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## Environmental carrying capacity and environmental capacity in

*by* Badaruddin Badaruddin

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# Evaluating Problems of Waste Management in Tarakan City, North Kalimantan

A. Ridwan Mulyawan<sup>1</sup>, Rizqi Puteri Mahyudin<sup>2</sup>, Badaruddin<sup>3</sup>, Ahmadi<sup>4</sup>

<sup>1</sup>Regional Development Planning Board (BAPPEDA) of Tarakan City, North Kalimantan, 77111, Indonesia

<sup>2</sup>Faculty of Engineering, Lambung Mangkurat University, Banjarbaru, South Kalimantan, Indonesia

<sup>3</sup>Faculty of Forestry, Lambung Mangkurat University, Banjarbaru, South Kalimantan, Indonesia

<sup>4</sup>Faculty of Marine and Fisheries, Lambung Mangkurat University, Banjarbaru, South Kalimantan, Indonesia

**Abstract**—Various programs are implemented in the context of waste management in Tarakan City. The program does not provide optimal impact if you see the amount of waste generation that continues to increase. Waste generation in 2011 amounted to 98.7 tons/day and in 2018 it increased 79.05% to 176.73 tons/day with the level of solid waste service reaching 68%. This study aims to determine the main problems in waste management in Tarakan City. This type of research is descriptive research. The respondents were five people from five different agencies. Data collection techniques in the form of interviews to find out waste management problems. The qualitative data from the interviews are then converted into quantitative data so that hierarchical analysis can be done. Analysis of the data using the Analytic Hierarchy Process (AHP) method with Software Expert Choice 11. The main problem is obtained from the multiplication of indicator scores with priority aspect issues. The results of the analysis show the main problem of solid waste management is the lack of a solid waste management budget (0.133); lack of garbage transport equipment (0.130); habit of residents in littering (0.118); sanctions in regulations are not implemented (0.114); and sanctions have less deterrent effect (0.107). The main problem of waste management in Tarakan City is related to the lack of solid waste management budget.

**Keywords**— Analytic Hierarchy Process, PPSP, Solid Waste, Tarakan, Waste Management.

## I. INTRODUCTION

Based on Central Bureau of Statistics (*Badan Pusat Statistik/BPS*) projection results, the population of Tarakan City in 2017 was 253,026 inhabitants consisted of 120,609 female inhabitants and 132,417 male inhabitants. Compared with the population projection in 2016, the population of Tarakan City experienced a growth of 3.62%.<sup>1</sup>

This population growth is also directly proportional to the amount of waste generated in Tarakan City. From 2011 to 2018, the amount of waste generated

in Tarakan City had increased by 79.05 percent. In 2018, the average amount of waste generated in Tarakan City was 176.73 tons per day with solid waste service levels reaching 68%.<sup>2</sup>

Actually, Tarakan City Government does not remain passive in handling the problem of managing this waste. Since 2011, the Tarakan City Government has joined 62 other regencies/cities in Indonesia to take part and play an active role in the Accelerated Development Program of Sanitation Settlements (*Program Percepatan Pembangunan Sanitasi Permukiman/PPSP*). This program has been running in two stages, namely the first phase starting in 2010 until 2014, then the second stage starting from 2015 to 2019.

In the early stage of Accelerated Development Program of Sanitation Settlements (PPSP), Tarakan City government has mapped the sanitation risk zone namely waste risk, the risk of waste water and the risk of drainage and clean water. One of the flagship programs of the Tarakan City Government in the first stage is educational activities based on waste management called Environmental Saving (*Tabungan Lingkungan/TaLing*).<sup>3</sup>

In this Taling activity, every elementary school student from grade 3 to grade 6, junior high school students and high school students are required to bring recyclable waste (paper, aluminum cans, plastic bottles, etc.) from their homes to school each day, predetermined to be exchanged for a number of points, this point if already collected can be exchanged into school equipment.<sup>3</sup>

In the second stage of Accelerated Development Program of Sanitation Settlements (PPSP), in addition to updating the sanitation risk zone map, Tarakan City Government also initiates a program called "Program Sampah Semesta (The Universe Waste Program, All Must Be Involved)" with the tagline "The trash is no longer visible and no smell exists". The implementation of the universal waste program is carried out by collecting waste directly from house to house using a waste cart (it can also be in form of a three-wheeled motorbike and alike),

waste carts that have been filled with waste are then taken and collected to the waste terminal (temporary waste disposal) and then moved directly using dump truck to the Final Processing Site (TPA).<sup>4</sup>

Various programs and activities carried out by Tarakan City Government in terms of solid waste handling need to be immediately known for the root of the problem so that it is in line with its goal of reducing waste generation. It is not enough just to issue new programs/activities and even replicate from other regions without regarding to local characteristics, because the best solution in the form of integrated waste management is a combination of the application of solid waste technology by adapting local situations and conditions.<sup>5</sup>

An integrated waste management system requires cooperation from all parties and aspects, the sustainability of waste management will not work without the willingness and awareness of the community.<sup>6</sup> This study aims to determine the main problems in waste management in Tarakan City.

**II. MATERIAL AND METHODS**

This study is a descriptive study to describe an event and symptom that occurs at the present time. This study used respondents as sources of information; the number of respondents was five people from five different agencies (Regional Development Planning Board (*Bappeda*); Environmental Department; Final Processing Site Unit; Work Unit for Settlement Environmental Health System Development; and Village

Office of Anal Beach) with purposive sampling method. Respondents were selected based on their expertise, experience and position in the research background.

Data collection techniques were in the form of interviews to find out waste management problems. Qualitative data from interviews were used as material for preparing questionnaires that would be used to assess the hierarchy of waste management problems. The qualitative data would then be converted into quantitative data so that hierarchical analysis could be carried out. Analysis of the data used the Analytic Hierarchy Process (AHP) method with the help of Expert Choice software 11.

**III. RESULTS AND DISCUSSION**

**3.1 Hierarchy of Waste Management Problems**

Unstructured and complex problems are broken down into homogeneous parts to be arranged in a hierarchy. The result of hierarchical arrangement is shown in Figure 1. It consists of two levels, namely the goal and the aspect that become the main problems along with its constituent criteria.

The structured aspects as shown in Figure 1 are in line with previous research which stated that the urban waste management system was basically seen as sub-system components that supported each other to achieve the goal of a clean, healthy and orderly city. The component includes the operational technical sub-system; organization and management (institution); laws and regulations; financing; and the role of the community (Human Resources).<sup>7</sup>

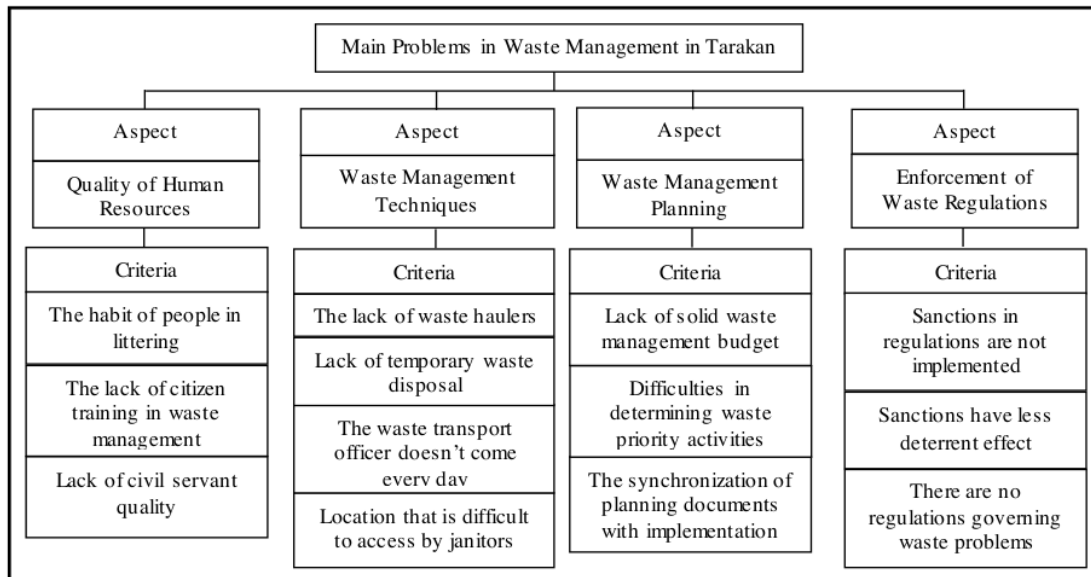


Fig 1. Hierarchy of waste management problems (Source: Primary survey results, 2019)

### 3.2 Priority Aspect Analysis of Waste Management

Weighting on variables by conducting pair wise comparison<sup>2</sup> between aspects illustrates priority aspects that hinder waste management in Tarakan City.

In Table 1. shows the results of the calculation of the matrix, which is an assessment of each aspect.

Table 1. Weighting the Priority Aspects of Waste Management Problems

No.	Aspect	Weight
1.	Waste Management Techniques	0.387
2.	Enforcement of Waste Regulations	0.260
3.	Waste Planning and Funding	0.246
4.	Quality of Human Resources	0.107

(Source: Results of analysis, 2019)

In the aspects of Waste Management Technical, the respondents concluded that this aspect was considered very priority as a barrier factor for waste management in Tarakan City with a total weight of 0.387.

Furthermore, which occupies the second, third and fourth priority respectively as a problem aspect of waste management is the aspect of Enforcement of Waste Regulations with a weighting value of 0.260; aspect of Waste Planning and Financing with a weight value of 0.246; and aspect of the Quality of Human Resources with a total weight value of 0.107.

The level of inconsistency of this hierarchy was 0.02 or according to the expected inconsistency ratio of less than or equal to 0.1.<sup>8</sup>

The Technical Aspect of Waste Management is considered a top priority because it includes basic activities in the waste management from upstream in the form of waste existence at the source<sup>13</sup> end up in the downstream or final processing. The activities include waste placement, waste collection, waste transportation, waste management and waste final disposal.<sup>9</sup>

The next aspect is related to Enforcement of Waste Regulations. This is in line with research that states the lack of national policies and legal frameworks for municipal waste management. A legal framework for the field of waste that is well described is needed so that it can effectively deal with waste management.<sup>10</sup>

The implementation of Law No. 18 of 2008 concerning Waste Management is not yet running effectively, it can be proven that Indonesia has become the second largest domestic waste producing country in the world at 5.4 million tons per year.<sup>11</sup> Enforcement of regulations / laws in the waste sector is an act and/or process of coercion in the framework of complying with the law based on statutory provisions and/or environmental requirements.<sup>12</sup>

The Aspects of Waste Planning and Financing have been in line with Government Regulation Number 81 of 2012 concerning Management of Household Waste and the same type as Household Waste.<sup>13</sup>

Article 9 paragraph 1 and 2 states that the regency / city government in addition to establishing policies and strategies, also preparing waste management master plan documents containing restrictions on waste generation; recycling of waste; reuse of waste; sorting waste; waste collection; waste transportation; waste management; final waste processing and funding.

Furthermore<sup>6</sup> in the regulation in article 29 paragraph 1 and 2 it is stated that in the handling waste management, the regency/city government collects retribution to each person for the services provided which are set progressively based on the type, characteristics and volume of waste.

The last aspect in this study is related to the aspects of Quality of Human Resources (HR). The intended HR consists of the community as a component of waste producer (the source of waste generation) and also people who are given assignments and authority in managing waste, both by private institutions and government agencies.

Improving the quality of human resources will have a positive impact on waste management. The more the number of family members who have participated in solid waste management training, the smaller the weight of the waste produced or caused.<sup>14</sup> In relation to waste management institutions, in another study it was stated that the factor of partnership in an institution was not access to machinery and equipment, but the ability of managers to use effectively and efficiently.<sup>15</sup>

### 3.3 Analysis of the Main Problems in Waste Management

The analysis carried out to get the main problem that became a barrier in the waste management in Tarakan City was to do geometric mean.

Assessment was carried out simultaneously on 13 (thirteen) criteria that had been arranged in a problem hierarchy. The<sup>7</sup> combination of the assessment of the five respondents can be seen in Table 2.

Table 2. Assessment of the Main Problems of Waste Management

No.	Aspect	Weight
1.	Lack of waste management budget	0.133
2.	The lack of waste transport equipment	0.130
3.	The habit of people in littering	0.118
4.	Sanctions in regulations are not	0.114

	implemented	
5.	Sanctions have less deterrent effect	0.107
6.	Lack of temporary waste disposal amount	0.076
7.	The waste transport officer does not come every day	0.072
8.	Location is difficult for janitors to access	0.070
9.	The lack of citizen training in waste management	0.053
10.	Difficulties in determining waste priority activities	0.044
11.	The synchronization of planning documents with implementation	0.040
12.	Lack of civil servant quality (Planning & Technical)	0.024
13.	There are no regulations governing waste problems	0.019

(Source: Results of analysis, 2019)

Based on the calculations in Table 2, it can be classified in four interval classes. This study will only discuss interval class 1 (0.105 - 0.133) which are the main problems of waste management.

From the calculation of geometric mean, it shows that the main problem of waste management in Tarakan City is in terms of the minimum waste management budget that gets an assessment of 0.133.

This is in line with the National Policy and Strategy study on the Acceleration of Waste Management which states that one of the problems in waste management in Indonesia is the low budget allocation for waste management, both from the Country's Budget (APBN), Provincial Budget (APBD Prov.), and Regency/City Budget (APBD Kab./Kota). Furthermore, it was stated that the comparison of the amount of waste management retribution revenue to the budget provided by the DKI Jakarta Province Sanitation Office was relatively small, only 1.3% of the total budget for the sanitation service.<sup>16</sup>

In a book published by the Ministry of Public Works and Public Housing it is also stated that there is a considerable difference between the ideal needs for waste management and what is stated in the 2015-2019 National Medium-Term Development Plan (RPJMN). The ideal need to achieve quality and waste service level of 100% from 2015 to 2019 is 66.33 Trillion while in the 2015-2019 RPJMN only allocates funding of 17.01 Trillion.<sup>17</sup>

Based on National Policy and Strategy Acceleration of Waste Management, the strategy in the aspect of funding is to allocate a waste management budget of at least 2% of the Regency/City Budget (APBD Kab./Kota).

In the last 2 (two) years, the City of Tarakan only allocated a budget of 0.5% annually for the management of waste. Waste management is intended to be used for the purpose of dissemination to the operations of the final processing site (TPA)

The further problem of waste management is due to the lack of waste transport equipment (carts, tricycles, dump trucks) with an assessment of 0.130. This is in accordance with the theory which states that the problems in operational technical of waste management include the inadequate capacity of transport equipment.<sup>19</sup>

In National Policy and Strategy the Acceleration of Waste Management also raises strategic problems related to the waste transportation, including:

- The lack of quantity and quality of waste transport vehicles;
- Waste transportation has not been done every day;
- The schedule or period of waste transportation has not yet been coordinated with the collection schedule (by the cart/motorbike car /crossroad car) which causes the queue of carts /motorized carts at the waste transport points;
- The specification of waste transport vehicles has not met the standard
- The mode of waste transportation has not been separated

The lack of waste transport equipment in Tarakan City is in accordance with the data from The Environmental Department as shown in Table 3.

Table 3. The ideal need for waste transport equipment

No	Description	Existence	Ideal
1	Waste cart	154 units	220 unit
2	Three-wheeled waste motorcycle	71 units	200 unit
3	Open trucks	17 units	25 units
4	Compactor trucks	2 units	5 units
5	Arm Roll trucks	4 units	10 units

(Source: Environmental Department of Tarakan, 2018)

The ideal need for three-wheeled motorized vehicles in each Village is 10 units. With the number of Village in Tarakan City as many as 20 villages, there are still 129 three-wheeled motorized vehicles needed to be able to ideally service waste transportation in Tarakan City.

In addition to three-wheeled motorized vehicles, another urgent matter is related to the number of waste carts and also open trucks. This is because three-wheeled motorized vehicles and waste carts are used for waste collection from the source to the temporary waste disposal, if the amount is less then it will have an impact

that the garbage will not be transported in people's homes. Whereas open trucks are used to transport waste from the temporary waste disposal to the final processing site which if the amount is minimal, there will be a buildup of waste in the temporary waste disposal.

With the results of the assessment of 0.118, the habit of residents in littering is a further problem in waste management.

The habit of residents in littering is in accordance with previous research which stated that the habit of littering was carried out in almost all communities, not only the poor, even those who are highly educated do so.<sup>20</sup>

In National Policy and Strategy the Acceleration of Waste Management was also mentioned about this, where there were problems with waste management in the socio-cultural field, namely:

- a. The community has not done the sorting of waste
- b. The community is still littering a lot
- c. Program sustainability is difficult to maintain
- d. Low knowledge of residents in managing waste

Thus, to get the right and good attitude towards waste disposal habits, it is necessary to provide information and counseling consistently about the dangers of waste to the environment and health. Increasing people understanding of waste management will give result to the right attitude towards waste and will form good habits so that a healthy, clean and free of waste environment is formed.

The habit of residents in treating this waste has been illustrated by a study conducted by Tarakan City government (Regional Development Planning Board/Bappeda). Of the total 20 villages in Tarakan City, only 10% or 2 (two) villages are categorized as not at risk of waste problems. The rest, as many as 30% or 6 (six) villages are in high risk category and as many as 12 villages or 60% are categorized as medium risk.<sup>22</sup>

The next problem is that sanctions in regulations that are not carried out with an assessment of 0.114. This is consistent with previous research conducted in Tarakan City, where it was stated that law enforcement was still considered weak, confirmation and repression of violators of the law had not been implemented optimally.<sup>23</sup>

In addition to Tarakan city, this law enforcement problem is also experienced by several cities in Indonesia. In Semarang city, the problem of waste management that occurs is the lack of law enforcement against the implementation of the Regional Regulation of Cleanliness and sanctions for violators of regulations.<sup>21</sup>

In Jayapura city, the problem of solid waste in the legal sector that arises is the weakness of the application of a legal framework that supports the implementation of

solid waste services such as Regional Regulations and Decisions on provisions issued by the government.<sup>22</sup>

The weakness of law enforcement in the waste sector and unclear about the pattern of private government cooperation (build, operate and own) is the concern of the DKI Jakarta Province government in the management of waste.<sup>16</sup>

In addition, in the National Strategy for the Acceleration of Waste Management, it was also stated that the strategic issues and problems of waste management in the legal sector include:

- a. The application of legal sanctions for violators has not been a priority;
- b. Limitation of Law Enforcement Devices (coordination and number)
- c. Arrangement of sanctions in legislation related to waste management;
- d. Synchronization of legal products related to waste management

The problem that is still related to the legal aspect and getting an assessment of 0.107 is related to sanctions that have less deterrent effect.

In law enforcement, basically it is influenced by several factors, in which these factors cannot stand alone and have a close correlation and influence each other. The factors include:<sup>26</sup>

- a. The legal factor itself is the presence or absence of regulations and deterrent effects arising from the application of the law.
- b. Factors in law enforcement, which includes the apparatus or institutions that form and implement the law.
- c. Factors of law enforcement supports

In full, the hierarchical assessment of each aspect and criterion carried out by the five respondents can be seen in Figure 2.

From Figure 2, because character of the hierarchy that are interrelated with each other, the criteria for the minimum waste management budget which is the main problem with the highest score cannot stand alone.

This connection can be seen from almost all of the existing criteria, where the respondents considered the emergence of these criteria due to the lack of budget allocated for funding the solid waste sector.

To enforce sanctions in regulations, a large budget is needed. This budget starts from regulatory socialization, periodic monitoring, prosecution and trials.

Large budgets are also needed to change people's habits in managing their household waste. Waste Management Training, Waste Sorting and Composting are needed.

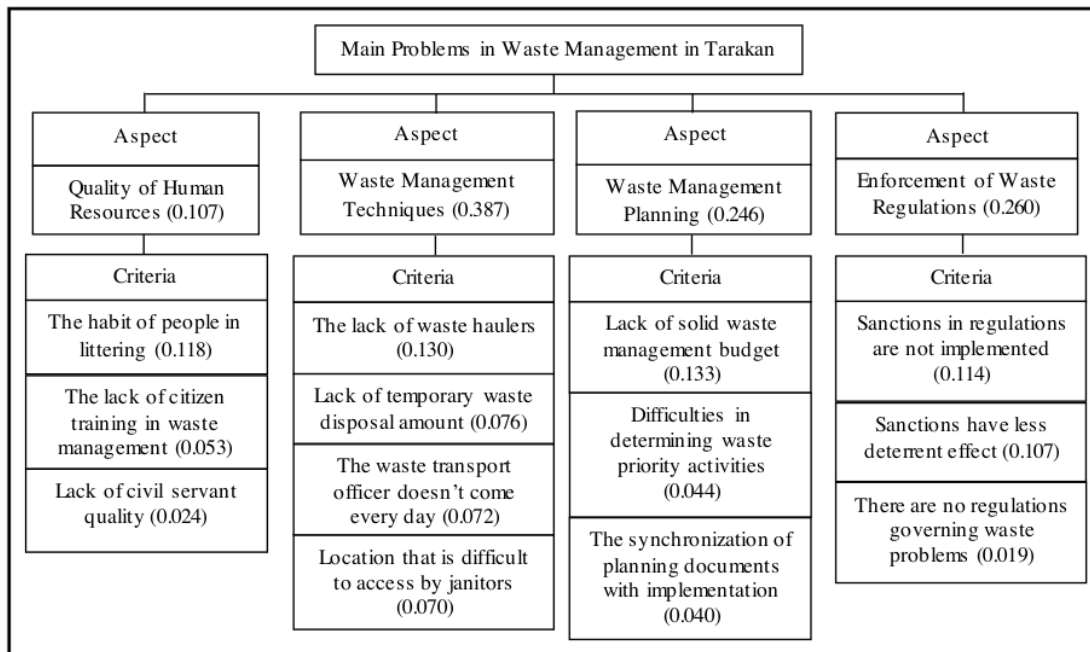


Fig 2. Hierarchy of the Main Problems in the Management of Waste in Tarakan City

The biggest budget issued by the City Government is related to the provision of garbage transport equipment. Increasing the amount of waste generation every year is not comparable with the increase in the number of garbage transport equipment. This is compounded by minor and major damage to the conveyance due to extra usage

The increase in the amount of waste per year is also not comparable with the increase in the budget in the waste sector. With limited budget in terms of handling or managing waste, the ability to determine priority programs / activities is needed.

The main problems of waste management that are at intervals of 1 (one) must be addressed in handling solutions. The solution is then used as a priority program/activity within a handling period of less than 2 (two) years.

#### IV. CONCLUSION

From the results of the assessment of the hierarchy that has been prepared, it can be concluded that the main problem in managing solid waste in Tarakan City is the lack of solid waste management budget. It cannot be denied, the course of a program/activity depends on the available budget allocation.

The community still believes that handling and managing waste are entirely the responsibility of the

government. The results of waste collection are still far from enough to finance the operations of waste management. This is increasingly burdening the government budget, both central and regional governments, which has been minimal in this sector.

The waste sector is still considered less attractive to investors compared to other sectors such as the road, bridge, transportation and so on. The unclear pattern of cooperation between the government and the private sector adds another problem in finding other sources of funds outside the Country's Budget (APBN)/ Regional Budget (APBD).

The waste management budget in Tarakan City in the last 2 (two) years is still very minimal, only allocating 0.5% of the total Regional Budget (APBD) each year.

Further study/research is needed to obtain alternative solutions to the problems of waste management in Tarakan City. The solution is then used as a priority program/activity within a handling period of less than 2 (two) years.

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