

Analysis of Samarinda City Waste Generation and Management towards a Sustainable City

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Abstract:- Samarinda City, as the capital of East Kalimantan, has experienced a significant increase in waste generation in line with population growth and economic activity. This gives rise to various environmental and public health problems. This case study aims to analyze waste generation in Samarinda City and evaluate the existing waste management system in Samarinda City. The research method used is a case study. The research location is Samarinda City, East Kalimantan. Data collection techniques include literature studies, visits to the Samarinda City Environmental Service for field observations, interviews with stakeholders. The data analysis technique used is SWOT Analysis. Waste management in Samarinda City needs to be improved to achieve a sustainable city. Educational efforts, community participation and the development of an integrated waste management system are the main keys in overcoming the waste problem in Samarinda City.

Keywords:- Waste Generation, Waste Management, Sustainable City, Samarinda

I. INTRODUCTION

The increase in the amount of waste generation caused by economic growth which results in increased public consumption of goods and services indirectly causes the composition of existing waste to become more diverse. The emergence of various types of waste composition in waste generation can be determined from the economic level of the community in each region. The amount of waste generation needs to be reduced and handled. Indirectly, waste management is related to the reduction and handling of waste originating from the source, namely the community itself. Community participation is the key to successful waste management. One of the factors that influences community participation is education. Educated communities are more active in carrying out recycling and waste sorting programs. The paradigm of the community's perspective on waste needs to be changed, for example empowering the community to participate in waste management and The increase in the amount of waste generation caused by economic growth which results in increased public consumption of goods and services indirectly causes the composition of existing waste to become more diverse. The emergence of various types of waste composition in waste generation can be determined from the economic level of the community in each region. The amount of waste generation needs to be reduced and handled. Indirectly, waste management is related to the reduction and handling of waste originating from the source,

namely the community itself. Community participation is the key to successful waste management. One of the factors that influences community participation is education. Educated communities are more active in carrying out recycling and waste sorting programs. The paradigm of the community's perspective on waste needs to be changed, for example empowering the community to participate in waste management and handling from household waste to landfill with legal instruments (Kahfi, 2017). Waste generation is the amount and type of waste produced by an area or community in a period of time. Waste generation can be calculated based on weight, volume or number of packages. The following are several types of waste generation that are commonly found: 1. Organic- Organic waste comes from food scraps, vegetables, fruit, and other domestic waste. Examples: food scraps, leaves, fruit, and waste from the kitchen. 2. Inorganic - Inorganic waste comes from non-organic materials such as plastic, paper, glass and metal. Examples: plastic bottles, newsprint, cans and waste from industry. Azkha (2007) Waste is an environmental problem that has long been of global concern and needs to be handled seriously so that it does not cause dangerous impacts. Everyone cannot be separated from the waste problem because everyone produces waste from the process of their activities. The volume of waste increases in line with the rate of population growth, technological improvements, socio-cultural activities and economic growth of society in an area. Waste generation can vary based on various factors such as: a. Number of population. The more population, the more waste is produced, b. Product use: The more non-degradable products are used, the more waste is produced. c. Environmental conditions Poor environmental conditions can affect the amount of waste produced.

Limited Waste Transport Capacity, Samarinda City has a Bukit Pinang Final Disposal Site (TPA), but this TPA has exceeded its capacity. Low waste transportation capacity causes some waste not to be transported, which ultimately hampers the government's efforts to create a clean and healthy environment. 4. Less effective waste management policies. Waste management policies in Samarinda, such as Regional Regulation no. 2 / 2011, did not run effectively due to lack of waste transportation capacity. This policy also does not pay enough attention to public education, which is important to change people's behavior in managing waste.

To overcome this problem, the government's role is very necessary, supported by community concern. Waste management must be carried out in a comprehensive and integrated manner, minimizing negative impacts on public health and the environment. The government must increase waste transportation capacity and provide better public education to change people's behavior in managing waste.

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Waste is one of the most significant environmental problems in the world. The negative impact of waste on the environment and public health is very serious. First, waste that is not processed properly can cause water and soil pollution. Garbage that is thrown away carelessly can cause groundwater to be polluted, which in turn can affect the quality of drinking water. Apart from that, unprocessed waste can also cause a decrease in soil quality, which can disrupt the plant growth process and threaten animal life. Second, waste that is not processed properly can become a nest for insects and rodents that carry disease. Garbage that is not properly processed can become an ideal place for insects such as mosquitoes and flies to breed. These insects can carry diseases such as dengue fever, malaria and diarrhea. Apart from that, unprocessed waste can also be an ideal place for rodents such as mice and bobcats to breed. These rodents can carry diseases such as typhus and leptospirosis. Third, waste that is not processed properly can cause an increased risk to public health. Waste that is not processed properly can cause an increased risk of cancer, asthma and lung disease. Apart from that, unprocessed waste can also cause an increased risk of infectious diseases such as diarrhea and cholera. Therefore, it is important to process waste properly and ensure that waste is not thrown away carelessly in order to reduce negative impacts on the environment and public health.

➤ Research Objectives:

- Analyzing Waste Generation in Samarinda City.
- Evaluating the Existing Waste Management System

II. RESEARCH METHOD

The type of research used is a case study. The research location is Samarinda City, East Kalimantan. Data collection techniques include literature studies, visits to the Samarinda City Environmental Service for field observations, interviews with stakeholders. The data analysis technique used is SWOT Analysis.

III. RESULTS AND DISCUSSION

A. Research Results

In Samarinda, the problem of waste generation is a serious concern for the government and society. Interview results show that community participation in waste management is still low, despite efforts by the government to increase awareness and provide facilities. The Department of Cleanliness and Parks (DKP) is trying to reduce and handle waste by separating wet and dry waste, as well as inviting the public to care more about the environment. The area that has the highest waste generation, namely 18.16%, is Sungai Kunjang District with the highest population, namely 139,320 people. This shows that the amount of waste generation is directly proportional to the population.

The main obstacle faced is the lack of adequate facilities and education. The public is expected to be more active in sorting waste from its source, but many do not understand the importance of this action. Research shows the need for more effective outreach and enforcement of sanctions for violators to increase community participation in waste management. The following is a table of Samarinda City Waste Generation data based on the population of 10 sub-districts in 2024.

Table 1 Table of Waste Generation in Samarinda City in 2024

NO	SUBDISTRICT	AREA (KM ²)	MALE (M)	FEMALE (F)	Number of population (People) M+F	Potential amount of waste generation		Value in %
						M ³ (6*0,7/1000*3,845)	Ton (6*0.7/1000)	
1	2	3	4	5	6	7	8	9
1	PALARAN	182.53	34,410	32,502	66,912	180.094	46.838	7.76
2	SAMARINDA SEBERANG	12.49	33,560	32,236	65,796	177.090	46.057	7.63
3	LOA JANAN 1 LI R	22.12	35,339	34,057	69,396	186.779	48.577	8.05
4	SUNGAI KUNJANG	17.18	70,750	68,570	139,320	374.980	97.524	16.16
5	SAMARINDA LILLI	229.52	67,496	65,835	133,331	358.860	93.332	15.47
6	SAMARINDA KOTA	69.23	16,287	16,092	32,379	87.148	22.665	3.76
7	SAMARINDA UTARA	100.95	57,196	54,880	112,076	301.653	78.453	13.00
8	SUNGAI PINANG	34.16	56,001	54,472	110,473	297.338	77.331	12.82
9	SAMARINDA ILIR	23.69	35,586	34,180	69,766	187.775	48.836	8.09
10	SAMBUTAN	26.13	31,852	30,577	62,429	168.028	43.700	7.24
TOTAL/day		718.00	438,477	423,401	861,878	2,319.74	603.3146	100.0000
TOTAL /year						846,706.79	220,209.83	

➤ *Analysis of Waste Generation in Samarinda*

SWOT analysis of waste generation and composition, SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) for waste generation and composition can provide strategic guidance in waste management. Following are some of the important points of a SWOT analysis related to waste generation: A SWOT analysis for waste generation involves identifying strengths, weaknesses, opportunities, and threats in waste management.

- *Strengths*

- ✓ *Resource Potential:*

Samarinda has potential human and natural resources that can be utilized for waste management, such as skilled labor, land for landfill, and energy potential from organic waste.

- ✓ *Existence of Regulations:*

Samarinda City has regional regulations regarding waste management which can become a legal basis for efforts to overcome this problem.

- ✓ *Public Awareness:*

As time goes by, public awareness of the importance of waste management tends to increase.

- *Weaknesses*

- ✓ *Lack of Infrastructure:*

There are still many areas in Samarinda that do not have adequate waste management infrastructure, such as temporary waste disposal sites (TPS) and final disposal sites (TPA).

- ✓ *Low Community Participation:*

Despite increasing awareness, community participation in waste segregation and reduction is still low.

- ✓ *Budget Limitations:*

The budget allocated for waste management is often limited, thus hampering the implementation of more effective programs.

- *Opportunities*

- ✓ *Utilization of technology:*

Development of technology in waste management, such as processing organic waste into compost or biogas, can be an effective solution.

- ✓ *Collaboration with the Private Sector:*

Partnerships with the private sector can increase waste management efficiency and open up investment opportunities.

- *Circular Economy Development:*

Application of the circular economy concept can create added value from waste and reduce waste.

- *Threats*

- ✓ *Increase in Population:*

Population growth will have an impact on increasing the amount of waste generated.

- ✓ *Climate Change:*

Climate change can trigger natural disasters that have the potential to disrupt waste management systems.

- ✓ *Lack of Law Enforcement:*

Lack of law enforcement against violators of waste management regulations can hamper efforts to address the problem.

By having people aware of the waste problem, handling the waste problem will also be easier because people will be encouraged to reduce the amount of waste they produce and will be encouraged to handle waste better (Usman, 2016)

- *Evaluation of Samarinda City's Waste Management System*

SWOT analysis Evaluation of Samarinda City's waste management system, SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) for the waste management system in Samarinda City shows several internal and external factors that influence waste management. Here are some important points from a SWOT analysis.

- *Strengths*

- ✓ *Availability Of Facilities:*

Samarinda City has sufficient waste transportation facilities, such as rubbish trucks and rubbish transport cars.

- ✓ *Citizen Compliance:*

Samarinda residents generally comply with waste management rules, such as throwing rubbish in the right place.

- *Weaknesses*

- ✓ *Landfill Capacity:*

Final Disposal Sites (TPA) in Samarinda have limited capacity, which can lead to piling of waste.

- ✓ *Infrastructure:*

Waste management infrastructure, such as temporary shelters (TPS), is still lacking.

- *Opportunities*

- ✓ *TPA Development:*

Development of a new TPA can increase waste management capacity.

- ✓ *Increasing Awareness:*

Increasing public awareness about the importance of waste management can increase citizen participation in the waste management process.

- *Threats*

- ✓ *Lack of Support:*

Lack of support from the government and community can hamper waste management efforts.

- ✓ *Climate Change:*

Climate change can affect the amount of waste produced and require adaptations in waste management systems.

Based on this SWOT analysis, strategies that can be taken include increasing landfill capacity, increasing public awareness, and optimizing waste transportation facilities.

B. Discussion:

➤ *Waste Generation in Samarinda City Shows an Increasing Trend Every Year.*

Waste generation in Samarinda City shows an increasing trend every year. Based on data from the Samarinda City Environmental Service, the volume of waste produced increased from 816,588 m³ in 2021 to 824,168 m³ in 2023, with an increase of 1.4% in two years. This increase was caused by population growth of 1.26% per year and increased community activity after the new normal order, which led to an increase in public consumption and, as a result, an increase in waste volume. In addition, analysis of waste transportation in Samarinda shows that the percentage of waste transported reached 70.93% in 2019, with a waste transportation target of 90% according to the Samarinda City Regional Medium Term Development Plan (RPJMD) for 2016-2021. Increasing waste transportation is important to optimize the waste management system and reduce negative impacts on the environment and public health.

With the increase in waste volume and the increase in the percentage of waste transported, the City of Samarinda must continue to increase its efforts in managing waste in a comprehensive and integrated manner to minimize negative impacts on the environment and public health.

➤ *The Waste Management System in Samarinda City is Still not Optimal.*

The waste management system in Samarinda City is still not optimal due to several main factors. First, there is a lack of public awareness about the importance of cleanliness and waste management. People still often throw rubbish carelessly, such as in rivers or gardens, which causes environmental pollution. Second, there is a lack of facilities and infrastructure, such as waste disposal sites (TPS), which are only available in limited quantities in each environment. Third, there is a lack of field workers who can help in waste management. Fourth, there is a lack of public awareness regarding participation in cleanliness and a lack of strong supervision and sanctions against people who violate the regulations. As a result, waste that is not transported causes an unclean and healthy environment, which is difficult for the city government to overcome. The community is still weak in their responsibility for the waste they produce, and there is minimal effort to reduce and process waste. The paradigm

that is developing is still Collect-Transport-Dispose. Not yet Reduce, Reuse and recycle (3R). Waste has become a serious problem in Indonesia. There is a big threat posed by waste if waste is not properly managed (Nur Cahyo, 2019). The main factors causing a lack of public awareness in waste management in Samarinda City are:

- *Lack of Public Understanding about Waste Management:*

Many people do not understand the process of waste management from waste source to final handling, so they do not understand the importance of sorting waste and handling it properly.

- *Habit of Littering:*

People still often throw rubbish in rivers, gardens or public places, which causes environmental pollution.

- *Lack of Facilities and Infrastructure:*

There are few waste disposal sites (TPS) in each neighborhood and a lack of rubbish bins in public places such as houses, streets and other public places, which causes rubbish to be scattered everywhere .

- *Lack of field workers:*

Lack of workers who can help in waste management, such as cleaners and field workers who are responsible for collecting and transporting waste.

- *Lack of Public Awareness in Participation and Supervision:*

Lack of public awareness in participation in cleanliness and lack of strong supervision and sanctions against people who violate regulations, which causes many people not to pay attention to the importance of cleanliness.

Various kinds of waste as a by-product of human activities continue to be produced every day. In markets, industry, offices, households and even schools, waste problems are not spared. This is caused by people's habit of throwing rubbish carelessly which is difficult to eliminate. The basic problem of society in throwing rubbish carelessly is caused by the fact that so far people have behaved or have habits that are not correct in managing waste (Amri, 2017). The way to overcome the habit of people throwing rubbish carelessly is as follows:

- *Education and Awareness Campaigns:*

Conduct ongoing educational campaigns regarding the importance of disposing of waste in the right place. Involving the community, especially young men and women, in outreach activities regarding the negative impacts of littering and the benefits of environmentally responsible behavior.

- *Providing Waste Disposal Infrastructure:*

Build and maintain adequate waste disposal infrastructure. This includes increasing the number of rubbish bins in each neighborhood and ensuring that these bins are always available and clean.

- *Implementation of Strict Sanctions:*

Imposing strict sanctions on people who throw rubbish carelessly. Signs prohibiting littering near rivers or public places can help prevent this action.

- *Make Warning Banners:*

Make warning banners that are placed around bridges close to rivers. It is hoped that this banner can warn the public or road drivers not to throw rubbish in the river.

- *Creating a Collective Waste Disposal Site:*

Building a collective waste disposal site that can be used by the community to dispose of their waste. This will help reduce litter that is thrown away carelessly.

Disposal or disposal of waste is generally carried out at the Final Processing Site (TPA) in the form of a landfill. TPA requires a large area of land, especially if the waste management carried out still adheres to the collect-transport-dispose principle. Some cities, which generally have limited land, cannot provide land for landfill. Some cities use landfill land in other adjacent administrative areas which are able to provide large enough land. The selection of landfill locations generally only considers land availability, land ownership and land prices (Maryati, 2019). How to build safe and effective waste disposal (TPA) infrastructure is as follows:

- *Plan Carefully:*

Make a thorough plan for the landfill infrastructure, including purchasing equipment, setting a waste collection schedule, and waste management.

- *Involve the Community:*

Involving the community in waste management will increase their awareness and responsibility in protecting the environment.

- *Community Education:*

Socialize the importance of good waste handling through educational campaigns and creating educational materials.

- *Optimize Waste Utilization:*

Look for ways to use waste into economically valuable products, such as making compost or handicrafts from recycled materials.

- *Provide Incentives:*

Provide incentives to people who are active in handling waste, for example subsidies for purchasing rubbish bins or managing household waste.

- *Maintain Sustainability:*

Ensure that the landfill infrastructure is running well and continuously updated to remain effective in the long term.

- *Facility Development:*

Build adequate regional level waste processing facilities and final waste processing sites (TPA). This facility must be

equipped with facilities and infrastructure for controlling drainage and processing leachate (waste runoff water).

- *Development of Integrated Waste Management Sites:*

Development of integrated waste management sites at the sub-district level or several sub-districts to manage waste at its source spread throughout the region.

- *Development of Reduce, Recycle, Reuse Waste Processing Sites:*

It is hoped that every community will receive information regarding 3R waste processing. receive guidance to be able to carry out environmentally sound waste processing, in the form of environmental education as well as outreach and improving education. Apart from that, there is cooperation with related agencies in dealing with waste problems thereby increasing community empowerment (Ediana, 2018). Development of reduce, recycle and reuse waste processing facilities at the village/subdistrict/Traditional Village level to minimize the volume of waste entering the landfill.

- *Organic Waste Management:*

Waste can be divided into organic and inorganic. Based on an analysis of the characteristics of solid waste from many developing countries, it was found that the majority (more than 80%) of the total solid waste consists of organic waste, which usually does not receive much attention for processing or recycling. re (Moqsud et al., 2008) Processing organic waste to reduce the volume of waste and reduce the negative impact of waste decomposition.

By following these tips and criteria, landfill infrastructure can be built safely and effectively, so that it can help maintain environmental cleanliness and prevent pollution. Community behavior is still limited to sorting and selling inorganic waste according to the selling value of used goods. This is a result of the lack of skills in changing the form of waste into creative objects with higher selling value (Majdi, 2023). How to optimize the use of waste into economically valuable products is as follows:

- *Education and Awareness Campaigns:*

Carry out ongoing educational campaigns regarding the importance of using waste as goods of economic value. Involving the community, especially housewives, in outreach activities and direct practical training on how to utilize waste into products of economic value.

- *Product Development:*

Developing products that can be made from waste, such as handicrafts from plastic waste, compost from organic waste, and other products that can be sold or used by the public.

- *Community-Based Waste Management:*

Optimizing community-based waste management by empowering communities to sort and process waste at home. This can be done through intensive training and mentoring.

- *Utilization of Technology:*

Using technology and applications that can help in waste management, such as waste banks and efficient waste collection systems. This can increase productivity and efficiency in waste utilization.

- *Local Economic Development:*

Building cooperatives and programs that can provide economic and ecological value to the community. This can be done by integrating waste utilization with marketing and marketing programs for the products produced.

- *Infrastructure Development:*

Building adequate infrastructure for waste processing, such as TPS and TPA that can accommodate waste properly. This will help in reducing the volume of waste that is thrown away carelessly.

By following these tips and criteria, waste utilization can be optimized so that it can provide economic and ecological benefits for society. Optimal use of waste can have a significant economic impact on society. By implementing effective recycling and waste management programs, communities can create new business opportunities. For example, processing organic waste into compost can be a source of income for local farmers. In addition, recycled plastic and paper waste can be used as raw materials for new products, creating sustainable small and medium industries. Thus, waste management not only reduces the volume of waste produced, but also improves the local economy through job creation and cost savings. On the ecological side, proper use of waste can help protect the environment and reduce the negative impacts of waste. By reducing the amount of waste that goes to final disposal sites (TPA), we can reduce land and water pollution, as well as greenhouse gas emissions resulting from the decomposition process. In addition, composting and recycling programs can increase public awareness about the importance of protecting the environment. By educating the public about waste segregation and the importance of recycling, we can create a more environmentally responsible culture. Thus, good waste management not only provides economic benefits, but also contributes to ecosystem sustainability. Waste management in Samarinda City needs to be improved to achieve a sustainable city.

Here are some steps you can take:

- *Policy and Strategy:*

The Samarinda City Government has issued the Jakstrada (Regional Strategy Policy) program for household waste management. This program includes comprehensive and integrated waste reduction and handling, minimizing negative impacts on public health and the environment.

- *Supervision and Sanctions.*

Mayor Regulation (PERWALI) of Samarinda City Number 18 of 2022 stipulates supervision and administrative sanctions for waste management. This includes management

information systems, coaching and performance evaluation, and financing.

- *Community Education:*

Efforts to build awareness among the community are not easy, because they require cooperation from the government, community and third parties as supporters. And the estimated time needed is also not small, it takes quite a long time to raise public awareness about the waste problem (Yunik'ati et al., 2019; Muttaqien et al., 2019). Apart from that, positive examples and motivation are needed in providing stimulus to the community as well as consistency from those who make policies in certain areas. Direct outreach activities and seminars on waste management can encourage community participation in managing waste so that it doesn't end up being thrown away (Maolani & Ishak, 2018). Policies that only regulate sanctions without public education are ineffective. The government must take a bottom-up approach by providing education and education to the public to change their behavior in managing waste.

- *Trash Can Facilities:*

The availability of good and sufficient trash can facilities is important to support waste management efforts. The government must provide more and better facilities to make it easier for people to dispose of waste properly.

- *Coordination and Cooperation:*

In overcoming the waste problem, good coordination and cooperation is needed between the government, the community and various related agencies. The government must encourage this collaboration to achieve the goal of effective waste management.

Waste management in Samarinda City is still a significant challenge to achieve a sustainable city. Samarinda City, as the capital of East Kalimantan Province, faces population growth of 1.26% per year and increased community activities which increase the volume of waste. Waste that is not managed properly can reduce the quality of human life and have a negative impact on cleanliness, the environment and society. Samarinda City has adopted the Jakstrada (Regional Strategic Policy) program for household waste management. However, the Bukit Pinang TPA, which is a Final Disposal Site (TPA), has exceeded its capacity, indicating the need for increased waste management capacity.

Analysis of waste management policies in Samarinda shows that waste management is ineffective due to low waste transportation capacity. This causes most of the waste not to be transported, which in turn hampers efforts to create a clean and healthy environment. In addition, existing policies do not pay enough attention to public education, which is very important for changing people's behavior. To achieve a sustainable city, waste management in Samarinda City needs to be improved by strengthening waste transportation capacity and providing more focus on public education. In this way, people can be more disciplined in disposing of waste and reduce the accumulation of waste that disturbs the environment.

IV. CONCLUSION

Waste management in Samarinda City needs to be improved to achieve a sustainable city. Educational efforts, community participation and the development of an integrated waste management system are the main keys in overcoming the waste problem in Samarinda City.

SUGGESTION

Further research needs to be carried out to determine the characteristics of waste generation in each sub-district in Samarinda City. It is necessary to study the feasibility of implementing appropriate waste processing technology for the City of Samarinda. It is necessary to carry out more intensive outreach and education to the public about the importance of sustainable waste management.

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