjust the infrastructure and facilities for waste management using materials available in the area.
2	Fish Traders	Interest in managing waste	1. The maximum potential must be established to prevent pollution caused by the entry of waste into the water. 2. All actors must play a role in creating a circular economy starting with the collection of recycled technological products of marine waste indicated by innovation. Use of recycled products 3. Fishermen are willing to deal with waste but this depends on the amount of financial incentives received.
		Knowledge of waste management methods	1. Enabling fishermen to reduce marine pollution by collecting garbage in the sea 2. Clean farming approach is an effective attempt to change the habit of indiscriminate waste disposal by preventing the entry of waste. Poachers can identify waste from their extra antlers as plastic waste. 3. A part of the desert was burnt and left untouched and a part was thrown into the river.
		Infrastructure	1. It is necessary to increase marine waste reduction campaigns, as well as public service advertisements in print and electronic media, to invite coastal communities and industry to participate in keeping sea waters clean and healthy. 2. Fishermen are aware that there are trash cans in the corner of the village but they still throw garbage carelessly
3	Traders	Interest in Manage Waste	1. Traders are willing to manage waste if village authorities provide facilities. 2. The relationship between the government and the local community is ineffective.
		Awareness of waste management practices	1. Traders can identify household waste and business waste, such as fish waste, snacks and others 2. The average trader does not understand how to manage plastic waste
		Infrastructure	Traders dont use waste banks

It would be beneficial if local populations were made aware of the importance of more organised technical and administrative municipal trash management. Only by separating biological and inorganic garbage can the practise of

treating trash at source be considered an ecological mindset. Our products' eco-friendliness and durability for several applications are major factors in achieving sustainable waste management goals and decreasing garbage from on-the-go establishments. The responsive strategy, in which communities self-sort and dispose according to wind direction, is by far the most common method of rural waste management across regions. This method requires extensive land use for collecting and transit from source to final destination, known as end-to-pipeline systems. Participation in the utilisation of 3R technology for trash management has increased but is still modest. Sustainable waste management in the countryside centres on the delivery of protective services, such good housekeeping, that result in cost savings. So that raw materials may be used optimally and hazards can be reduced while conserving energy and resources, liquid raw materials and other energies are employed as tools to reuse raw materials scattered during their use. poor method.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors declare that they have no conflicts of interest.

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Author's Short Biography

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Since 2012, I've been a member of the teaching staff in the Development Economics Study Programme at the Faculty of Social Science at Universitas Pembangunan Panca Budi (UNPAB) in Medan. Since 2018 I've been working as a member of the BALITBANG team in the province of North Sumatra. Contributing regularly to national and international publications and publishing works as either sole authors or co-authors with academics from other institutions. Every published book has an ISBN, an electronic ISBN, and intellectual property rights. With any luck, this book's readers will be able to add to its wealth.

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