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The Role of Community Initiatives in the Implementation of Zero-Waste Policy in Kendal Regency: Case Study of KerDUS Community

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ABSTRACT

The waste problem increasingly threatens life. The biosphere encompasses both land and water bodies. Burned waste causes air pollution and produces greenhouse gases that contribute to global warming. Various methods have been implemented, including recycling, but only 20% of waste is successfully recycled. This This study investigates efforts to reduce waste by adopting a zero-waste lifestyle in Kendal Regency, Indonesia, with the participation of the KerDUS Community. The research employs qualitative methods such as interviews, documentation, participatory observation, and literature review. The results show that the education and training conducted by the KerDUS Community have successfully increased public awareness of the importance of waste management. This article also examines the environmental policies needed to support the implementation of a zero-waste lifestyle, including regulations, incentives, and the development of recycling infrastructure. We also discuss strategies to increase awareness and community participation through continuous education, environmental campaigns, and collaboration between the government, communities, and the private sector. With the right policies, it is hoped that the zero-waste lifestyle can be more widely and effectively implemented to reduce waste generation and its negative impacts on the environment in Kendal Regency.

A. Introduction

Population growth has a direct impact on the increase. in the accumulation of waste. As populations grow, so too do consumption and the demand for goods. Modern society, driven by convenience, increasingly favors practical and instantaneous products, many heavily reliant on plastic materials. Initially, plastic was designed to replace paper bags made from wood, offering a sustainable alternative with hopes of reducing deforestation and forest ecosystem degradation. The material's durability, practicality, cost-effectiveness, attractiveness, lightness, ease of access, and long-lasting properties were some driving factors behind its adoption. However, as consumption has expanded, especially of single-use plastics, the situation has taken a concerning turn. The explosion of plastic waste is now a global crisis.

The Government Regulation of the Republic of Indonesia Number 27 of 2020 defines waste as the byproduct of human activities and natural processes. The uncontrolled accumulation of waste on land and water bodies has become an urgent environmental issue. By 2040, it is estimated that 1.3 billion tons of plastic waste will pollute the Earth's ecosystems (National Geographic, 2020). Indonesia has been identified as the second-largest contributor of plastic waste to the world's oceans, according to research by Jambeck et al. (2015). Despite being a relatively minor region, Kendal Regency is not immune to this global challenge. The area's rapid urbanization and population growth has compounded the waste crisis, necessitating the development of localized strategies to address these issues effectively.

While much global research has delved into waste management issues and strategies (e.g., Chalmin & Gaillochet, 2009; Nizar, 2017), a significant gap remains in understanding the unique challenges and opportunities faced by regions like Kendal Regency. This study aims to fill this gap by exploring policies that support a zero-waste lifestyle in Kendal Regency and evaluating the effectiveness of community education in waste management practices. Unlike many previous studies focusing on technical solutions such as recycling technologies, this research emphasizes the importance of integrating waste management with community empowerment and environmental sustainability. It highlights the local waste management challenges and offers context-specific solutions to foster a more sustainable approach. A central theme of the article is the need for effective environmental policies to support the transition to a zero-waste mindset, particularly within the local community. It proposes initiatives for community education that emphasizes waste sorting, recycling, and reducing consumption as essential steps toward sustainable waste management.

The slogan "Throw waste in its place" has long been used as a call to action, yet it is no longer a suitable solution for the current waste crisis. This approach fails to address the long-term environmental impacts at the Final Processing Site (TPA), where waste is collected in trash bins is often disposed of in landfills with limited capacity and slow decomposition processes. As a result, waste accumulates at TPAs, leading to pollution, health risks, and environmental disasters. A tragic example of this is the TPA Leuwigajah disaster in Cimahi, West Java, in 2005, where a 200-meter-long and 60-meter-high pile of waste collapsed after heavy rains, triggering an explosion of methane gas and killing 150 people (detiknews, 2020). Such incidents underscore the urgency of implementing comprehensive waste management systems beyond mere disposal.

Efforts to educate the community on waste management have yielded mixed results. Many initiatives, such as establishing waste banks or waste donation programs, have seen limited success. Individuals often sell valuable waste to scrap collectors and dispose of non-valuable waste in trash bins or TPAs. Additionally, even in waste banks where sorting is encouraged, improper waste management persists. Waste brought to these banks is often contaminated, smelly, and infested with pests, requiring intervention from staff for proper handling. Furthermore, the financial sustainability of waste banks is often challenged, as waste management costs typically exceed the revenue generated from the sale of recyclables, causing many waste banks to go bankrupt.

Proper waste management must begin at the source. requiring a shift in mindset. Educating the community about the importance of waste management and environmental awareness can help individuals see waste not as something to be discarded but as a resource to be reused. In Kendal, the Regional Secretary has emphasized that changing the approach to waste management from its very source is essential, especially in urban areas with limited space and dense populations. Effective environmental policies that Promoting waste sorting and recycling is crucial in creating sustainable systems. These policies must encourage responsible consumption and provide the necessary tools and education to empower residents to manage their waste more efficiently.

This article discusses the policies needed to promote a zero-waste lifestyle in Kendal Regency, focusing on community education. Waste sorting and processing should be an integral part of the community's daily activities, starting with individuals making more conscious purchasing decisions and avoiding products that generate excessive waste. Furthermore, educating residents on proper waste segregation—separating organic, inorganic, and hazardous materials—will facilitate more efficient waste processing. Inorganic waste, such as plastics, Styrofoam, fabrics, glass, and paper, can be managed using the 3R (Reduce, Reuse, Recycle) approach, which aims to reduce the volume of waste while promoting environmental sustainability.

A key component of this approach is the potential for creative, environmentally conscious individuals to see waste as a resource. Used materials, whether food scraps or discarded objects, can be transformed into valuable products that are aesthetically pleasing, cost-effective, and environmentally friendly. As the demand for recycled products increases, so will the need for raw materials, creating a circular economy where waste is minimized and valued. In this system, waste no longer contributes to environmental degradation but becomes a source of income and sustainability for the community.

Past studies have explored various technical approaches to waste management, such as recycling technologies and advanced waste processing methods (Zaman & Lehmann, 2013). While these solutions have successfully reduced waste volumes, they often neglect the vital role of education and behavioral change in achieving sustainable outcomes (McKenzie-Mohr, 2000; Thøgersen, 2006). Moreover, waste management research in Indonesia has predominantly focused on urban areas, overlooking semi-urban regions like the Kendal Regency, where limited infrastructure and community awareness exacerbates the issue (Widiarti, 2012).

Waste symbolizes modern inefficiency and misallocated resources, so it is necessary to educate the community about the uses and dangers of excessive plastic (A. Zaman, 2022). To anticipate the surge in waste, zero-waste Education is needed from upstream to downstream, as the zero-waste concept offers waste management through the elimination, recycling, and recovery of used items (Nizar et al., 2017). This study looks at how zero-waste policies can be used to solve the waste problem in Kendal Regency as a whole. It supports the ideas of preventing waste, getting rid of waste, recycling, and recovering resources as basic waste management principles.

B. Methods

This qualitative research describes how a zero-waste lifestyle is implemented as an environmentally conscious character. This approach is one way to reduce waste from its source. The research data were obtained from participatory observation, interviews, documentation, literature studies, and questionnaires to determine the percentage of recycled items using the formula adopted by Zaman (2013).

$$Diversion\ rate = \frac{Weight\ of\ recyclabels}{Weight\ of\ garbage + Weight\ of\ recyclables}\ x\ 100\%$$

The primary participants are members of the KerDUS Community in Kendal Regency, a group dedicated to promoting zero-waste practices. Participants were We selected through purposive sampling, prioritizing those with at least one year. of active involvement, regular participation in community activities, and key roles, such as program coordinators and leaders. We interviewed a total of 9 participants and distributed 30 questionnaires to gain broader insights. Zaman's formula was applied by measuring the weight of recyclables and total waste during community waste collection events, with weights determined using calibrated scales. The gathered information will be looked at by reducing the amount of data, showing the data, and coming to a conclusion. This will help describe the eco-friendly way of life that people live by implementing zero-waste in their daily lives (Sugiyono, 2016).

C. Results and Discussion

1. Zero-waste Concept

Zero-waste is a management concept to create sustainable living principles (Abdullah, 2016 in Khairunisa & Safitri, 2020). Zero-waste is not mandatory but rather an individual awareness to be responsible for their daily consumption residues. It is also an ideal environmentally conscious concept in waste management involving the community, government, and businesses to minimize waste's amount and adverse environmental impact (Zulfa et al., 2021). The zero-waste culture does not grow suddenly but requires knowledge, experience, appeals, invitations, habituation, and real examples that impact life. Zero-waste is a new perspective in waste management emphasizing the 3R principles (Reuse, Reduce, and Recycle) (Handayana et al., 2019). According to Abhishek Kumar et al. (2021), the approach is to inspire the reshaping of the resource supply chain away from an outdated mode so that entire products or by-product materials are reused or recycled.

Zero-waste is one way to minimize waste production and reduce landfill waste (Ali, 2019). The waste management paradigm, which has relied only on the end-of-pipe approach, should be replaced by viewing waste as a resource that can be utilized with waste processing technology (energy waste) (Setyono & Sinaga, 2021).

Zero-waste management campaigns can be implemented in the community to raise awareness not to create waste. Waste management programs should focus on increasing human capacity, not just adding waste collection equipment or creating landfills (Nizar et al., 2017), as this has been commonly done in several regions but with less than optimal results. People are still accustomed to consuming many items that potentially generate waste but are unwilling to process or reuse these used items. Therefore, efforts are needed to reduce waste from its source to decrease or even eliminate waste generation.

The zero-waste concept fundamentally rejects incinerators, landfills, and the existence of waste, striving to create sustainable communities (Nizar et al., 2017). Incinerators and landfills are not yet solutions to the waste problem, especially since their combustion results cause pollution, smog, and unpleasant odors. The waste problem remains difficult to solve, particularly in Kendal City, Indonesia. Waste issues usually receive the least attention compared to others, even though the quality of waste services is a benchmark for good governance (Africa, 2010 in Nizar et al., 2017).

Public awareness to reduce waste generation is still low. Due to funding, management, and maintenance constraints, plans to process waste into electricity are still in a tug-of-war. No single strategy can solve the current waste problem (Nizar et al., 2017). Zero-waste management campaigns can be implemented in the community to raise awareness not to create waste. Therefore, education on waste management and inculcating a zero-waste lifestyle from environmentally conscious communities are needed. This is similar to what the waste recycling craft community (KerDUS) in Kendal Regency does. This community educates the public by providing waste management training. This training is often referred to as plastic study or workshops. Anyone can attend these activities voluntarily, and they are open to the public.

2. Zero-waste Management

Zero-waste is a lifestyle that minimizes waste usage so humans almost do not produce waste, as used items or food scraps can be reused, recycled, or processed into specific products. A zero-waste habit can reduce or eliminate disposal on land, water, or air, which threatens the planet's health, humans, animals, and plants (ZWIA, 2004 in Ali, 2019).

The implementation of zero-waste requires well-organized environmental planning and management. Thus, the zero-waste program is not only good at the beginning but becomes a necessity and sustainability. The implementation of zero-waste requires short-term and long-term planning. The long-term priorities of zero-waste include integrating environmental education to foster environmental awareness and character in the community. Meanwhile, the short-term programs include the application of 3R (Reduce, Reuse, Recycle), environmentally friendly policies, creative and innovative industrial design, and guaranteed production marketing.

The success of zero-waste is inseparable from management, which prioritizes transformation strategies, from education to educating the community to research on environmentally friendly waste reduction. The next priority is sustainable consumption and behavior, which includes shopping

according to needs and reducing the use of equipment that contributes to waste generation. Zero-waste requires the transformation of environmentally friendly industrial design that is cradle to cradle and clean production, so it produces little or no waste because all residual items can be used as raw materials for other products. Zero-waste products are designed to be recyclable, so their remnants do not become waste. Achieving sustainable zero-waste requires innovative waste processing or alternative waste technologies. This can be explained in Figure 1.

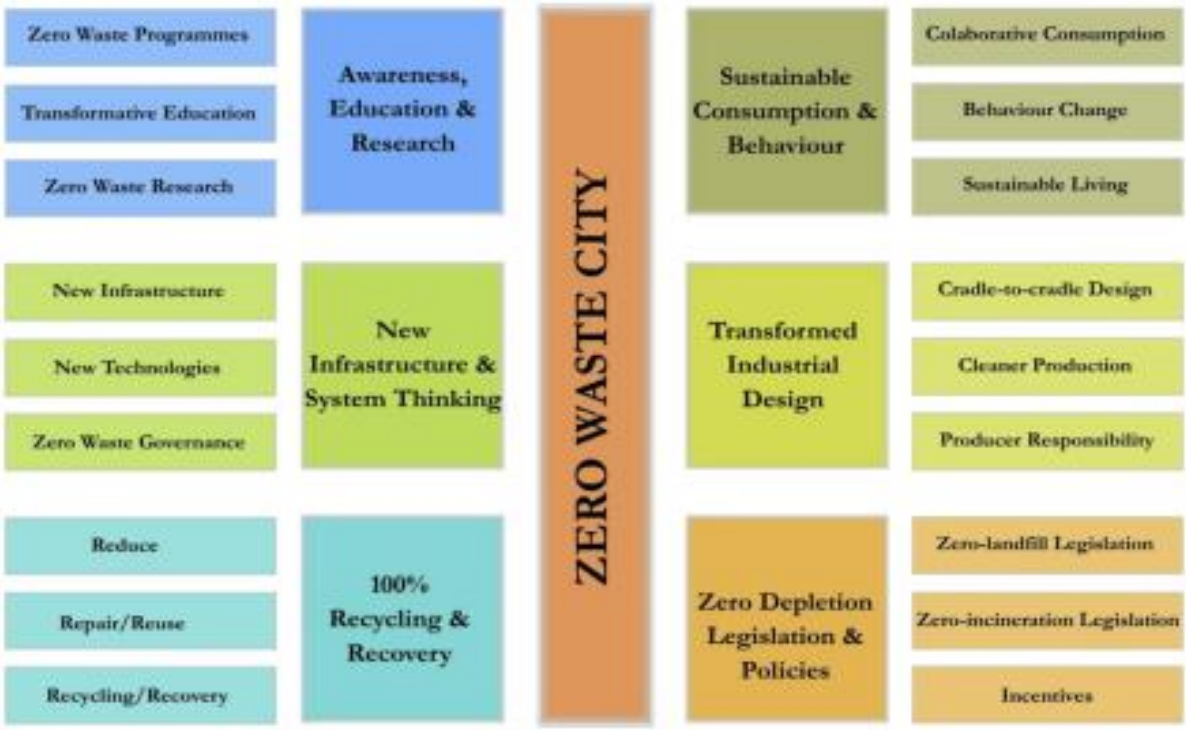

Figure 1. Zero-waste Management
Source: (A. U. Zaman & Lehmann, 2013)

Developing the idea of a waste management system into a zero-waste system requires the integration of several parameters, including geography, waste prevention through design, behavior change, waste reduction through reuse, and redesign. According to Zaman (2013), the seven main domains of zero-waste indicators are geo-administrative, socio-cultural, management, environmental, economic, organizational, governmental, and policy.

The involvement of all parties is necessary to implement the zero-waste concept, including the private sector, government, and educational *institutions* in campaigning for the zero-waste concept (Nizar et al., 2017). These seven indicators are interconnected to achieve zero-waste. Besides these seven indicators, program sustainability is also crucial for the success of zero-waste. The zero-waste domain chart is shown in Figure 2.

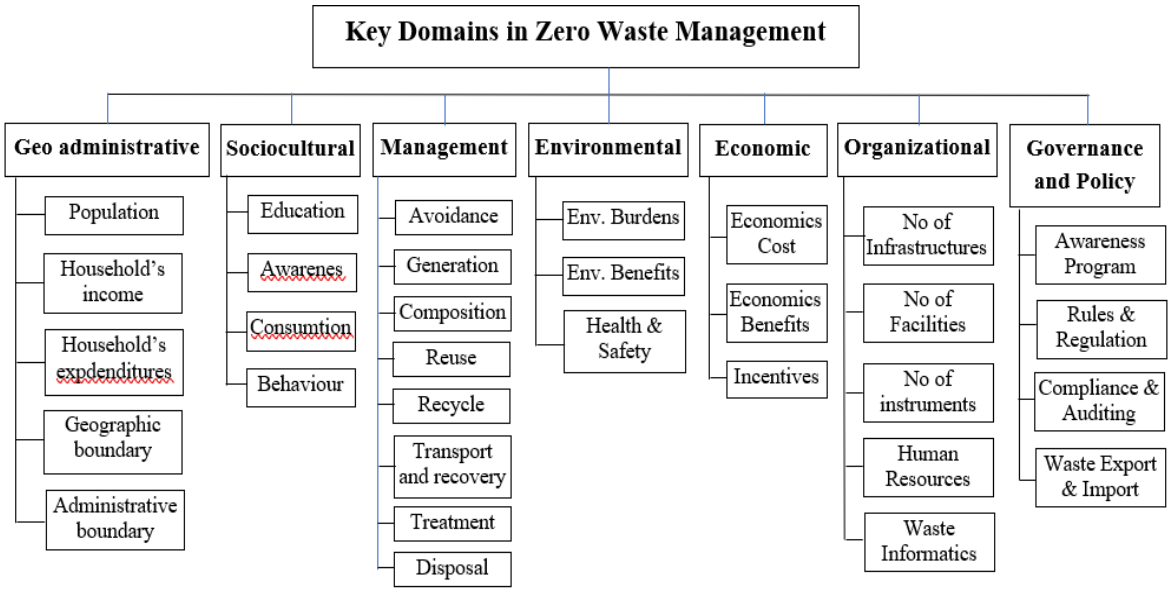

Figure 2. Domain Scheme in Zero-waste Management System
Source: (A. U. Zaman & Lehmann, 2013)

The Zero-waste concept implemented by the KerDUS Community in Kendal Regency is still an independent initiative in collaboration with schools, pesantren (Islamic boarding schools), the Health Office, the Environmental Office, and the PKK women's groups. The zero-waste education conducted is still local within Kendal Regency and has slightly expanded to the eastern part of Batang Regency. The management of the KerDUS community is still in the form of share ownership that is not solely profit-oriented. Their flagship product is the ecobrick, capable of containing dozens or even hundreds of used plastics in a plastic bottle for building materials such as chairs, tables, walls, fences, gates, or similar structures. The KerDUS Community's ecobricks have a minimum weight standard of 0.33 times the bottle volume, which has been tested for strength and recognized internationally. The management and calculation of ecobricks are registered with the Global Ecobrick Alliance (GEA). GEA records the number and weight of collected ecobricks, showing how much plastic has been saved. An example of an ecobrick crafted by the KerDUS community is shown in Figure 3.

Figure 3: Example of Ecobrick by KerDUS Community
Source: Author

3. Zero-waste Development

Zero-waste is the most cost-effective and efficient waste management concept but requires diligence, habituation, and responsibility. The first city to implement the zero-waste concept was Canberra, which enacted the Zero-waste Act in 1996 (Nizar, 2017). The Act implied that "The government will not produce waste starting in 2010." The zero-waste program includes the "Resource Recovery Park," a place that helps industries create products from separated materials and market reusable items.

Adelaide has implemented the zero-waste concept since 2004 with the Zero-waste SA Act to improve waste management systems and foster zero-waste in South Australia (ZWSA, 2011 in Zaman, 2013). Adelaide banned plastic shopping bags that could generate waste and promoted composting and recycling. Therefore, Adelaide continues to build composting facilities, achieving a target of 82% composting and reducing waste sent to landfills.

Stockholm is a country with high environmental quality standards. Stockholm is very prominent in regulations and policies in waste management systems, with one of the most important waste management policies being the ban on putting combustible waste and organic waste in landfills (Avfall Sverige, 2008 in Zaman, 2013). The zero-waste project includes "Vision Stockholm 2030," a future sustainable development plan to become a fossil fuel-free city by 2050 (Stockholm City, 2009 in Nizar, 2017).

The flow rate of materials with circular and linear systems (Song et al., 2015 in Ali, 2019). The development and activities of zero-waste in cities worldwide are shown in Table 1.

Table 1. Zero-waste Achievements and Events

Year	Country	Milestone/Event
1970s	United States	The term 'Zero-waste ' was introduced by Paul Palmer
1986	United States	National Coalition Against Mass Burn Incineration formed in Seattle
1988	United States	Introduction of Pay-As-You-Throw (PAYT)
1989	United States	California Integrated Waste Management Act was passed to achieve a 25% waste diversion target from landfills by 1995 and 50% by 2000
1990	Sweden	Thomas Lindhquist presented Extended Producer Responsibility
1995	Australia	Canberra enacted the No Waste by 2010 Act
1997	New Zealand	The Zero-waste New Zealand Trust established
1997	United States	California Resource Recovery Association (CRRA) held a zero-waste conference
1998	United States	Zero-waste adopted as a key waste management principle in North Carolina, Seattle, Washington DC
1999	United States	CRRA held a zero-waste conference
2000	United States	San Francisco Global Alliance for Incinerator Alternatives formed
2001	United States	Grassroots Recycling Network published the Citizen's Agenda for Zero-waste
2002	New Zealand	Publication of the book Cradle to Cradle
2002	United States	Zero-waste International Alliance (ZWIA) formed and the first Zero-waste Summit held in New Zealand
2004	United States	ZWIA defined zero-waste

2004	Australia	Zero-waste established in South Australia
2008	United States	Sierra Club adopted a zero-waste producer responsibility policy
2012	United States	The documentary film Trashed premiered at the Cannes Film Festival; Zero-waste Business Council established in the United States

Source: (Ali & Kumar, 2019)

Conventional waste management still follows the collect-transport-dispose system with a linear circular system, resulting in landfills becoming unsightly areas filled with waste piles. Waste in these landfills is considered useless and harmful to the environment. Even long-buried waste can produce methane gas, which can potentially explode and cause disasters. Managing waste in landfills also requires large areas far from residential areas, as it can cause odors, leachate, and sources of disease and pollution. Therefore, environmentally friendly and cost-effective waste management is needed, which can be achieved through the zero-waste concept.

The zero-waste concept operates cyclically, involving the government as policymakers, instilling environmental awareness in the community, environmental management that supports sustainable development, green economics, and the private sector and government in processing and marketing waste products. With the cyclic concept, waste from previous materials can be used as raw materials for recycled products, continuing until the product/material is used again. The cyclic waste diagram is explained in Figure 4.

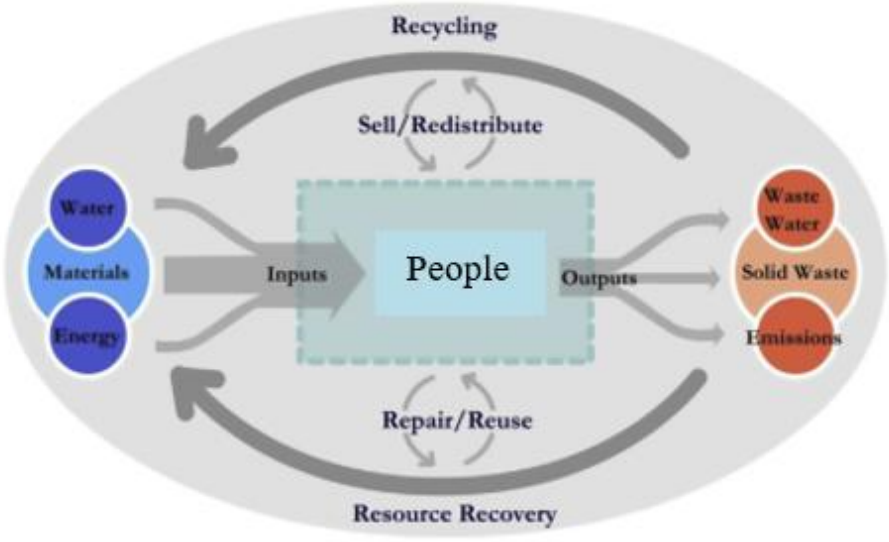

Figure 4. Material Flow in a Zero-waste System
(Source: Girardet, 1992, 1999 in Zaman, 2013)

The zero-waste concept does not always follow a cycle, as the quality and lifespan of materials vary, leading to their eventual disposal as waste. Zero-waste applies a mixed flow diagram between cyclic and linear diagrams. This is explained in Figure 5.

Figure 5. Material Flow Rate Through Circular (Zero-waste) and Linear Systems
Source: (Song et al., 2015 in Ali & Kumar, 2019)

The steps of the zero-waste action plan include:

a. Pre-evaluation: Pre-data collection, data analysis, and Waste Management Systems (WMS) pre-assessment.
b. Strategy Implementation: Education and awareness of waste, transformative knowledge of waste, responsible shopping practices, collaborative consumption, cradle-to-cradle product design, extended producer responsibility, expanding product use-life, creating recycling markets, improving collection systems, decentralized recycling centers, improving source reduction, empowering social technology, environmentally friendly technology, interim landfills, restrictions on mass incineration, economic incentives, standardized waste data, and zero-waste research.
c. Post-evaluation: Post-data collection, post-assessment, and performance evaluation.
   The action plan steps are explained in Figure 6.

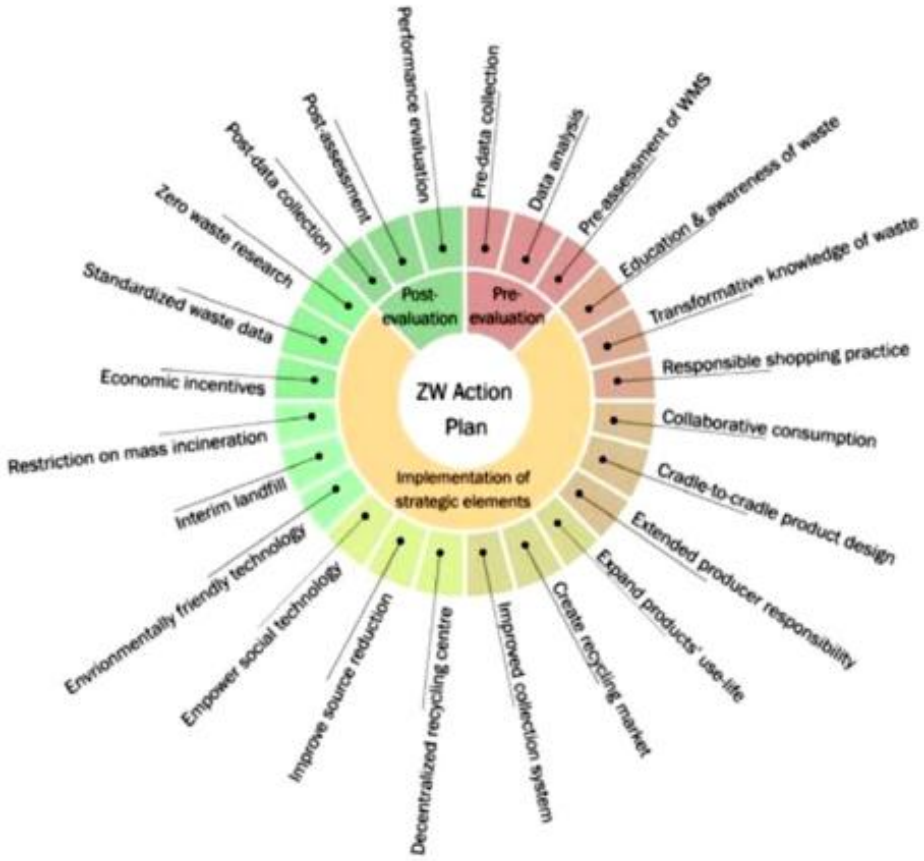

Figure 6. Zero-waste Action Plan
(Source: Ali & Kumar, 2019)

The implementation of zero-waste in the community must be properly planned so that it can be applied and accepted by the community. Therefore, before implementation, a field situation analysis, community characteristic data, and waste data in the community are conducted. This data is analyzed to select and determine an action plan that can be implemented using several strategies. The implementation results are evaluated as feedback and improvements towards a better zero-waste .

4. Zero-waste Lifestyle

Waste, the residue of human activities, can become either a disaster or a blessing. This depends on how we perceive and manage the existence of waste. Excessive consumption leads to global issues such as climate change, loss of biodiversity, increased air, water, soil pollution, deforestation, and depletion of resources and materials. Therefore, strategies are needed to minimize waste and eliminate waste from processes and their residues for the sustainability of life (Zero-waste SA Strategy, 2020 in Nizar, 2017).

Management strategies start from the source, which is public awareness. If people are responsible and wise about the waste they produce, waste generation will decrease or even disappear. Successful waste management begins with a community that is wise and environmentally conscious. Other supporting aspects include the involvement of the private sector, government, environmental care communities, and the education sector in campaigning for the zero-waste movement. Through

zero-waste management campaigns, awareness will arise to avoid creating waste. Thus, waste management focuses not on adding waste collection equipment or creating sanitary landfills but on human awareness (Nizar, 2019).

The KerDUS Community educates and provides examples of a zero-waste lifestyle that can be applied in daily life, such as bringing baskets or bags for shopping (Hidayati et al., 2021). These shopping baskets are made from woven coffee wrappers, while shopping bags are made from unused clothes or t-shirts repurposed into shopping bags. When traveling, to school, or to the office, people bring food in lunch boxes and drinks in tumblers that can be refilled repeatedly. Reducing the use of tissues by using handkerchiefs, napkins, or cloths. Food wrappers, snack packaging, or parcels are cleaned and collected to be made into crafts such as bags, mats, brooches, flowers, or eco-bricks.

Mothers who cook in the kitchen also sort their waste. Vegetable scraps and fresh fruit peels can be collected to make eco enzymes, while food scraps and other organic waste can be put into compost drums to make liquid organic fertilizer and compost. The finished liquid organic fertilizer and compost can fertilize vegetables or plants around the house or garden. Vegetables can be cooked and eaten, and the leftovers can be made into fertilizer.

Processing kitchen waste into liquid organic fertilizer requires compost drums arranged according to needs so that leachate and residue can be separated directly for easy harvesting. The KerDUS Community in Kendal innovates by creating tools to decompose waste into liquid organic fertilizer and compost using compost drums or stacked buckets. Each household can use these drums safely and can hold much waste. These drums are estimated to hold kitchen waste up to a year until the residue is full. The residue is then buried or covered with plastic to be made into compost for about three months. Liquid organic fertilizer is usually harvested weekly, depending on the type and quantity of organic waste added. The amount of black liquid flowing through the compost drum hose indicates that the leachate or liquid organic fertilizer is full. The compost drum is illustrated in Figure 7.

Figure 7. KerDUS Community Compost Model
Source: Author

The composter is partitioned to separate solid waste and leachate (liquid organic fertilizer). The leachate is drained through a clear hose installed at the bottom of the compost drum to flow directly

into a collection bucket. The compost drum has small holes for air entry and hoses on the right and left sides to exit maggots/BSF flies (waste-decomposing flies rich in protein for animal feed).

The leachate used for liquid organic fertilizer must be aerated for about two days to remove gas and foul odors. This liquid fertilizer is environmentally friendly, made from natural materials, and enhanced with bioactivators created from the fermentation of pineapple, banana stems, coconut water, brown sugar, and rice washing water for four weeks.

The KerDUS Community educates the public about zero-waste through various divisions, including the eco brick division, bungpi division, gazebo florist division, POC Konco Resikan division, maggot division, bioactivator division, PVC pipe lantern division, Nigel soap division, and fabric doormat division. Each division has expert trainers/mentors according to their expertise. The division structure is shown in Figure 8.

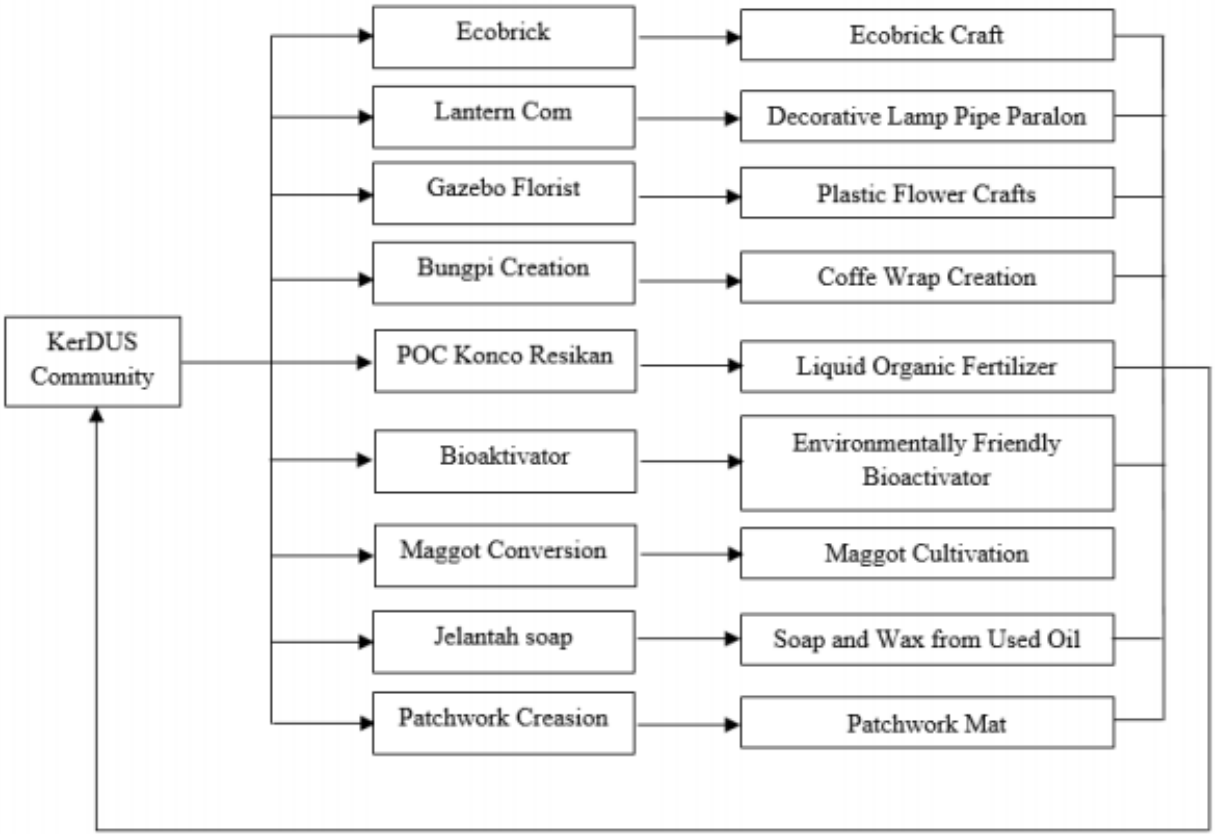

Figure 8. Divisions of KerDUS Community
(Source: Author)

Figure 9 shows the processed products and zero-waste concepts of the KerDUS Community. The Community's vision, "Zero-waste Konco Resikan," is a cheer to boost the spirit of the Community and training participants.

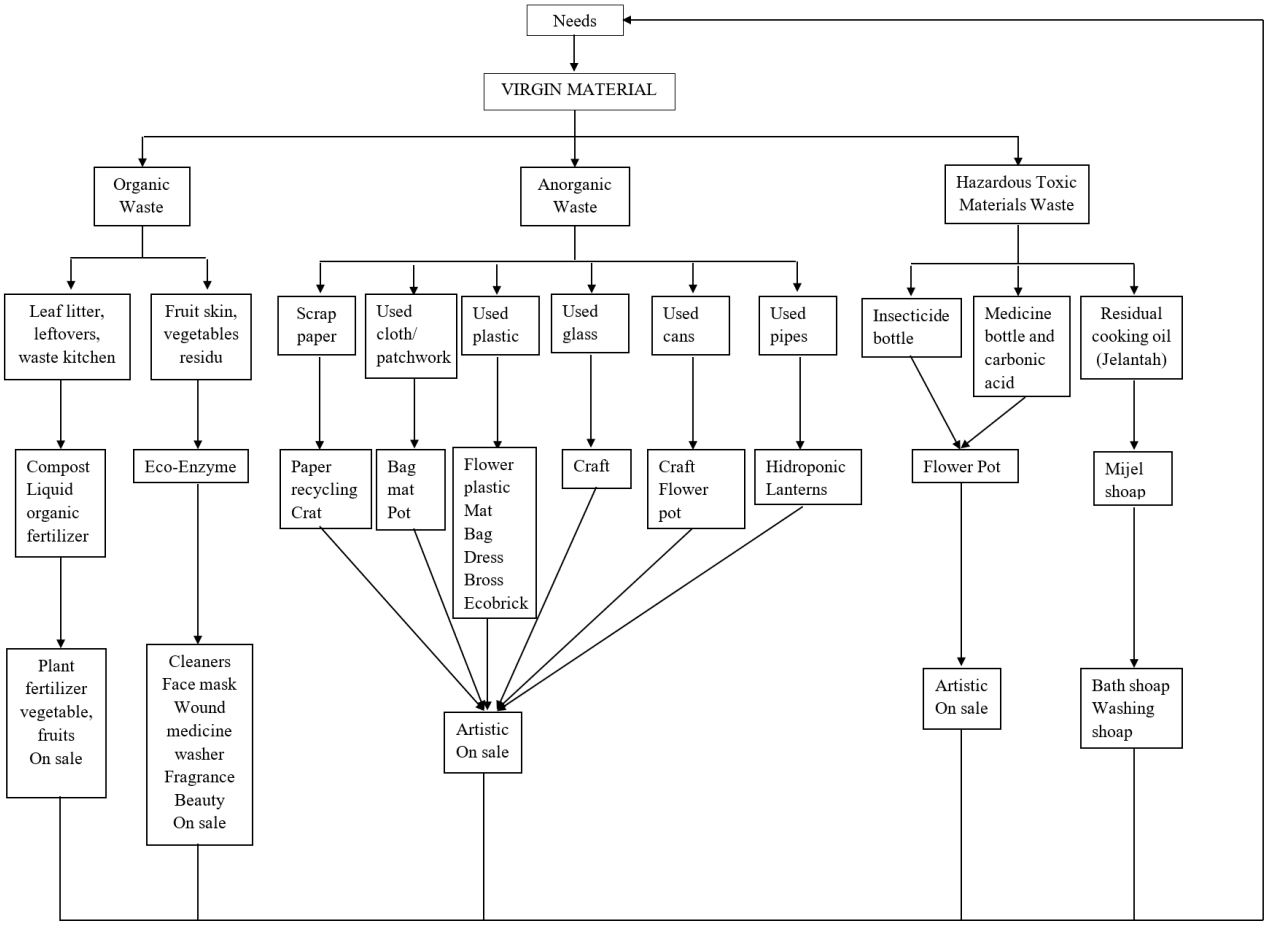

Figure 9. Zero-waste Concepts of KerDUS Community
(Source: Author)

In addition to educating the community, the KerDUS Community also practices a zero-waste lifestyle daily. Research findings indicate that community members produce an average of 1.5 kg of waste per day, with an average waste processing rate of 1.1 kg. According to Zaman's formula (2013):

$$Diversion\ rate = \frac{Weight\ of\ recyclabels}{Weight\ of\ garbage + Weight\ of\ recyclables}\ x\ 100\%$$

On average, 73.33% of KerDUS Community members practice a zero-waste lifestyle by processing their waste, both organic and inorganic

5. Challenges in Implementing Zero-waste

Implementing the zero-waste lifestyle in Kendal Regency highlights the intricate challenges of achieving sustainable waste management in semi-urban areas. A primary obstacle is the limited public awareness and commitment to zero-waste practices. Local initiatives, such as the efforts by the KerDUS Community, aim to promote education and provide training on waste management. However, participation remains low, and even those who attend training often struggle to implement the practices consistently. This inconsistency arises from perceived complexities, a lack of motivation, and

the absence of strict regulations or enforcement by local authorities. Research by Deviyanti HS (2023) found that despite a temporary increase in awareness following training sessions, participants often fail to sustain their efforts due to these barriers, underscoring the need for systemic support to enhance public engagement.

Another significant challenge lies in community-produced recycled products' economic viability and marketability. Items such as liquid organic fertilizer, compost, ecoenzyme, and crafts made from inorganic waste face difficulty penetrating the market. As noted by Budiani et al. Widiarti (2012) states that a preference for mass-produced chemical products over environmentally friendly alternatives is a persistent issue, even though the latter offers greater sustainability benefits. Consequently, many recycled products are used personally or shared within small local networks, limiting their broader impact. The lack of effective distribution channels and government or private sector marketing support further exacerbates this problem, reducing financial incentives for communities to engage in waste processing.

Addressing these limitations requires a multifaceted approach involving collaboration among communities, the government, and the private sector—research by Kustanti et al. Kurniawan (2023) emphasizes the importance of institutional support, comprehensive public education, and market development to encourage zero-waste practices. Strengthening partnerships across stakeholders can help create a supportive ecosystem for sustainable waste management. By integrating public awareness campaigns, financial incentives, and efficient distribution systems, Kendal Regency can establish a model for effective zero-waste implementation, ensuring environmental and economic sustainability.

6. Environmental Policies and Waste Management Strategies

More stringent and comprehensive environmental policies are needed to support the implementation of a zero-waste lifestyle. The government should issue regulations that support zero-waste programs, such as banning single-use plastics and providing incentives for people who adopt a zero-waste lifestyle. Additionally, policies are needed to encourage industries to produce environmentally friendly and easily recyclable products (Zaman, 2022).

Necessary environmental policies include introducing a tax or incentive system for industries that produce environmentally friendly products and imposing sanctions on industries that do not comply with environmental regulations. Furthermore, the government needs to develop adequate recycling infrastructure and facilities and provide easy access for the community to manage waste. For example, the government can provide composting facilities in every village or organize regular recycling waste collection programs.

Strategies to increase public awareness and participation in waste management include continuous education, environmental campaigns, and collaboration between the government, communities, and the private sector. Continuous education can be carried out through school programs, social media campaigns, and community activities. Collaboration between the government,

communities, and the private sector is essential to creating an effective and sustainable waste management system (Nizar et al., 2017).

Continuous education can be carried out through school programs, social media campaigns, and community activities. For example, the government can collaborate with schools to integrate waste management and zero-waste lifestyle materials into the curriculum. Social media campaigns can also disseminate information and raise awareness about managing waste sustainably.

Collaboration between the government, communities, and the private sector is crucial to creating a compelling and sustainable waste management system. For example, the government can work with communities like KerDUS to organize training and workshops on waste management. Moreover, the private sector can support zero-waste programs by providing environmentally friendly products and supporting recycling activities.

With supportive policies and appropriate strategies, the zero-waste lifestyle is hoped to be implemented more widely and effectively in Kendal Regency. This will help reduce waste generation and its negative impact on the environment and increase public awareness and participation in preserving the environment.

D. Conclusions

Implementing a zero-waste lifestyle in Kendal district faces complex challenges, including low public awareness, limited commitment, and lack of regulatory support and adequate infrastructure. Local initiatives such as the KerDUS Community have made significant contributions through education and training, but community participation remains limited, and many participants struggle to maintain the practices taught. In addition, marketing waste products such as liquid organic fertilizer, compost, and inorganic waste crafts is also a significant obstacle due to the community's preference for manufactured products and the lack of effective distribution channels. Although these challenges are significant, a more coordinated approach and institutional support can create a more sustainable waste management system and empower local communities.

Addressing these challenges requires stronger environmental policies and collaboration between communities, government, and the private sector. The government needs to adopt policies that support waste reduction, such as banning single-use plastics, incentivizing eco-friendly products, and developing a recycling infrastructure that is easily accessible to the public. We should expand continuous education through schools, social media, and community programs to increase public awareness. More research could be done to see how well working together across sectors helps to increase the number of markets for zero-waste products and find technology-based waste management solutions. With the right approach, Kendal District can become a model for zero-waste lifestyle implementation in semi-urban areas, supporting environmental sustainability locally and nationally.

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