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**THE POPULATION GROWTH FORECASTING TOWARDS NEED FOR WASTE  
MANAGEMENT FACILITIES IN MAJENE REGENCY**

Oleh

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**Abstract**

This study aims to determine and analyze population growth forecasting in Majene Regency in 2019-2030 and analyze the need for solid waste facilities in Majene Regency in 2019-2030. This research is a case study research using quantitative descriptive analysis method. The results found that the population of Majene Regency will be forecasted to increase by 26,420 during the 2019-2030 period or an average increase of 2,402 annually in the same period and the garbage collection of Majene Regency is forecasted to increase each year. In creating a clean, healthy and comfortable environment through improving the quality and quantity of waste management in Majene Regency, it can be done by implementing a waste management strategy that is equipped with adequate and reliable personnel, finance, and transportation management as well as cooperating and coordinating with relevant stakeholders, in relation with solid waste funding as an alternative source of financing in increasing the quantity and quality of solid waste facilities.

**Keywords: Population, Forecasting, Waste Management Facilities & Majene Regency**

**PENDAHULUAN**

Population and development are two terms that cannot be separated in the development process. Population information, both on the amount of distribution, structure and composition according to various groups is needed for a variety of development planning not only in the form of data at the time the plan was made, but population information is also needed in the future and in the past [1].

Population has a dual function in the economy, in a market context the population is on the demand and supply sides. On the demand side, residents are consumers, sources of demand for goods and services. On the supply side, the population is a producer, if the population is a businessman or trader, if the population is merely a worker. In the context of development, the view of the population is divided into two parts, there are those who consider it as an obstacle to development and there are those who consider it as a driver of development [2].

The view that states the population as an obstacle to development, due to high population growth will cause problems such as reducing per capita income, unemployment, environmental damage caused by the increase of deforested or damaged forests to expand settlements and more importantly the problem of waste that continues to increase with increasing rate population growth.

The high growth of urban population will inevitably lead to the development of bigger cities. The development of this city has become the focus of international attention, both in terms of policy and science, because of its serious impact on the global environment such as large land consumption, air pollution, water scarcity, poverty, social segregation, and vulnerability [3]. The growth of urban population also raises its own problems for the area. One of them is the provision of facilities and infrastructure to meet the basic needs of the population, such as housing, clean water, educational facilities, and



health. Other social facilities for community activities, such as open spaces where residents gather and sports facilities must also be available to meet the social needs of those living in urban areas. To date, one focus of attention related to high urban population growth has been around efforts to provide shelter and improve living conditions for the population [4].

As a result of the expansion of the city area which is accompanied by the growth of urban population will also increase the activities of the people in it so that they require public services and basic infrastructure such as clean water, waste water, drainage, waste and so on. According to Nurmandi [1], urban growth that is not aligned with the demands of meeting the needs of urban communities will also have an impact on the decline in optimization of urban infrastructure services. That is because the increase in community activities in urban areas will affect the quantity and quality of waste produced so that in the end if not managed properly can cause negative impacts in the form of a decrease in environmental quality.

Indonesia around 15-20% of the waste is disposed of properly and the rest is disposed of properly into the river, causing flooding problems. It is estimated that 85% of small cities and more than 50% of medium sized cities officially dispose of their waste in open places. A common environmental problem in urban areas is poor urban waste management. Waste which is a part of the rest of human activities needs to be managed properly so as not to cause various problems to human life or disruption to the environment such as environmental pollution spread of disease, declining aesthetics and as a carrier of disease. Waste management in cities in Indonesia has yet to achieve optimal results. Various obstacles are still faced in carrying out waste management both economic, socio-cultural constraints and the application of technology [4].

Solid waste management problems become very serious in urban areas due to the complexity of the problems faced and high population density, so that waste management is often prioritized for handling in urban areas [5]. Urban

growth that is not aligned with the demands of meeting the needs of urban communities will also have an impact on the decline in optimization of urban infrastructure services. That is because the increase in community activities in urban areas will affect the quantity and quality of waste produced so that in the end if not managed properly can cause negative impacts in the form of a decrease in environmental quality.

Most of the urban waste generated is inorganic waste, if it is thrown away on a plot of land or a certain area of land. This rubbish is difficult to decompose by the soil, so that if there is a buildup, the soil will lose its recycling system. The soil is decaying, and if so, the soil cannot be planted with fresh plants and the environment becomes dirty and rotten. The more densely populated the city, the more land is polluted [6].

Majene Regency is one of the five Regencies in the region of West Sulawesi Province. Majene Regency is one of 5 districts within the province of West Sulawesi which is located on the west coast of West Sulawesi extending from South to North approximately 146 square kilometres from Mamuju Regency. Population of Majene Regency in 2017 according to the Central Statistics Agency (BPS) recorded 169,072 inhabitants, experiencing growth of 1.6% from the previous year, with a total number of households of 34,939 households. The total population of men is 82,618 people and women are 86,454 people, so the sex-ratio is 100. The population density of Majene Regency is 178 people per square kilometres, with Banggae District being the most populous area with 1,675 people per square kilometres and Ulumanda District is an area the population is rarely with 20 inhabitants per square kilometres [7].

Garbage in Majene Regency greatly affects the population, so currently the number of residents in Majene Regency in each year is constantly experiencing an increase growth. This will certainly affect the results of disposal both from individual households and companies, activities and changes in people's lifestyles. This can have an impact on increasing the amount of waste generation. Seeing this development, the



Majene Regency also needs the priority of the same solid waste service as other cities, so this is a challenge for the Government of the Majene Regency in providing maximum waste management services

Solid waste facility here means an activity or material that serves to serve the needs of waste management including, storage, transportation, collection and final disposal of waste, so that indirectly is how the government's role in overcoming population growth with the need for waste disposal facilities provided by the surrounding community so that the garbage does not become waste and is polluted like throwing out of trash is not in place [7]. The area that receives solid waste services is an urban area with a service area of 55.19 km<sup>2</sup> with a population of 61,499 people who receive cleaning services from the city population of 63,140 people.

## METHODS

This research is a case study research using a model (analysis tool) quantitative descriptive analysis method. This research was conducted to examine the forecasted population growth and the need for solid waste facilities for the period of 2015-2025, where the research location was in Majene District, West Sulawesi Province. The data needed in this study consists of primary data and secondary data. Primary data, namely data obtained directly from the results of the interview. This interview was conducted as an introduction in collecting secondary data, so that the data obtained was relevant to the research. Secondary data used were sourced from publications of government offices that were directly related to this research, including: the Department of Hygiene and Landscaping (DKP) of Majene Regency, the Department of Public Works and Spatial Planning, West Sulawesi Province, and the Central Statistics Agency Majene.

Population Forecasting According to Mantra, 2000 (in Muta'ali, 2015: 29) Population forecasting is not a forecast in the future but is a scientific calculation based on certain assumptions of population growth variables

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namely birth, death, and migration. Forecasted population and the amount of waste generated by the people of Majene Regency in 2019-2030, the population growth method is used. The model used is Exponential Rate of Growth with the following formula: (Demographic Institution FE-UI, 2010).

$$P_n = P_o e^{r \cdot n}$$

Which:

- P<sub>n</sub> = total population in years n or t
- P<sub>o</sub> = population in the initial year
- R = population growth rate
- n = period of time between the base year and year n (in years)
- e = exponential number (natural logarithm) 2.7182818

To calculate the volume of waste produced by the people of Majene Regency is in accordance with the size of the volume of waste used in Indonesia (national) Calculate the prediction of the amount of waste generation based on the results of population forecasting and standardize the amount of waste generation based on city classification and calculate the volume of waste generation in Majene District which is included in the medium city classification, a unit of 2.75 liters/person/day is used. Calculating the number of waste facilities needed in 2019-2030 formulations are used, as following: Waste facility needs by adjusting to the predicted results of the amount of waste generation. Calculation method:

$$\text{Waste Volume} = \text{Waste Generation} \times \text{Population}$$

Note, the generation of garbage (l/person/day) multiplied by the number of population served by the municipal waste treatment plant is the amount of waste per day that must be sorted, reused, recycled and treated by regional scale landfills. Calculation of the number of collection equipment and garbage fleet needs in 2019-2030.



$$\text{Garbage Truck Needs} = \frac{\text{Garbage Dumps per Day}}{\text{Capacity} \times \text{Retase}}$$

$$\text{Container Needs} = \frac{\text{Water Plies per Day}}{\text{Container Capacity}}$$

## RESULT AND DISCUSSION

Based on statistical data, the population of Majene Regency in 2008 was 148,772 residents and in 2018 it was 171,272 residents or an increase of 22,500. The population growth of Majene Regency from 2008-2018, using the Exponential Rate of Growth formula was 1.29%. Based on the population growth rate, the condition or forecasting of the population of Majene Regency can be calculated using the same formula, the results of the calculation can be seen in the table below.

**Table 1. Forecasting of Population in Majene Regency in 2019-2030**

Year	Population
2019	173.493
2020	175.743
2021	178.023
2022	180.331
2023	182.670
2024	185.039
2025	187.439
2026	189.870
2027	192.332
2028	194.827
2029	197.353
2030	199.913

The population of Majene Regency in 2019 is forecasted at 173,493 and in 2020 will increase by 2,250 to 175,743 residents. In 2021 it will again increase by 2,279 to 178,023 residents. The population of Majene Regency will be forecasted to increase by 26,420 during the 2019-2030 period or an average increase of 2,402 annually in the same period. The population increase that occurred in Majene Regency was caused by several factors, such as: 1) increase in the number of births, the birth rate is highly correlated with

an increase in population due to marriage. The increasing human population due to marriage differs from animals that have a mating season, humans can mate and have children at any time of the year; 2) decreased mortality, advances in technology and innovation in the health sector will result in public health will also increase, life expectancy will increase, many diseases can be cured, infant mortality and maternal mortality will decline. Advances in medicine have led to various diseases being eradicated or getting more effective treatment; 3) cultural influences, the concept of controlling the number of births cannot be accepted by society. Implementing birth control measures is considered taboo in certain cultures. Some cultures foster the belief that getting married at a certain age or having a number of children will increase sustenance in the future and is considered ideal. In some cultures, boys are preferred. This indirectly forces the couple to produce children of the preferred sex, besides that there is pressure from the family and community to have children; 4) migration is a problem in several parts of the world, especially in developing countries. there are several factors driving and pulling migration can occur, but the most pressing factor is the economic factor. Humans will migrate to places that have high economic resources to be able to sustain a life that increasingly demands high incomes; 5) urban development planning, an increase in population at a certain time will have an impact on urban planning patterns to support the quality of life of the population. Infrastructure improvement and followed by the progress of entertainment facilities will increasingly encourage urbanization to occur. Especially in the Regional Government Work Plan (RKPD) of West Sulawesi Province in 2019 Majene Regency development direction will be directed to the development of education centers at all levels of education, especially state universities (Universitas Sulawesi Barat). In the field of economic development, it will focus on developing centers for deep cocoa and coconut plantations, marine and fisheries development, and development of the oil fields of the mandar

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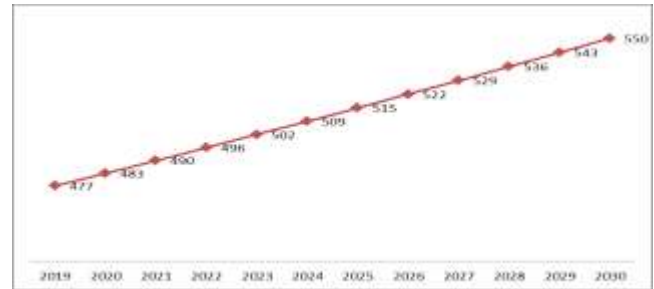
block. In the field of socio-cultural development, it will be directed at the development of the burial complex of kings and mandar heroes, the development of museums, and the development of monuments. To encourage regional development and regional progress, infrastructure development in this area will be directed towards regional port development and basic infrastructure development.

### **Waste Forecasting Forecasting in Majene Regency**

The forecasted solid waste generation is obtained from the derivation of population growth multiplied by the amount of waste per capita per day, referring to the Indonesian National Standard (SNI) 19-3983-1995. Calculation of waste generation forecasting in Majene Regency for the next 11 (eleven) years is calculated based on the following data: 1) forecasted population for the next 10 years; 2) waste generation per day in Majene Regency (2.75 litre/capita/day) and for a year multiplied by 365 days; 3) based on the calculation of population forecasting, Majene Regency is still in the category of medium city classification so that the amount of waste generation per capita day is assumed to be fixed, such as 2.75 litre/capita/day.

Midden in Majene Regency is forecasted to increase every day and every year along with an increase in the population of Majene Regency during 2019-2030. In 2020, garbage piles in Majene Regency every day 477 liters/capita/day and 174,144 liters/capita/year. In 2021, waste accumulation is 483 liters/capita/ day or an increase of 7 liters/capita/ day and 178,690 liters/capita/year or an increase of 2,288 liters/capita/year. In 2022, landfill waste is 496 liters/ capita/day or an increase of 6 liters/capita/day and 181,008 liters/capita/year or an increase of 2,317 liters/capita/year. The upward trend in waste piles per day and per year can be seen in the graph below.

**Figure 1. Forecasting of Garbage Dump per Day in Majene Regency**



The increase in the number of landfills in Majene Regency was caused by an increase in population in the same period. Waste in general is produced by the consequences of human activities, every human activity must produce waste or garbage whose amount and volume is proportional to the level of consumption of goods or materials that we use every day.

Along with the increase in landfill waste in Majene District, facilities for transport and landfills are needed. These facilities are expected to be able to support the cleanliness of Majene Regency so that people's lives are comfortable and away from diseases that will be caused by the accumulation of garbage in settlements, markets, tourism sites, entertainment venues and sewers.

### **3.2 Solid Waste Facility Projection**

The calculation of population growth projections and the volume / amount of garbage per capita, the estimated need for solid waste facilities (including truck fleets) can be estimated as needed. Calculation of waste facility and infrastructure needs is very necessary to find out how much the needs of the garbage dump and garbage transportation fleet (truck).

### **Container Garbage Needs**

The needs of the garbage dump, a projected amount of solid waste generation is required, then the amount of the solid waste generation will be divided by the size of the volume of capacity per one planned garbage dump unit, where for each unit of the planned garbage dump capacity of 8 cubic meter, which is adopted from the size of the volume of container capacity. From the volume of this waste generation and the garbage dump,



the facility needs for this project can be projected for the next 11 years.

The calculation results shown in the table, the need for garbage dump will always increase along with the increase in population and landfill. In 2019, the need for garbage dump is 60 with 477 liters/capita per day. In 2025, the need for garbage dump will increase to 64 with 515 liters/capita per day. In 2030, the need for garbage dump will reach 69 with 550 liters/capita per day.

The need for containers in Majene Regency will be far greater in urban areas which are the center of economic activity. In the Guidelines for Urban Solid Waste Management issued by the Department of Settlement and Regional Infrastructure, the Director General of Urban and Rural Governance (2003), as well as those stated in SNI 19-3964-1994 and SNI 03-3242-1994, the classification of sources or locations of waste collectors is as the following: 1) Settlement; 2) Terminal; 3) Market; 4) Hospital; 5) Offices; 6) Shopping; 7) Hotels; 8) Walk; 9) Drainage; 10) River; 11) City Park; 12) Industry.

#### ***Garbage carrier fleet needs***

The needs of the fleet of garbage transporters, it is necessary to project data on the amount of solid waste generation, then the amount of solid waste generation will be divided by the size of the volume of capacity per unit of truck multiplied by the number of transportation rations such for each unit of truck with a capacity of 8 cubic meter which is adopted from the size of the volume of container capacity with twice the number of rotations.

There will be 30 units of waste transport fleet. In 2025 the needs of the waste transport fleet will increase to 32 units and by 2030 the need for the transport fleet will be 34 units. The need for a fleet of garbage transportation with an increasing number from 2019-2030 is considered sufficient to be able to cope with the transportation of garbage from depots and TPS to landfill, so that waste is managed properly in transportation without considering waste separation and recycling efforts as in modern management.

#### ***3.5 Solid Waste Management in the Majene District in the Future***

Waste management in Majene Regency is classified into two management sections, namely Upstream and Downstream. Upstream management includes storage, collection and transfer services whereas downstream management includes the transportation, processing and final processing of waste at the midden.

Integrated waste management will include the classification of waste into organic and non-organic, toxic and non-toxic, building waste, recycled and composted waste, with the main emphasis on the operationalization of the principles of reduce, reuse, and recycle. The problem of waste is actually not only the responsibility of the government, but the community also has a greater responsibility because they produce waste, so if there are some deficiencies found in serving the community, that they should have the initiative to clean up the waste. Efforts by the government to continuously carry out socialization to the community are needed in the hope of building a mindset that public participation in reducing the amount of waste generation is more important than holding a treatment facility.

In realizing a clean, healthy and comfortable environment through improving the quality and quantity of waste management in Majene Regency in addition to management: personnel, finance, sufficient and reliable waste transportation fleet can be done with strategies including: Conducting cooperation and coordination with relevant stakeholders in terms of funding sources to increase the quantity and quality of waste facilities such as garbage dump and garbage transportation fleets, ranging from housing to garbage dump as well as the fleet of garbage transportation.

#### **CONCLUSION**

The population of Majene Regency will be forecasted to increase by 26,420 during the 2019-2030 periods or an average increase of 2,402 annually in the same period and the garbage

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collection of Majene Regency is forecasted to increase each year. In creating a clean, healthy and comfortable environment through improving the quality and quantity of waste management in Majene Regency, it can be done by implementing a waste management strategy that is equipped with adequate and reliable personnel, finance, and transportation management as well as cooperating and coordinating with relevant stakeholders, in relation with solid waste funding as an alternative source of financing in increasing the quantity and quality of solid waste facilities.

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