Pol. J. Environ. Stud. Vol. 32, No. 2 (2023), 1867-1876
DOI: *10.15244/pjoes/158779* ONLINE PUBLICATION DATE: 2023-02-09

Original Research

Forecast of Waste Generated and Waste Fleet Using Linear Regression Model

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Received: 11 August 2022
Accepted: 28 December 2022

Abstract

Sukolilo District has 115,855 inhabitants with a population density of 4,897 inhabitants/square kilometers. The increase of population simultaneously increase the rate of waste generation. The increase in the rate of waste generation affects waste collection. Thus, optimization of waste management in operational, technical, and community participation aspects in Sukolilo District, Surabaya City, is needed. The optimization of waste management require to forecast the population, the amount of waste generation, and its effect on the number of waste transportation fleets in the next 10 years. Therefore, this research presented the data in order to solve the issue of waste management. This research is conveniently offered to be one of the major consideration for the Sukolilo District Government in accordance with the waste management issue. Field surveys were conducted to collect data on population, waste generation, and the condition of the waste fleet. Then, the data was analyzed with linear regression model to estimate the total waste generation and waste fleet. The projected population growth in 2030 is 146,054 people. The calculation of the amount of waste generation based on the formula from the Indonesian Ministry of Environment Regulation in 2030 is 26,655 tons/year. Meanwhile based the result of this study, the simple linear regression equation in 2030 is 65,442 tons/year. The increase in waste generation from 2021 to 2030 reached 35,041 tons, with a percentage of 115%. Thus, that, the calculation of the waste fleet requirements for the next 10 years is 40 waste container tanks and 20 arm roll trucks. Population growth in Sukolilo District is in line with the total amount of waste generation. Therefore, it is necessary to add a waste fleet at that location in the next 10 years. The authors suggest that improving the quality and the quantity of the waste fleet is indeed recommended.

Keywords: forecast, regression, waste fleet, waste generation

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Introduction

Waste is an item or object discarded because it is no longer used [1]. Waste is a problem for mankind because it has a negative impact that can affect the health of the surrounding community because certain types of waste can cause various diseases. Hence, waste reduce the beauty or aesthetic value of the city, produce air pollution and pungent stench, and increase the risk of flooding hazards in the rainy season where uncollected waste can clog waterways [2]. The sources of waste come from households, agriculture, offices, companies, hospitals, markets, and other human activities. The trend of consumptive lifestyle somehow contributes to the increase of waste production. In big cities, waste always causes various complicated problems to be solved. This is because the impact caused is a problem for the environment. Waste disposed of in open dumping has the potential to cause various types of diseases and as a breeding ground for disease sources. The amount of municipal waste is expected to increase fivefold by 2020 to 2.1 kg per capita [3]. According to Khair et al. (2019) the amount of waste in Indonesia is based on statistical data on solid waste in Indonesia in 2008, the amount of waste transported to the temporary shelter (TPS) or landfill (TPA) is 11.6 million tons/year, composted 1.2 million tons/year, burned 0.8 million tons/year, and waste disposed of into the river 0.6 million tons/year. The waste problem in Surabaya City is not much different from other cities in Indonesia. Most of Surabaya City's waste is dominated by settlements or households, approximately 43.4% or 1,212 tons/day of organic and inorganic waste [5]. In early 2000, Surabaya City experienced a serious waste problem caused by the unpreparedness of the Benowo landfill, which was prepared to be a replacement landfill after the closure of 2 previous landfill owned by the Surabaya City Government, namely Lakarsari landfill in 2000 and Keputih/Sukolilo landfill in 2001. Surabaya's waste emergency was exacerbated by not transporting waste piles of around 168,000 cubic meters or 42,000 tons of waste from the villages to the middle of Surabaya City [6]. In general, the factors influencing waste transportation are population density, quantity, quality of waste, characteristics, and service area. However, distance, transportation system, vehicle type, frequency, and labor also play a role in waste transportation. Sukolilo District is one of the sub-districts in East Surabaya, consisting of seven villages. Sukolilo District has a population of 115,855 people with a population density of 4,897 people/km^2 [7]. The increasing population has led to rapid development in Sukolilo District. One proof of this is the increasing number of villages and housing. The daily average waste generation in Sukolilo District in 2012 was 326.54 m^3/ day or contributing to 3.16 % of the total generation of Surabaya City per day [8]. The increase in the number of villages and housing in Sukolilo District has increased the amount of waste generated. A good waste collection system is needed to manage waste in villages and housing. The amount of household waste generation in big cities is 0.4-0.5 kg/person/day [9] compared to waste generation in East Surabaya, which is 0.33 kg/person/day [10]. The amount of waste generated affects the need for more collection equipment. In addition, an increase in waste volume increases waste collection costs [11]. Waste collection is carried out at 8 TPS in Sukolilo District, Surabaya City. The waste collected at each TPS will be transported to the TPA in Benowo District. Waste transportation is carried out using 6 units of dump trucks with a capacity of 10 m^3 and 4 units of arm roll trucks with a capacity of 8 m^3 [12]. Transportation using the Hauled Container System (HCS) method of transferring waste from sources with high landfill rates is expected to overcome the problem of waste transportation. Transportation time shows that the working hours of dump trucks and arm roll trucks start from 03.00 A.M. until completion, so waste vehicles have inefficient working hours [12]. Optimization of waste management in operational, technical, and community participation aspects in Sukolilo District, Surabaya City, is needed. One uses the load count analysis method, which directly measures the generation and composition of domestic and non-domestic waste [13]. Few similar studies have been conducted to forecast the population, the amount of waste generated, and its effect on the number of waste transporting fleets in the next 10 years in Sukolilo District, Surabaya City. This study is expected to be useful for the Sukolilo District Government in planning the procurement of waste transportation fleets and dealing with waste problems at the District level to improve the health status of the people of Sukolilo District. The study aims are to forecast the population, the amount of waste generation, and its effect on the number of waste transportation fleets in the next 10 years in Sukolilo District, Surabaya City, Indonesia in 2022.

Material and Methods

Description of the Study Area and Context

This study is conducted in Sukolilo District, Surabaya City, East Java Province (Fig. 1). Sukolilo District has an area of 29.69 km^2 and have 7 urban village [7]. The majority of the area is part of ponds and mangrove forests, because it is located near the Madura strait.

Method of Collecting Data

The data used in the research are primary and secondary. Primary data is obtained directly in the field in cycle time data from loading waste at the TPS to unloading at the landfill. Secondary data is obtained from literature studies, writings, relevant references,

Fig. 1. Geographic location of the research area of Sukolilo Distric, Surabaya City, East Java Province in Indonesia.

journals, book articles, and other research. Population data was sourced from the Surabaya City Statistics Agency (BPS). Data on waste generation, TPS, and waste transportation equipment were obtained from the Surabaya City Environmental Agency (DLH).

Data Analysis Method

After obtaining secondary and primary data, the analysis will be performed using linear regression [14]. This article uses time series data for 2016-2020 as actual data from the Surabaya City Statistics Agency to project the population in 2023 (Table 1). In addition, this article also uses time series data for 2016-2020 as actual data from Surabaya City Environmental Agency to project waste generation (Table 2). The results of the projection calculation will be used as a basis for calculating the need for the Temporary Garbage Storage (TPS) and waste transportation equipment for optimizing waste processing in Sukolilo District in 2030.

Population Projection

The geometric method is used to project the population in an area where the population increases exponentially using Eq. (1) (Regulation of the Indonesian Minister of Public Works No. 03 of 2013 concerning the implementation of waste infrastructure and facilities in handling household waste and waste similar to household waste).

Table 1. Total Population in Sukolilo District, Surabaya City, Indonesia.

Year	Total population (people)
2016	112.209
2017	113.664
2018	114.309
2019	116.915
2020	120.726

Source: Central Bureau of Statistics Surabaya City, (2021)

Table 2. Total Waste Generation in Sukolilo District, Surabaya City, Indonesia.

Year	Total waste generation (tons/ year)
2016	18.229
2017	17.135
2018	16.079
2019	18.890
2020	30.076

Source: Surabaya City Government, (2021)

$$Pn = Po\ (1 + r)^{dn} \tag{1}$$

Where, Pn is the total population in the next n years, Po is the population at the end of the period, r is the average population growth per year, and d is the projection period.

Waste Generation Calculation According to the Minister of Environment and Forestry

The waste generation target per year is stated in tons/year [15]. The calculation of the waste generation target using Eqs. (2) and (3).

$$PJTS = \frac{(JP \times ETS)}{1000} \tag{2}$$

$$TTS = PJTS \times 365 \text{ days} \tag{3}$$

Where, PJTS is the potential amount of waste generation (tonnes/day), JP is the total population, ETS is the estimated waste generation per person of 0.5 kg (medium and small cities), and TTS is the waste generation target per year (tonnes/year).

Waste Generation Calculation According to Linear Regression

Simple linear regression is a statistical method that tests the extent of the causal relationship between the causal factor variable (X) and the effect variable. The causal factor is generally denoted by x or predictor, while the effect variable is represented by y or response [16]. The simple linear regression equation model using Eqs. (4) to (6).

$$y = a + bX \tag{4}$$

$$b = \frac{n\,(\Sigma xy) - (\Sigma x)\,(\Sigma y)}{n\,(\Sigma x^2) - (\Sigma x)^2} \tag{5}$$

$$a = \frac{\Sigma y - b.\Sigma x}{n} \tag{6}$$

Where, x is a predictor variable or causal factor (independent), y is a response variable or a dependent variable, and a is a constant, b is a regression coefficient (slope); the magnitude of the response generated by the predictor, n is the amount of data, Σx is the amount of data x, Σy is the number of data y, Σxy is the number of data xy.

Unit Conversion

The unit conversion calculation using Eq. (7) [17].

$$p = \frac{m}{v} \tag{7}$$

Where, p is the density of waste (kg/ m^3), m is the weight of waste (kg), and v is the volume of waste (m^3).

Calculation of Waste Fleet Needs

Waste container requirements using Eq. (8):

$$N_{containers} = \frac{Vwaste}{Vcontainers} \tag{8}$$

Where, $N_{container}$ is the required number of container containers (tub), V_{waste} is the volume of waste (m^3), and $V_{container}$ is the volume of the container tank (m^3). Requirements for collecting/transporting equipment using an arm roll truck using Eq. (9):

$$\frac{Vwaste}{\text{Tool capacity x rite}} \tag{9}$$

With the number of fleets (units), the volume of waste (m^3), equipment capacity (m^3), and transportation rites (rit).

Result and Discussion

Research Data

Total population in Sukolilo District, Surabaya City, Indonesia (Table 1.) Total waste generation Sukolilo District, Surabaya City, Indonesia (Table 2.)

Population Projection

The steps for calculating the projected population growth are as follows:

Finding r (average population) using Eq. (10).

$P_{2020} = 120.726$
$P_{2016} = 112.209$
Constant = 1
dn = 5 (year)

$$r = \left(\frac{120.726}{112.209}\right)^{1/5} - 1 = 0.0147 \times 100\ \% = 1.47\ \% \tag{10}$$

The percentage growth of the average population is used to forecast the population in Sukolilo District, Surabaya City, Indonesia, from 2021 to 2030. From these results, a population growth projection calculation was obtained using the Geometric method using Eq. (11). Further calculations up to 2030 can be seen in Table 3.

$$P_{2021} = P_{2020}\,(1 + r)^{dn} = 120.726\ (1 + 0.0147)^1 = 122.501 \text{ people} \tag{11}$$

The calculation of population growth projections shows an increase in population from 2021 to 2030 (Table 3). While an increase in the birth rate is one of the influencing factors, there is another reason behind the growth of the human population: humans have no limitations on reproduction [18]. Humans can reproduce and have offspring at any time of the year, unlike other living things with limited reproduction at certain times. Decreasing the death rate is one of the main causes of overpopulation due to medical advances; many diseases can be cured due to advances in preventive and curative medicine, diseases have been eradicated, or more effective treatment is available [19]. Developments in medicine have reduced mortality and increased life expectancy in humans. The infant mortality rate is very low, and the number of deaths during childbirth has decreased. Good prenatal care has increased the chances of survival for both mother and baby. Lack of education and illiteracy are important factors responsible for high population growth [20]. The less educated fail to understand the need to curb population growth. Birth control and family planning methods do not reach the illiterate sections of society. The educated strata can make more responsible decisions about marriage and childbearing. Thus, education is an effective tool to curb high population growth. With cultural influences, the concept of birth control is not widely accepted. Implementing birth control measures is taboo in certain cultures [21]. Some cultures foster the belief that getting married at a certain age or having a few children is considered ideal. In some cultures, boys are preferred. This indirectly forces couples to produce children of the preferred gender. In addition, there is pressure from family and society to have children. Migration is a problem in some parts of the world. If people from different countries migrate to a particular part and settle in that area, then the area faces the negative effects of overpopulation [22]. This can lead to unequal distribution of natural resources, directly affecting the population increase.

Waste GenerationCalculation According to the Minister of Environment and Forestry

The calculation of waste generation per year is based on the data in Tables 4 and 6. Forecasting waste generation for the next 10 years, from 2021 to 2030, using the Minister of Environment and Forestry formula and linear regression. The yearly waste generation target is expressed in tons/year [15]. The steps for calculating waste generation using Eqs. (12) and (13). Further calculations up to 2030 can be seen in Table 4

JP_{2021} = 122.501 people
ETS = 0.5 kg (waste per person for medium and small cities)

$$PJTS = \left(\frac{122.501 \text{ x } 0.5 \text{ kg}}{1000}\right) = 61.25 \text{ tons/ day} \quad (12)$$

$$TTS = 61.25 \text{ tons/ day x } 365 \text{ days} = 22.356 \text{ tons/ year} \quad (13)$$

Waste Generation Calculation According to Linear Regression

The calculation of waste generation forecast using the regression equation is based on the data in Tables 5 and 6. The steps for calculating waste generation using the linear regression equation are as follows:

Based on the data from Table 5, several results were obtained, among others.

Table 3. Projected population growth in Sukolilo District, Surabaya City, Indonesia

Year	Total population (people)
2021	122.501
2022	124.302
2023	126.129
2024	127.983
2025	129.864
2026	131.773
2027	139.798
2028	141.853
2029	143.938
2030	146.054

Table 4. Minister of Environment and Forestry equation for population and waste generation in 2021-2030.

Year	Total population (people)	Total waste generation (tons/ year)
2021	122.501	22.356
2022	124.302	22.685
2023	126.129	23.019
2024	127.983	23.357
2025	129.864	23.700
2026	131.773	24.049
2027	139.798	25.513
2028	141.853	25.888
2029	143.938	26.269
2030	146.054	26.655

Table 5. Regression equation for a population with waste generation.

Year	X (people)	Y (tons/year)	x^2	xy
2016	112.209	18.229	12.590.859.681	2.045.457.861
2017	113.664	17.135	12.919.504.896	1.947.632.640
2018	114.309	16.079	13.066.547.481	1.837.974.411
2019	116.915	18.890	13.669.117.225	2.208.524.350
2020	120.726	30.076	14.574.767.076	3.630.955.176
Σ	577.823	100.409	66.820.796.359	11.670.544.438

Description: X = Total population; Y = Total waste generation

$$\Sigma x = 577.823$$
$$\Sigma y = 100.409$$
$$\Sigma xy = 11.670.544.438$$
$$\Sigma x^2 = 66.820.796.359$$

An example calculation is as Eqs. (14) to (16).

$$a = \frac{(100.409)\,(66.820.796.359) - (577.823)\,(11.670.544.438)}{5\,(66.820.796.359) - (577.823)^2} = -151.849.3175 \quad (14)$$

$$b = \frac{5\,(11.670.544.438) - (577.823)\,(100.409)}{5\,(66.820.796.359) - (577.823)^2} = 1.487748995 \quad (15)$$

$$Y = a + bX = -151.849.3175 + 1.487748995\,X \quad (16)$$

Forecasting the amount of waste generation from 2021 to 2023 is by entering the data X (total population) in Table 4, into the linear regression equation formula. For example, the year 2021 is as Eq. (17). Further calculations up to 2030 can be seen in Table 6.

Table 6. Regression equation for population and waste generation in 2021-2030.

Year	Total population (people)	Total waste generation (tons/ year)
2021	122.501	30.401
2022	124.302	33.081
2023	126.129	35.799
2024	127.983	38.557
2025	129.864	41.356
2026	131.773	44.196
2027	139.798	56.135
2028	141.853	59.192
2029	143.938	62.294
2030	146.054	65.442

$$P_{2021} = Y = -151.849.3175 + 1.487748995\,X = -151.849.3175 + (1.487748995)\,(122.501) = 30.401 \text{ tons/ year} \quad (17)$$

Increase in the amount of waste 2021 to 2030 using Eq. (18).

$$\text{Total amount of waste} = 65.442 - 30.401 = 35.041 \text{ tons} \quad (18)$$

Percentage of total waste 2021 to 2030 using Eq. (19).

$$\text{Percentage of total waste} = \frac{65.442 - 30.401}{30.401} \times 100\% = 115.26\,\% \approx 115\,\% \quad (19)$$

It can be seen from Table 6 that the increase in the amount of waste generation from 2021 to 2030 is 35.041 tons/year, with a percentage of 115%.

Based on the graph above (Fig. 2), the results of the two waste generation calculations are similar. The results show that an area's population increase is directly proportional to the increase in waste generation disposed to the landfill. This is in line with Azmiyati and Rancak (2021) research on the significance of population growth and gross regional domestic product in the correlation of waste generation. His research shows a strong relationship between the population variable and gross regional domestic product growth and the population variable and waste generation, concluding that these variables are very significantly related. The more waste generated, the government must also pay attention to the facilities needed, especially in handling waste disposal [24]. For example, increasing the number of landfills in each area, both in villages and sub-district, and the government must also pay attention to the number of fleets needed to transport waste to the landfills so that people are also aware of a clean environment. The government should also warn the community, especially in Sukolilo District, about the dangers of waste disposal. Waste that

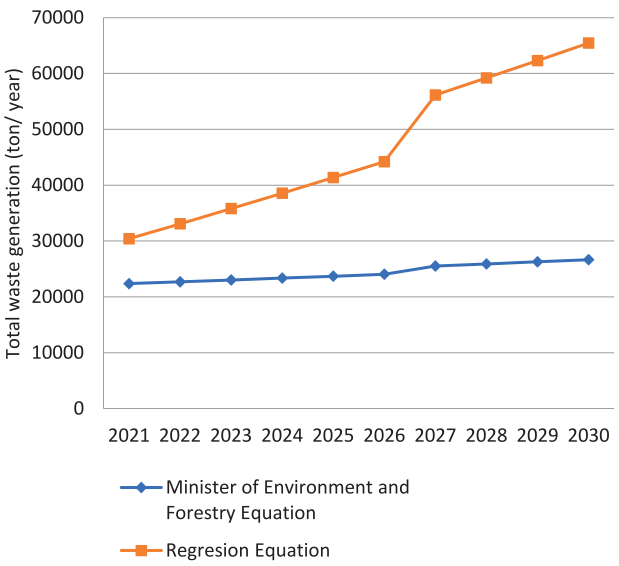

Fig. 2. Waste generation calculation graph.

is not in the right place will result in dirty and flood-prone areas.

Forecasting of Waste Fleet Needs

Based on calculations from Table 6, it can be seen that the population in Sukolilo District, Surabaya City, Indonesia in 2021 is 122.501 people, and the waste generated is 30.401 tons/year. In 2021, there will be 10 units of waste transporting fleet, including 6 units of dump trucks and 4 arm roll trucks. In 2030, the population will increase by 146.054 people, and the waste generated will be 65.442 tons/year. The increase in the amount of waste generation from 2021 to 2030 is around 35.041 tons/year. Due to the annual increase in waste generated, it is necessary to do calculations to forecast the fleet's needs. The fleet uses arm roll because transportation operations are more efficient with more effective transportation times. The steps for forecasting the number of fleets using Eq. (20).

$$\begin{aligned} m &= 35.041 \text{ tons/ year} \\ &= 35.041.000 \text{ kg/ year} \\ p &= 300 \text{ kg/ m}^3 \text{ based on SNI 3242-2008} \\ v &= \frac{35.041.000 \text{ kg/ year}}{300 \text{ kg/ m}^3} \\ &= 116.803 \text{ m}^3\text{/ year} \\ &= \frac{116.803 \text{ m}^3\text{/ year}}{365 \text{ days}} \\ &= 320 \text{ m}^3\text{/ day} \end{aligned} \tag{20}$$

Waste container needs based Eq. (21).

$$\begin{aligned} V_{waste} &= 320 \text{ m}^3 \\ V_{container} &= 8 \text{ m}^3 \\ N_{container} &= \frac{320 \text{ m}^3}{8 \text{ m}^3} \\ &= 40 \text{ waste container} \end{aligned} \tag{21}$$

Need for arm roll trucks for waste collection and transportation based Eq. (22).

$$\begin{aligned} \text{Waste volume} &= 320 \text{ m}^3 \\ \text{Container capacity} &= 8 \text{ m}^3 \\ \text{Ritation} &= 2 \text{ rit/ day} \\ \text{Number of arm roll trucks} &= \frac{320 \text{ m}^3}{8 \text{ m}^3 \text{ x } 2} \\ &= 20 \text{ units of arm roll truck} \end{aligned} \tag{22}$$

After calculating the fleet needs in 2030 to transport waste amounting to 116,803 m^3/year or 320 m^3/ day. In Sukolilo District, Surabaya City, Indonesia, it is necessary to add 40 waste container tanks and 20 units of arm roll trucks. The transportation system with arm roll trucks does not consider the age factor of the vehicle in its regulation. Ogunbiyi et al. (2020) explain that vehicles with a high age do the ritation >5 times. Another thing that needs to be considered in the waste transportation process is the container. The fixed container system is suitable for serving waste sources with small quantities such as from households, while the transport container system is suitable for large quantities of waste such as markets and commercial areas [26]. One alternative to increase productivity in the fixed container system is to equip the vehicle to raise the waste container on the vehicle. In Surabaya City only 8 transfer stations are causing high transportation costs, so that transportation costs are not high and the effectiveness of waste collectors can be increased, the distance from the source of waste to the transfer depot should not be too far. This is also confirmed by Rathore and Sarmah (2019) that a clean and efficient transfer station with minimal environmental disturbance can be applied in large cities. The advantage is that transportation costs from the service area to the transfer station and fleet requirements are lower due to increased vehicle utilization. However, a cost-economic comparison between the transfer station and the direct haul container system should be made to determine the optimal cost.

Current Waste Management Policy Sukolilo District, Surabaya City, Indonesia

The community-based waste management policy is a major program that focuses on reducing plastic waste by converting it into economically valuable goods. There are several sub-programs that have produced derivative activities that have proven to have a real impact on the lives of target groups. In accordance with the Regulation of the Minister of Environment of the Republic of Indonesia Number 13 of 2012 Article paragraphs 1 and 2 explains that reduce, reuse, and recycle (3R) activities are all activities that are able to reduce everything that can generate waste, reuse activities that are suitable for the same function or other functions and waste management activities to make new products [28].

Waste bank is a place for sorting and collecting waste that can be recycled and/or reused which has economic value [29]. The number of waste banks in Surabaya continues to grow every year, due to the initiative of citizens who care about their environment. For some of these existing waste banks, their turnover varies greatly each month. For beginners, the turnover can reach Rp. 800.000,- to Rp. 1 million, and some have even reached Rp 70 million per month, just by sorting inorganic waste to be collected at the waste bank [30]. Before the existence of the waste bank, many people disposed of household waste around the local river. As a result, the piles of garbage around these residential areas make the environment dirty and unsightly, and the river water becomes dirty. This is exacerbated by the low mindset of the community on the importance of preserving the surrounding environment by not littering. The implementation of the waste bank program was initially very difficult for the community to accept. The community perceived the waste bank program as a program that was only aimed at the environment and would make their settlement more rundown, and smelly due to the piles of garbage in the waste bank. Over time, these thoughts disappeared and the waste bank managers managed to manage and invite the local community to save and participate in the waste bank program.

The programs in the waste bank are saving/ borrowing with waste, paying electricity with waste, treatment with waste, caring for the environment with waste, greening with waste, recycling, and a reading garden as a new program in the waste bank. The working mechanism of this waste bank is flexible in accordance with the needs and circumstances of the local community based on households where the community will get a reward for depositing waste while still referring to the waste bank implementation mechanism, namely: sorting waste, depositing waste into the waste bank, weighing waste, recording the results obtained by customers, then transportation [31]. This is part of community empowerment. In addition, the process of saving by using waste is also indirectly able to improve the mindset of the community and be able to increase the family income of the community (customers of the waste bank).

Waste Management in Sukolilo District, Surabaya City, Indonesia, in the Future

The data obtained above shows that the waste generated by the residents of Sukolilo District, Surabaya City, Indonesia, is increasing because the population growth is also increasing. Waste management is already quite good and structured but needs improvement due to inadequate transportation facilities. The waste problem is not only the government's responsibility, but the community also has a greater responsibility because they produce waste. Efforts are needed from the government to continuously conduct socialization in the community to build a mindset that community participation in reducing the amount of waste generation is more important than providing handling facilities to increase awareness and discipline of citizens. In waste management, the term waste hierarchy is known, a concept and prioritization tool that can develop waste management strategies to reduce resource consumption and protect the environment [32]. Tchobanoglous and Kreith (2002) revealed 4 (four) waste management options (waste reduction at source, recycling, waste-to-energy and landfilling) that can be done interactively or hierarchically. For regions that do not emphasize economic aspects, strategies for waste management are selected based on the degree of clarity of environmental acceptance [34]. Reducing waste at source would be the most important level to prevent waste problems. Recycling, including composting, would be the second management option as it can return the resource to commercial use after the original product no longer has a benefit. Waste energy is the third option, as waste can generate energy rather than just being incinerated or buried. Landfilling is the last option that is no better or worse than incineration [35]. The United Nations Environmental Program, 2010 lists a waste hierarchy similar to an inverted pyramid [36]. With the increasing problems in waste management, waste management cannot be solved with only one waste management option but with a comprehensive and integrated management system.

Conclusions

The results of the linear regression model in this study are valuable in estimating the total population, waste generation, and waste transportation fleet in the next 10 years. In 2016, the population of Sukolilo District, Surabaya City, Indonesia, was 112,209 people, with waste generation of 18,229 tons/year. In 2030 the population will be denser, 146,054 people with waste generation of 65,442 tons/year. These results indicate that the increase in total population is very significant to the increase in waste generation rate. Predictions of future waste generation can provide reliable information needed for the evaluation of current and 10-year waste transportation fleet requirements. The waste fleet requirements in Sukolilo District, Surabaya City, Indonesia, from 2021 to 2030 are 40 units of waste containers and 20 units of waste trucks. Surabaya City is currently named the cleanest city in Indonesia. The role and efforts of the government within the Surabaya City administrative area are needed to maintain this predicate. The results of this study can be used as a reference in realizing a clean, healthy and comfortable environment. Various efforts have been made including socialization, personnel management, finance and retribution. However, the fulfillment of an adequate transportation fleet still needs to be evaluated. To fulfill this, it is necessary to cooperate and coordinate with related stakeholders regarding waste funding to increase the quantity and quality of waste facilities. The crucial point that needs to be done immediately is the addition of a waste transportation fleet from Neighborhood Association (RT) to TPS and from TPS to landfill.

Acknowledgments

This study was financially supported by the Institute of Research and Community Service through the Penelitian Internal Unusa Skema 2 (Utama) Universitas Nahdlatul Ulama Surabaya number: [055/UNUSA/Adm.SK/V/2022], with the contract number [349.3/UNUSA-LPPM/Adm-I/III/2022].

Conflict of Interest

The authors declare no conflict of interest.

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