



# The Analysis of Priority Environmental Issues in The Waste Problem of Samarinda City in 2024

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**Abstract.** The problem of waste is of great concern because it affects the cleanliness aspect and social issues that can cause conflict within the community. Judging from the rapid development of Samarinda City, it has a profound impact on environmental problems. The method used in this study is a qualitative approach, which involves conducting descriptive research from the results of primary surveys and secondary data processing. The primary survey took the form of interviews conducted with agencies related to environmental issues in Samarinda City. Secondary data from related institutions was used to enrich the analysis of this study. The DPSIR approach is used, which consists of driving forces, pressures, conditions that occur (state), impacts, and responses to find out the problems and cause-and-effect relationships of the waste problem in Samarinda City. The results showed that the problem is one of the city problems of particular concern to the Samarinda City government. The amount of waste generation in Samarinda City reached 2,251.475 m<sup>3</sup> /day, equivalent to 600.512 tons/day. The results of the analysis supplied from the driving force consisted of geographical location and the trade and service sector, pressure consisted of population and community behavior in managing waste, the conditions that occurred (state) consisted of increasing waste generation and the condition of waste management facilities and infrastructure, impact consisted of environmental pollution and waste management that was not optimal and the response (response) carried out, namely the implementation, supervision, and enforcement of waste management laws and activities to improve waste management infrastructure.

**Keywords:** DPSIR, Samarinda City, Waste Management.

## 1 Introduction

Urban problems are one of the environmental dimensions related to the daily problems urban communities face. One of the urban problems is the waste problem. Urban problems are one of the ecological dimensions associated with the daily problems urban communities face. One of the urban problems is the waste problem. Urban environmental problems can result from various activities, both on a limited scale (narrow) and on a broad scale. For example, family activities that produce household waste have not

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M. R. Septyandy et al. (eds.), *Proceedings of the International Conference on Tropical Studies and Its Application (ICTROPS 2024)*, Advances in Engineering Research 263,

[https://doi.org/10.2991/978-94-6463-732-8\\_28](https://doi.org/10.2991/978-94-6463-732-8_28)

been in the spotlight on a limited scale because their impact does not interfere with health. On a broader scale, environmental problems become essential because many components bear the effects, while the party causing the impact benefits economically. Environmental problems are generally caused by natural events, rapid population growth, overuse of natural resources, industrialization, and transportation [1].

The problem of waste is of great concern because it affects aspects of cleanliness and social issues that can cause conflict within the community, following Indonesian Government Regulation 27 of 2020, which explains that waste is the residue of daily human activities or natural processes in solid form. Cities in Indonesia are also still facing obstacles in the waste sector. Waste in urban areas generally results in increased waste generation. It is natural for cities to become one of the areas that inevitably produce a lot of waste. Judging from the rapid development of Samarinda City, it has a profound impact on environmental problems. Samarinda City has a landfill with overload conditions that endanger the surrounding environment. In 2021, 2022, and 2023, the volume of waste produced by Samarinda City is 816,588.00 m<sup>3</sup>, 824,168.00 m<sup>3</sup>, and 841,286.00 m<sup>3</sup>, respectively. This data shows that the amount of waste production in Samarinda City continues to increase, which will harm Samarinda's environment [2].

The DPSIR (Driving Force, Pressure, State, Impact, and Response) model is an analytical framework widely used to evaluate environmental conditions in sustainable development. Complex environmental problems require an approach framework that can describe and communicate environmental issues comprehensively, and the DPSIR framework can answer these problems. The DPSIR method describes the causal relationship between various components of sustainable development: economic, environmental and social. Driving forces or triggers are things related to causes related to human needs, such as economic conditions and social factors. Pressures are human activities that suppress environmental components, divided into two major groups: environmental suppressors and human behavior. States are environmental conditions, in this case, water quality and quantity, air environmental conditions, land conditions, and waste management conditions in Indonesia. Impact is access to changes in environmental conditions/states/systems, especially the decline in environmental carrying capacity. The response is the response of policymakers or the community to the impact and condition of the community environment [1].

Therefore, this research was conducted to determine the impact of waste problems faced by Samarinda City and to determine efforts to manage and reduce the effects in Samarinda City using the DPSIR method as a relevant method to discuss causal relationships related to environmental issues in Indonesia.

## 2 Material and Methods

The method used in this study is a qualitative approach, which involves conducting descriptive research from the results of primary surveys and secondary data processing. The primary survey was in the form of interviews conducted with agencies related to environmental issues in Samarinda City. Secondary data from related institutions was used to enrich the analysis of this study. The DPSIR approach was used, which consists

of the driving force, pressure, state, impact and response to find out the problems and the cause-and-effect relationship of the waste problem in Samarinda City.

### 3 Results

The analysis results of secondary data obtained from DLH Samarinda City regarding data on waste problems in Samarinda City. The DPSIR approach consists of driving forces, pressures, conditions that occur (state), impacts and responses to discover the issues and cause-and-effect relationships of waste problems in Samarinda City. Then, a primary survey was conducted through interviews with agencies related to environmental matters in Samarinda City.

#### 3.1 Waste Problems

Waste management is one of the city problems that is of particular concern to the Samarinda City government. According to the Samarinda City Environment Agency, the waste generation of Samarinda City in 2023 reached 2,251.475 m<sup>3</sup> per day or equivalent to 600.512 tons per day. The total annual waste generation alone reaches 821,788.37 m<sup>3</sup> or 219,168.88 tons. Law Number 18 of 2008 concerning Waste Management, which includes waste reduction and handling, states that waste reduction is at least 30% of total waste generation and waste handling is at least 70% of total waste generation. According to DLH Kota Samarinda, in 2024, waste reduction is 19.75%, and waste handling is 79.78%. This data shows that waste reduction has not reached the target of 30% of total waste generation. It can be concluded from this data that waste management in Samarinda has not yet reached the target based on Law Number 18 of 2008 concerning Waste Management, which, of course, can be said to be one of the waste problems in Samarinda City.

The results of interviews with resource persons regarding waste problems in 10 sub-districts in Samarinda City, the results of interviews regarding the waste management process in 10 sub-districts in Samarinda City itself follow the same process and rules, namely first reducing waste by limiting, reusing, and recycling waste. The Samarinda City Environment Agency works with each sub-district's Cleanliness and Environment Section to socialize with the community about adequately managing waste.

#### 3.2 The Driving Force, Pressure, State, Impact, and Response (DPSIR) Analysis Results

##### 1. Driving Force

A driving force is a driving factor or trigger that explains related issues or problems in an area. This trigger factor leads to various human activities or activities that put pressure on the environment [3]. The driving forces of the municipal solid waste problem include the following.

- Strategic Geographic Location

Samarinda City is the capital city of East Kalimantan Province, which is directly adjacent to Kutai Kartanegara Regency. Astronomically, Samarinda City is located between  $0^{\circ}21'18''$  -  $0^{\circ}9'16''$  South latitude and  $116^{\circ}15'16''$  -  $117^{\circ}24'16''$  East longitude and traversed by the equator or equator line located at  $0^{\circ}$  south latitude. The area of Samarinda City is  $\pm 716.97$  km<sup>2</sup> and is drained by the Mahakam River. The Mahakam River connects Samarinda City as a service centre with various regions in the interior of East Kalimantan, such as Kutai Kartanegara, West Kutai, East Kutai, and Mahakam Ulu regencies. Samarinda City, the capital of East Kalimantan province and one of the centres of economic growth, education, trade, and services, makes Samarinda City a very rapidly developing city. Samarinda City has 10 subdistricts. The population of Samarinda City, based on data from the Samarinda City Statistics Agency (2024), is 861,878. The population density in Kota Samarinda in 2023 reached 1,200 people/km<sup>2</sup> [2].

- Population Growth

The annual population growth rate is a figure that shows the average population increase per year within a certain period. This figure is expressed as a percentage of the base population [2]. The city's geographical location, economic development, and the potential of natural resources have impacted the increase in population. Based on data released by the Central Bureau of Statistics in the book Samarinda in Figures, it is known that the population growth rate per year 2022-2023 in Samarinda City reached an average rate of 1.43%. The total population, population growth rate, population percentage distribution, and population density in Kecamatan Samarinda Utara, Kecamatan Samarinda Ulu, Kecamatan Sungai Pinang, Kecamatan Sambutan, Kecamatan Samarinda Ilir, Kecamatan Samarinda Kota, Kecamatan Samarinda Seberang, Kecamatan Sungai Kunjang, Kecamatan Loa Janan Ilir, and Kecamatan Palaran can be seen in Table 1.

**Table 1.** Population Growth Rate

No.	District	Population (people)	Population Growth Rate Year 2022-2023 (%)	Population Density (km <sup>2</sup> )
1.	Palaran	66,912	2.63	302.37
2.	Samarinda Ilir	69,766	-0.59	4,060.88
3.	Samarinda Kota	32,379	-1.34	2,991.78
4.	Sambutan	62,429	3.35	618.42
5.	Samarinda Seberang	65,796	0.74	5,267.89
6.	Loa Janan Ilir	69,396	2.02	2,655.80
7.	Sungai Kunjang	139,320	2.20	323.70
8.	Samarinda Ulu	133,331	0.17	6,027.62
9.	Samarinda Utara	112,076	2.78	488.31
10.	Sungai Pinang	110,473	1.06	3,233.99
	<b>Total</b>	861,878	1.43	1,200.39

An increasing population can increase domestic waste production, namely liquid and solid waste. The existence of human activities and the increase in population are the causes of waste production, which will continue to increase. The emphasis of the city's solid waste problem is the increasing waste production, both personal and activity/business scale, as well as public participation and awareness of the environment that still needs to be improved.

## 2. Pressure

Pressure is closely related to issues or problems that occur in an area. That happens in an area. In simple terms, this pressure is the thing that happens because of an issue or problem. It occurs due to a problem issue or, in other words, a direct effect that arises from a trigger [3]. The pressure from the municipal solid waste problem includes the following.

- Trade and Services

As the capital of East Kalimantan Province and one of the centres of economic growth, education, trade, and services in East Kalimantan, Samarinda City has become a strategic activity centre in various industrial activities and residential development. These factors influence the high population of Kota Samarinda, both the native population and migration from outside Kota Samarinda. The trade and services sector is the economic sector that absorbs the most labour. Development in the trade sector can improve the regional economy and realize a populist economy. The trade sector can open access between the demand and supply of goods and services. The economic growth of Kota Samarinda cannot be separated from the high population. An increasing population causes a higher demand for goods and services, which an increase in supply must meet. Although trade and services play a role in supporting the economy of Samarinda City, the trade and services sector can also open space for the increase in municipal waste.

- Community Behavior in Managing Waste and the Environment

Various environmental problems, such as household waste, are closely related to human life and can be encountered daily, both in individual life and the environment. However, the problem we often encounter in the community is that many people still throw garbage everywhere. This condition is related to not knowing how to manage waste properly. Most waste is generated from household activities, known as domestic waste. Household waste that is not handled correctly is due to the lack of knowledge of coastal communities in managing household waste [4].

Community participation in waste management can be seen based on the Samarinda City EHRA study results, which show that the community's behaviour is diverse. It starts from being thrown into the TPS outside the yard to being buried in the yard, and some are burning their waste.



No.	District	Area (Km <sup>2</sup> )	Total Population (Person)	Potential Waste Generation	
				m <sup>3</sup> /day	Ton/day
7.	Sungai Kunjang	43	139,320	356.554	97.524
8.	Samarinda Ulu	22	133,331	356.554	93.331
9.	Samarinda Utara	230	112,076	286.071	78.453
10.	Sungai Pinang	34	110,473	290.736	77.331
	<b>Total/Day</b>	<b>718</b>	<b>861,878</b>	<b>2,251.475</b>	<b>600.512</b>
<b>Total/Year</b>				<b>821.788,37</b>	<b>219.186,88</b>

• Waste Management Infrastructure

Some of the infrastructure owned by the Environment Agency of Samarinda City as a technical agency with the main tasks and functions in the waste sector can be seen in Table 3.

**Table 3.** Waste Transportation Infrastructure in 2023 [5]

No	Equipment Name	Quantity (units)	Usage Type
1.	Dump Truck	52	Garbage collection, park transportation and berm transportation
2.	Arm Roll Truck	21	Garbage and workshop transportation
3.	Truk Tangki	9	Road spraying and faecal transportation
4.	Truk Engkel	6	Worker shuttle and garden waste
5.	Truck Crane	2	Tree cutting
6.	Pick Up	22	Sweep transport and service operations
7.	Excavator	2	UPTD TPA
8.	Loader	1	UPTD TPA
9.	Bulldozer	2	UPTD TPA
10.	Sweeper	1	Road cleaning equipment
11.	Speed Boat	2	River trash patrol
12.	River Cleaning Ship	2	River trash cleanup



**Fig. 2.** Some Means of Waste Transportation in Samarinda City [5]

Samarinda City has 2 (two) landfills or TPA: TPS Bukit Pinang in Bukit Pinang, Samarinda Ulu, and TPA Sambutan in Sambutan, Sambutan. The area and capacity can be seen in Table 4.

**Table 4.** Landfills in Samarinda City [5]

No.	City	Location	Landfill Name	Type of landfill	Landfill Area (Ha)	Capacity (M <sup>3</sup> )	Existing Volume (M <sup>3</sup> )
1.	Samarinda	Jl. P. Suryanata, Bukit Pinang	TPA Bukit Pinang	<i>Open Dumping</i>	10.5	105,000	Overload
2.	Samarinda	Jl. Sultan Sulaiman Pelita VII, Sambutan	TPA Sambutan	<i>Control Landfill</i>	30	345,000	6,000

With the number of existing transportation fleets and waste generation in Samarinda City, the Samarinda City Government tries to carry out good handling as much as possible. The percentage of waste management in Kota Samarinda can be seen in the table below. The percentage of waste management in Samarinda City can be seen in Table 5.

**Table 5.** Waste Management in Samarinda City in 2023 [5]

No.	Management Description	Target		Achievements	
		Ton/Year	%	Ton/Year	%
1.	Waste Generation	240,973.19	-	218,799.98	-
2.	Reduction	65,052.76	27.00	43,203.88	19.75
3.	Handling	173,500.70	72.00	174,555.35	79.78

#### 4. Impact

Impact, in general, is the impact received from the existence of a problem or issue. This impact explains the changes in existing conditions and will ultimately lead to a response [3]. The impacts of municipal solid waste problems include the following.

- Environmental Pollution

Waste problems in Samarinda City directly impact environmental damage, better known as environmental pollution. One indicator of environmental damage or pollution can be seen from the Environmental Quality Index of an area. According to the Samarinda City Environment Agency in the 2023 City DIKPLHD Book, the IKLH of Samarinda City is 59.90, and there has been a decrease compared to the IKLH in 2022, which amounted to 56.09 with a moderate category [5]. From this value, the Ministry of Environment and Forestry needs to act so that the IKLH in Samarinda City does not decrease yearly. Meanwhile, the main parameters for assessing IKLH can be seen in Table 6.

**Table 6.** The Environmental Quality Index (IKLH) of Samarinda City in 2018-2023 [5]

No.	Component	2018	2019	2020	2021	2022	2023
1.	Water Quality Index	34.74	42.50	40.71	45.81	45.81	50
2.	Air Quality Index	87.84	91.18	86.94	85.98	81.81	85.31
3.	Land Quality Index	47.16	42.12	28.93	26.78	26.15	29.92
<b>Environmental Quality Index</b>		55.61	56.95	56.85	57.78	56.09	59.90

The high rate of waste generation certainly affects Samarinda City's IKLH assessment. Waste itself has a negative impact in the form of unpleasant odours and disruption of water quality due to waste disposed of in water bodies. So, it can be said that the amount of waste generation in 2023 is one of the factors in the decline in the IKLH value of Samarinda City.

- Nonoptimal Waste Management

The amount of waste generation that reaches 2,261.04 m3 per year for North Samarinda, Samarinda Ulu Subdistrict, Sungai Pinang Subdistrict, Sambutan Subdistrict, Samarinda Ilir Subdistrict, Samarinda Kota Subdistrict, Samarinda Seberang Subdistrict, Sungai Kunjang Subdistrict, Loa Janan Ilir Subdistrict, and Palaran Subdistrict compared to the limited capacity of TPS is very inadequate. The condition of the TPS in several locations is an unfit quality, so there is often a sight of scattered garbage that is uncomfortable to see. Waste management data for Samarinda City can be seen in Table 7.

**Table 7.** Waste Management Balance Sheet of Samarinda City in 2022-2023 [1]

No.	Description	Year 2022	Year 2023	Change (Year 2023-Year 2022)	
		Ton/Year	Ton/Year	Ton/Year	Percent (%)
I	AMOUNT OF WASTE CONSUMPTION (Population × Population)	214,347.89	218,799.98	4,452.09	2.08%
	Estimated Generation Factor per capita)				
II	Waste Reduction Amount	42,048.70	43,203.89	1,155.18	2.75%
	Percentage of Waste Reduction	19.62%	19.75%		
a	Amount of Waste Generation Limitation	5,544.56	3,462.45	-2,082.11	-37.55%
b	Amount of Waste Reutilization	13.80	16.35	2.55	18.48%

No.	Description	Year 2022	Year 2023	Change (Year 2023-Year 2022)	
		Ton/Year	Ton/Year	Ton/Year	Percent (%)
c	Amount of Recycled Waste	36,490.34	39,725.09	3,234.74	8.86%
III	AMOUNT OF WASTE HANDLING	171,784.81	174,555.35	2,2770.54	1.61%
	<i>Percentage of Waste Handling</i>	80.14%	79.78%		
d	Sorting/Collection				
e	Transportation				
	Waste is transported to the waste processing site (sorting residue)				
	Waste is transported to the final processing site (processing residue)				
	Processing	759.55	895.85	136.10	17.92%
f	Amount of waste processed into raw materials (animal feed, compost, recycling, and upcycling)	759.55	895.85	136.10	17.92%
	Amount of waste utilized as an energy source	0.00	0.00	0.00	-
	Final processing	171,025.25	173,659.70	2,634.44	1.54%
g	Amount of waste processed at the final processing site	171,025.25	173,659.70	2,634.44	1.54%
IV	WASTE MANAGED (II + III)	213,833.51	217,759.24	3,925.72	1.84%
	<i>Percentage of managed waste</i>	99.76%	99.52%		
V	UNMANAGED WASTE (I - IV)	514.38	1,040.74	526.37	102.33%
	<i>Percentage of unmanaged waste</i>	0.24%	0.48%		

From the table above, there is an increase in unmanaged waste from 0.24% in 2022 to 0.48% in 2023 or equivalent to 514.38 tons to 1,040.74 tons. This increase in management is very significant. Waste that has not been or is not managed is likely to pollute water and soil and be discharged into water bodies, both drainage and rivers in Samarinda City.

## 5. Response

The response is the reaction that arises from unwanted impacts, referring to the response of the community, both individuals and groups and the local government's reaction [3]. The responses to the municipal solid waste problem include the following.

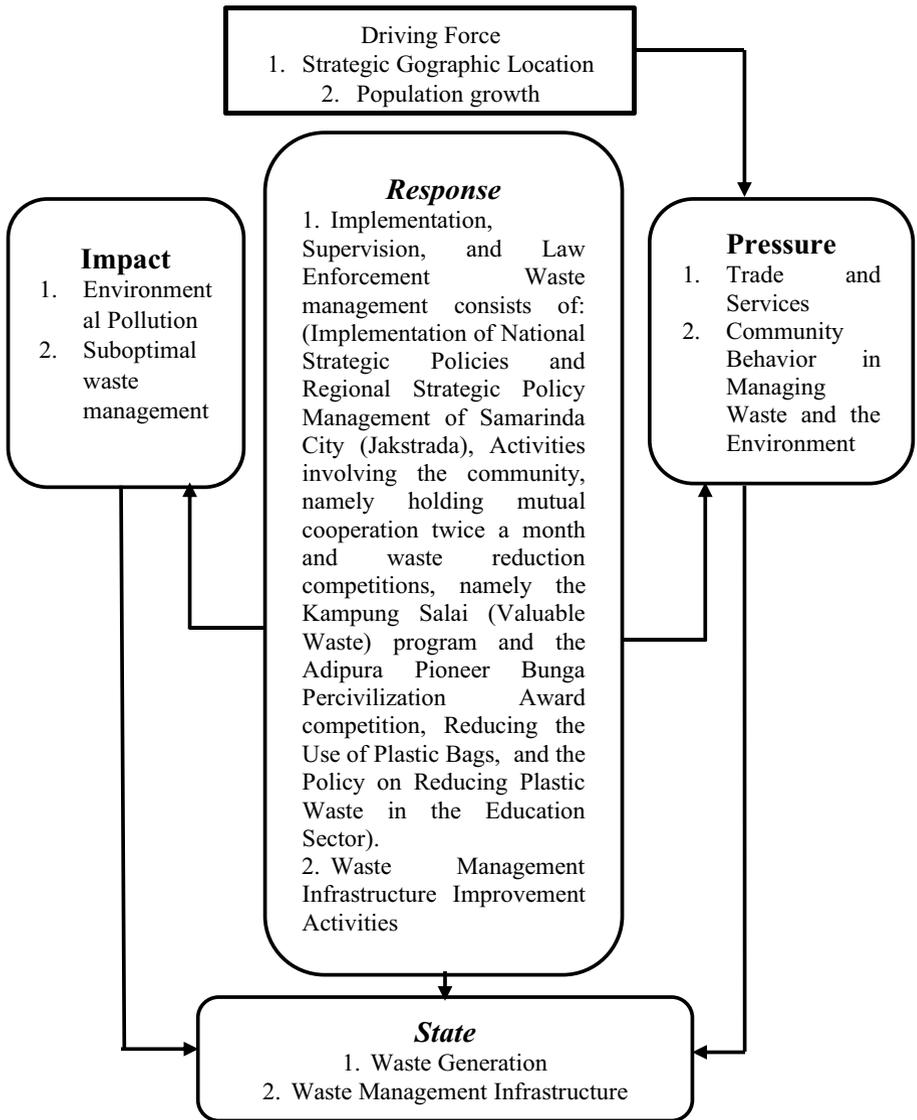
- Waste Management Implementation, Supervision, and Law Enforcement



**Fig. 3.** Some Participation of the Public, Communities, and Offices in Waste Management [5]

- Waste Management Infrastructure Improvement Activities

Activities to improve the quality of temporary shelters or TPS in Samarinda City are carried out by repairing several existing TPS and replacing old TPS that are no longer suitable for use. Repairing the infrastructure itself is the task of the Environmental Agency, but for minor repairs, the sub-district can use PROBEBAYA (Community Development and Empowerment Program) funds through community consultation. The community has been encouraged to dispose of waste at the new TPS location. The road to the Sambutan landfill was also repaired to facilitate waste transportation to the Sambutan landfill. Road improvement was carried out to facilitate the waste collection process and make it more efficient. The following is the framework of the Driving Force, Pressure, State, Impact, and Response (DPSIR) of Samarinda City's waste management problems.



**Fig. 4.** The Framework of the Driving Force, Pressure, State, Impact, and Response (DPSIR) of Samarinda City's Waste Management Problems

## 4 Conclusions

Based on the research entitled Analysis of Urban Waste Problems with the Driving Force, Pressure, State, Impact, and Response (DPSIR) Method, it can be concluded that the waste problem is one of the city problems that are of special concern to the Samarinda City government. The amount of waste generation in Samarinda City reaches 2,251.475 m<sup>3</sup>/day, equivalent to 600.512 tons/day. The results of the analysis of the waste problem in Samarinda City using the DPSIR method, namely, the main triggering factor of the city's waste problem is the geographical location of Samarinda City, which is very strategic, and the trade and service sector is growing rapidly. The pressure that occurs is in the form of a population that continues to increase every year and community behavior in managing waste that is still not following the regulations and policies of the Samarinda City government. The current condition is that the large amount of waste generation will continue to increase, as well as the condition of various waste management facilities and infrastructure. The impact caused by waste problems is in the form of environmental pollution and suboptimal waste management. The response from the government in dealing with this waste problem includes implementing, supervising, and enforcing waste management laws and activities to improve waste management infrastructure facilities, which are also part of the response to this analysis.

**Disclosure of Interests.** The authors have no competing interests to declare that are relevant to the content of this article.

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