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Waste Management Strategy in Urban Areas to Achieve the Service Target (A Case Study on Waste Management in Mojokerto, Indonesia)

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ABSTRACT

Mojokerto, a municipal city in Jawa Timur Province, Indonesia, consists of two districts and 18 villages. Its waste services cover 67% of the villages with the capability of transporting 78.2% of the waste generated by 349 m^3/day produced by 135,024 inhabitants. The research aims to develop a sustainable waste management strategy with qualitative descriptive method. Data collection was carried out through documentation, focused group discussion, interviews, and observations on the process of waste management. Waste management was seen technically from the operational, institutional, regulatory, funding, community participation aspects with reference to the theory and analysis of Strength, Weaknesses, Opportunity, and Threat (SWOT). Waste management in Mojokerto uses the collection, transportation, and disposal system leading to uncontrolled waste generation at the landfill as well as high operational cost. Trials on waste reduction in terms of sources as well as waste management at the regional level were done; yet, they had not provided optimum result as waste disposed at the landfill amounting to 273 m^3 per day. Waste management in the landfill with landfill control systems and solid waste generation rate of 1.6% per year lead to failure in cost recovery. Developing waste management strategy to reduce the volume of waste sources by involving the active participation of domestic and community scale or regional groups, improving the quality of the management of the landfill as a processing site instead of disposal, increasing waste services coverage, increasing cooperation with individuals, developing the system of rewards and sanctions, recovering costs of waste management, regional cooperation in waste management, optimizing the utilization of solid waste infrastructure are all necessary. The strategy relies on a change of mindset for managing solid waste between the public and private sector with the implementation of reduction, reuse, recycling and environmentally safe disposal.

KEYWORDS: waste management; SWOT analysis; waste management strategy

INTRODUCTION

In Indonesia, waste has long become such a problematic issue. It has been identified as one of the factors causing negative externalities to the activities in urban areas. Population growth continues to increase from year to year and is more concentrated in urban areas, they are central to the development of social and economic life in the region; the areas are very attractive for people to develop their socio-economic life [1].

Waste management in Indonesia, especially in Mojokerto, sticks to the system of collection, transportation, and disposal, known as final approach (end of pipe), in which waste is collected, transported, and disposed to the final waste processing site, referred to as landfills. The existing landfill of Randegan, Kedundung Village, Magersari Sub-District, has been predicted as no longer able to accommodate waste generated by the people in Mojokerto in 2-3 years from now. The government has planned for relocation in Bloto Village, Prajuritkulon

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Sub-District, with an area of approximately 3 ha. During this time, the waste system in Mojokerto uses a granular system, namely through the separation between organic and non-organic which is then mixed with various chemicals, so that the waste can be used as a fertilizer. Waste management in Mojokerto is done by the Cleaning and Landscaping Agency. Waste production in Mojokerto per day is as much as 349 m^3. Waste management services are 78.2% per day as much as 273 m^3 of waste. The amount of waste generated by urban activity are mostly found in housing areas, as much as 213 m^3/day, followed by public places, namely market of 82 m^3/day, arterial and collector roads of 32 m^3/day, and schools of 22 m^3/day. The focus of study is on the composition and amount of waste generated in Mojokerto, on SWOT analysis of waste management in Mojokerto, and on how to develop a suitable waste management strategy in Mojokerto.

Review of Related Literature:

According to Act Number 32 of 2009 on the Protection and Management of the Environment, environment is the unity of space, power, state, and living creatures, including humans, and behavior that affect the continuity of livelihood and well-being of humans and other living creatures. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs [2]. According to Act Number 18 of 2008 on Waste Management, waste is what is left by daily activities of human and / or natural processes in the solid form. Based on the origin, waste is classified into organic and inorganic waste. To achieve optimal waste services, there should be a shift on municipal solid waste management. Transformative paradigm is the concept of municipal waste management that can prevent or minimize pollution and other negative impacts detrimental to society and the environment. According to Sudradjat [3], a pioneer to change the paradigm of waste management from the end of pipe approach, that refers to the disposal of waste directly to landfill, towards 3R waste management (Reduce, Reuse, Recycle).

The enactment of Act Number 18 of 2008 on Waste Management is the basis for a systematic and sustainable waste management that includes reduction and waste management. In order to carry out waste management in an integrated and comprehensive manner in the fulfillment of social rights and duties and authority of the government and local government to carry out the public service, a strategic planning of sustainable waste management is required [3]. Planning which includes the city scale, arranged in an integrated manner based on the results of the analysis of the potential and problems of the various components according to the needs in waste management. Sustainable waste management and environmentally waste management are going to a “Zero Waste” state and integrated waste processing site (Christia & Gamse, 2010).

Research Method:

The study is descriptive qualitative method in order to obtain a clear picture of the conditions and processes of waste management in Mojokerto. The necessary data in this study are all characteristics of garbage consisting of source, type, and volume of waste; operational technical on waste management consisting of local collection, temporary storage, transportation, and final processing; institutional and regulatory management consisting of institutions at the government level, management institutions at the community level; and public participation. Data collection techniques used were focused group discussions, interviews, observation, assessment, and documentation. In a qualitative study, researchers examine the validity of the data by means of triangulation to obtain accurate data. Triangulation includes triangulation method and data. All data obtained were compiled and analyzed using content analysis approach method of SWOT analysis (Strength, Weaknesses, Opportunity, and Treat). All the data were analyzed simultaneously to obtain Strengths, Weaknesses, Opportunities, and Treats and interbreed in IFAS / EFAS (internal factor and external factor).

Findings and Discussion:

1.1. Findings:

Mojokerto has 135,024 inhabitants, which consist of 66,818 male and 68,206 female. Mojokerto is a small town ± 50 km west to the capital city of Surabaya, East Java Province. Mojokerto is at 7 ° 33 South Latitude and 112 ° 28 East Longitude. Its territory is lowland 22 m above sea level in average with sloping soil conditions between 0-3% east and north. Mojokerto has an area of 1,646 hectares with a population density average is 8,203 people per km^2. The number of population density based on an area is 157.39 people/ha. Mojokerto is divided into 2 Sub-Districts, Magersari and Prajurit Kulon, 18 villages, 655 RT, 176 RW, and 72 sub-villages. Administratively, it is adjacent to Mojokerto Regency—Brantas River on the north, Soko Sub-District on the south and west, and Mojoanyar Sub-District on the east.

Waste management in general is under the Cleaning and Landscaping Agency, assisted by other agencies that manage waste within certain authority of the Market Agency. Institutional conditions of waste management based on the results of focused group discussions are as follows. First, there are two agencies managing waste management, namely the Cleaning and Landscaping Agency that supervises the Regional Technical Implementation Unit (UPTD) of the Final Processing Site (TPA), located in Jatibarang Village as waste processing center. Constraints in budget and UPTD personnel cause waste management in the landfill to be less

optimal. Second, Market Agency is in charge of waste management in the markets. Local Revenue (PAD) acts as a measure of financial capacity of a city in building the infrastructure of public facilities and infrastructure of the city.

Community participation in waste management is mostly done in the form of voluntary work, provision of household dustbin, transporting garbage from waste sources to landfills and processing waste into compost. At the community level, a number of village residents have made efforts sorting and waste processing. As many as 98.9% of people do not sort the waste before disposal and the rest 1.1% of respondents do. Households of 1.1% (3.7 m^3/day) have done waste sorting. Waste reduction at the sources (households) is of 1.9% (6.5 m^3/day). End of the process is in the form of landfill waste management. Mojokerto has one final landfill located in Randegan, Magersari Sub-District. Randegan Landfill will expire in 2017. Management of waste uses open dumping system and semi-controlled landfill. The problems at Randegan Landfill are limited area and pollution around the landfill as no WWTP processes leachate. There are seventeen (17) new landfills, and seven (7) more are needed.

Up to the present time, there are two (2) integrated landfill with a total capacity of 20 m^3/day, equivalent to 0.21% of city waste generation. Government services in waste management are divided into two major parts, the waste management on public roads by private companies, and household waste by stakeholders and the local people in cooperation with the Head of Village and Neighborhood. Transporting waste from the landfills to final processing site or final landfill is the responsibility of the Cleaning and Landscaping Agency. Until now, the Agency has provided 65 units of wheelbarrow with each carrying capacity up to 1.5 m^3/day, three-wheeled motorcycles as many as four (4) units, and a pick-up car. As many as 26 units of wheelbarrow and three-wheeled motorcycles are needed in the next five years. There is still a lack of transportation facilities as there are eight (8) new trucks consisting of one ordinary truck, four (4) dump trucks, and three (3) arm-roll trucks from the total requirement of nine (9) units. The absence of a strategy for cooperation scheme with private and community groups in waste management is another issue to tackle. There are two (2) new waste banks which have done the 3R approach in waste management. Increasing community participation in waste generation with 3R principles is needed. Based on the analysis, the internal conditions of waste management can be described as follows:

a. Institutional; clarity of duties and functions of SKPD to the division of authority between the regulator and the operator; in fact, the coordination among SKPD is so limited. The availability of adequate number of human resources is not supported by the quality of expertise in solid waste. There is difficulty of inter-regional cooperation.

b. Regulation; there is absence of local regulations on the management of garbage

c. Financing; local budgets and revenue are insufficient for waste management.

d. Technical operations; facilities and infrastructure for waste management are available at the regional level; yet, the processing is not optimal. Waste reduction efforts carried out by the 3R pilot project and sorting are not sustainable.

e. Community participation; the people are involved in the management of waste from waste sources, but it is not supported by the program to improve awareness on the importance of 3R waste management continuously.

Based on the analysis of external factors, here are the external factors affecting waste management:

a. Institutional; regional waste management is supported by central and provincial governments.

b. Financing; chances in sources of funding from the central government, provincial government, and private, but it is not supported by a conducive investment climate.

c. Technical operations; waste processing that is safe for the environment is not supported by the composition of waste that is still dominated by organic waste with high water content.

d. Community participation and socio-cultural; there must be more active involvement of the community in waste reduction and private sector.

1.2. Discussion:

Based on the data, there are some points that can be made regarding strategic issues in waste management in Mojokerto.

a. Processing of waste in the landfill is still using open dumping system and control landfill with limited facilities and infrastructure.

b. Waste management started from the sources to reduce the volume of waste that must be processed at the landfill has not been implemented on an ongoing basis. Integrated waste management will reduce operational costs of waste management.

c. Waste management service coverage is still limited; the volume of waste transported amounted to 78.2%, 76.3% of which with indirect handling and 1.9% of which is on community-based treatment.

d. Waste management is not cost recovery as waste retribution cannot cover operating costs, while budget subsidies in waste management is still limited (below the budget requirements).

e. There is absence of waste management legislation.

f. Waste composition is predominantly organic waste with high water content; this has caused waste extermination technology with thermal processes cannot be done easily.

g. There is difficulty in inter-regional cooperation in waste management system with mutual benefit, although the central government has been seeking to form cooperation in the management of the regional landfill.

h. Integrated waste management among the public, private and government has not been implemented, for all parties to carry out a partial management.

i. There is lack of solid waste management programs and education campaigns as a means of increasing awareness.

j. There is lack of public awareness in proper waste handling from the source in the waste management system of 3R.

k. Population growth and changes in urban lifestyle have become another issue.

l. An integrated and sustainable waste management has not developed and implemented.

The strategic position of waste management is in quadrant II according to the results of SWOT analysis. The selective maintenance position means that waste management is at the stage of utilizing the facilities and infrastructure that have been built or provided earlier in which facilities and infrastructure are old, thus careful selection is needed. Waste management is closely related to the increase in the population of a region, where the increase in population will affect the amount of waste per day. The volume of waste generated requires management in line with the increase in population. In the discussion, calculation on population projection is done with an arithmetic formula. Mojokerto waste generation projection to 2020 is 2.45liters/person/day, assuming that household will produce 81.5% of the overall waste generated. Increasing waste generation result in decreasing capacity of waste management that includes transportation and processing at landfill. Therefore, reduction in the volume of waste starts from the source is necessary in waste management.

Waste transportation service coverage in Mojokerto from landfill to final processing site is currently at 78.2%, while the level of service for household waste is 61%. SPM requires 80% access to the entire population, and 100% in densely populated settlements. Zoning of waste management services taking into account population density, function of an area, city development plan, and topography becomes a reference in improving service coverage.

Improvement of the quality management system to the Sanitary Landfill is as mandated by Act Number 18 of 2008. Final processing sites that are not yet qualified must be rehabilitated to meet the standards of the availability of sanitary landfill leachate treatment systems, equipment for methane gas capture, control of waste entering the landfill (must be residue and not fresh waste), and paying attention to geological conditions of landfill. Improved cooperation with the private sector in sustainable waste management through waste services is needed. City government needs to seek investment climate that is conducive to the involvement of the private sector to participate in waste management, as well as special incentives for companies that assist the implementation of environmentally friendly technologies in waste management.

The development of respect for the system of public and private involvement in waste management through 3R principles must be done. Growing awareness of the public to get involved in waste management, especially in efforts to reduce waste from the source can be developed and triggered by planned and systematic efforts. City government needs to develop a system that encourages people to be actively involved in eco-friendly and sustainable waste management such as 3R.

A special approach to the decision maker in order to allocate more budgets for waste management is indispensable, especially to ensure the sustainability of services and cost recovery. The city government also needs to develop a system of budgets from various sources of public and private retribution by openness and quality assurance of adequate and sustainable services.

There are limited efforts in regional cooperation for waste management. Limited ability of local governments in managing waste independently can be resolved with the cooperation of cross-regional or integrated regional waste management with the principle of mutual benefit. Optimal use of facilities and infrastructure of urban waste management is also needed. The availability of adequate waste facility is a key condition to giving excellent service, both in terms of the availability of means of transport as well as processing sites. Calculation of transportation systems is carried out by knowing exactly how much solid waste generated per day, the average volume of waste transported, as well as optimal transportation capacity per day to obtain data on facilities and infrastructure needed to achieve optimal transport services.

Conclusion:

The conclusion that can be drawn from this study is that waste management in Mojokerto is carried out by the Cleaning and Landscaping Agency with the sole job ranging from collection, transportation, and processing of waste from 132 villages. The volume of waste transported amounted to 78.2%, equivalent to 273 m3/day of waste transported. The volume of waste that is not transported is 21.8%, equivalent to 76 m3/day. The amount

of waste generated by urban activity are mostly found in housing areas, as much as 213 m³/day, followed by public places, namely market of 82 m³/day, arterial and collector roads of 32 m³/day, and schools of 22 m³/day. Waste is dominated by organic waste by 61.95% with high water content and the rest 38.05% is inorganic waste. The result of SWOT analysis confirm the following findings: that waste management is carried out through control landfill; that waste reduction is not optimal; that waste management is not cost recovery; that law enforcement is weak; that waste management has not been integrated; that public awareness campaigns are not optimal; that population grows rapidly, that facilities and infrastructure for waste management are insufficient; that there are waste management agencies; and that waste management funding comes from the city budget. Waste management strategies are done through waste reduction continuously. First, waste reduction starts from the source to the application of 3R at the household level in the form of sorting organic and inorganic waste and composting; and the implementation of 3R by the development of integrated landfill in every village, as well as empowerment of the community and waste management institutions. Second, the reduction of solid waste at the city level the form of sorting, composting and briquetting; landfill is only for residual waste that can no longer be processed with the sanitary system.

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