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The Analysis of Household Waste Management Based on Integrated Sustainable Waste Management in Sungailiat City

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Abstract: Statistics Indonesia (BPS) data in 2016 states that waste generation in Indonesia reached 65 million tons/year. It is predicted that in 2025, the number of waste generation in urban areas will increase to 2.2 billion tons/year of 4.3 billion of population in Indonesia. In Bangka Regency, there are several issues related to waste along with regional development and increasing population, which is the increasing of waste generation every year. The Environmental Department of Bangka Regency since 2018 had pursued a target of 30% waste processing and 70% waste management by 2025 according to the National Policy and Strategy program. Therefore, it is important to carry out a review and analysis of waste management in this place to achieve the target of reducing and handling waste in waste problems solving. If waste management has not done optimally, it will increase the air and water pollution which disrupt human life. In this paper, the concept is Integrated Sustainable Waste Management (ISWM). The method used is a qualitative analysis method by interview, observation, and documentation. The results showed several aspec in line with the ISWM, but other things has to improve in term of technical and non-technical aspects.
Keywords: waste, waste management, sustainable

1. Introduction

The waste problem is a complicated problem in Indonesia. Waste production in Indonesia reaches 200 thousand tons every day [1]. Statistics Indonesia or BPS data in 2016 states that waste generation reaches 65 million tons/year. It is predicted that in 2025, the number of waste generation in urban areas will increase to 2.2 billion tons/year of 4.3 billion population in Indonesia. The growth of population continually increases as consumptive lifestyle enhancement which followed by an increasing in waste generated. If it is not managed properly, it will lead to negative impacts such as the spread of disease, air pollution, and climate change. National data estimated only 60% –70% of total urban waste can be transported to the landfill by the authorized government agencies [2].

The government issued a policy in the form of laws and regulations, namely Law of The Republic of Indonesia Number 18 of 2008 on Waste Management, Regulation of The Government of The Republic of Indonesia Number 81 of 2012 on Management of Household Waste and Household-like Waste, and Regulation of The Minister of Transportation of The Republic of Indonesia Number Pm 33 of 2010 on Waste Management.

To solve the waste problem, Regulation of The President of The Republic of Indonesia Number 97 of 2017 on National Policy and Strategy (JAKSTRANAS) for the Management of Household Waste and Household-like Waste has been enacted. To carry out the mandate of the Presidential Decree, the Regional Government must formulate Regional Policies and Strategies (JAKSTRADA) by reducing 30% and 70% handling waste that must be achieved by 2025 as zero waste achievement program in Indonesia.

Urban Manager has responsible on waste management implementation. Each city has a challenge to provide an effective and efficient system for residents [1]. However, they often face problems beyond the ability of city authorities to overcome those problems due to a lack of organization, human resources, financial resources, complexity, and multi-dimensional systems [1].

Problems come up at every stage of solid waste management such as collection, transfer, transportation, and processing, those problems usually increase at landfills [3]. The waste problem also was experienced by Bangka Regency especially in Sungailiat City. The Environmental Department (DLH) of Bangka Regency, Bangka Belitung Islands Province since 2018 has pursued a target of 30 percent waste processing and 70 percent waste management by 2025 according to the National Policy and Strategy (Jakstranas) program. However, there are several issues related to waste along with regional development and population increase, currently the amount of waste is increasing every

year (data of Department of Environment, Bangka Regency). Then the areas of landfill continually decrease due to limited land, while the volume of waste are continually increasing.

Based on data of Governor Regulation of Bangka Regency No. 43 of 2018 on *Jakstrada*, the waste generation for household are increasing every year. The production of 84 thousand tons of waste per year will increase the costs “land lease” that should be paid by the government because it will require a new landfill to accommodate the waste while the old landfill capacity is not sufficient to accommodate excessive waste. Ofcourse, this condition will be detrimental to the regional economy.

The efforts to reduce waste are calculated from the total potential waste generation. If the estimation generation of household waste and household-like waste in the Bangka Belitung Islands Province is 0.4 kg/person/day, then the potential for waste generation in 2018 is estimated at 205,490.77 tons (Source: *JAKSTRADA* data recapitulation of all districts/cities in Indonesia. Province of Bangka Belitung Islands). The population growth rate of the Bangka Belitung Islands Province is 2.08 which means in 2025 at least 237,343.28 tons waste generation should be managed. Thus, the target to reduce 30% of the waste generation is 71,202.98 tons and the target for handling 70% of the waste generation is 166,140.30 tons.

Therefore, it is important to carry out a review and analysis of waste management in Sungailiat to ensure that the management is carried out in accordance with the prevailing and effective concept, in this paper, the concept of "Integrated Sustainable Waste Management" is being used as solving of the increasing of waste problems. This article aims to determine whether Waste Management is adequate which accordance with this concept.

The waste in this paper is specifically for household waste originating from daily household activities, excluding feces and specific waste, and waste similar to household waste originates from commercial areas, industrial areas, special areas, social facilities, public facilities, and other facilities.

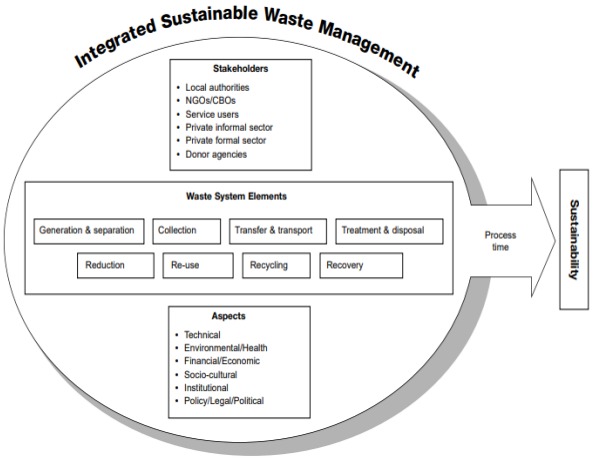

Figure 1. Integrated Sustainable Waste Management Model
Source : Anschutz *et al*, 2004 [4]

In the early 1990s, many non governmental organisations (NGOs) and international agencies that active in developing countries became dissapointed with the failure of the conventional, technical, approach in waste management [5]. A collaborative programme on solid waste management in low-income countries was built by funding of the Swiss Agency for Development and Cooperation. A workshop in 1995 (switzerland) resulted a framework for integrated municipal solid waste management in low income countries [6]. This novel approach was built on the comprehensive, holistic, and sustainable multiple level. It distinguishes three- dimension such as the scope (including the physical components of waste system related to strategic planning, financial management, public participation, the subjects (stakeholders or actor) and the last one is strategic objectives.

Integrated Sustainable Waste Management (ISWM) examines both government aspects and the physical components. Government aspects are users, financial, institutions, and policies [7]. We can say that ISWM (Integrated Sustainable Waste Management) does not focus only on physical aspects (facilities, technology), but also non-physical aspects which related to local context such as stakeholders (Local Authorities, NGOs, service users, etc.) with other aspects such as technical aspects, environmental health, regulations, funding, and culture.

In 2000s, the ISWM concept was further refined and becoming the norm in the discussion of solid waste management especially in developing countries which resulted guideline on the assessment of ISWM methodology [4].

ISWM comprises several important elements which linked to the key driver of waste management [5]. The aspects are public health (linked to waste collection), environment (linked to the environmental protection during disposal and treatment), 3R (reduce, reuse, recycle). Another important aspects

are the “software aspects” such as the governance strategies, stakeholders contributions, proactive policies and financial stability.

2. Material and Methods

The type of research is using qualitative descriptive content analysis. The method used in this research is a qualitative method by means of observation, in-depth interviews, and documentation. This method is used because the research subjects are stakeholders involved in waste management, thus demanding in-depth information. Human behavior will be easily understood if we focus to their meaning and purpose in carrying out an action or activity. Observation has been done in Temporary Dumps and landfill of Sungailiat City (observed the condition of the facilities, the behaviour of the people as well as the management conducted by the responsible institution). In-dept interviews has been done to six research subjects which consisted of a collector, a scavenger, a garbagecollector workers, a respondent from the Garbage Bank, a respondent from the landfill, and respondents who works as a staff of the Environmental Department (DLH) in Bangka Regency [8].

3. Results and Discussion

Based on the author's analysis, observations, and interview regarding the concept of Integrated Sustainable Waste Management (ISWM), there are several aspects that has been reviewed including technical and non technical aspects.

This concept has been reviewed and used in research by Wilson et al. in 2013. Based on their research, ISWM is suitable concept that applied in developing contries so that cities could overcome their waste problems. This concept is different with another popular concept called Integrated Waste Management (IWM) where IWM mostly used in developed contries. Vice versa ISWM examines physical and nonphysical aspects. The results of the research showed the performances of ISWM has improved waste management over the past 10 years. It also increase the collection coverage and controlled disposal until 50% in low income cities. Recycling rate are achieved of 20-30% in many lower income countries [9].

Figure 2. The Truck and TPS in Sungailiat

3.1. Technical aspects

Domestic Waste in the Sub-sector of Solid Waste in Bangka Regency is managed by the Regional Work Unit of the Environmental Department by the Cleanliness and Gardening Sector. Initially, flow of waste management in the city of Sungailiat starts from household waste. The society put their waste in front of their house (and the waste officer will pick their waste and put it in TPS), or the society can put their waste directly in TPS (temporary collection points) which are scattered in several points at the city of Sungailiat. There is no separation between organic & inorganic waste from the source whether it is from the society or from the officer eventhough it is the most important thing in term of waste management. Regarding waste sorting, formal advice for society to sort waste from the household scale has been made, but many households have not done this while waste sorting from its source is very important to use this waste easily and transported to landfill.

Afrer waste container then proceeds by transportation using a dump truck to the landfill in Kenanga (there is a leachate pool to accommodate). There are also TPS 3R (the Reduce, Reuse, Recycle Waste Management Site) in Karya Makmur Village and Sri Menanti Sub-District and Waste Bank to compost organic waste. In the future, it is planned to establish a recycle centre to use inorganic waste into more useful items. The amount of waste brought to TPS 3R and Waste Bank is not enough compare to the original amount of waste. There are still many unseparated waste in the TPS. The container itself is not using a separation system between organic and inorganic. The schedule of picking up the waste is quite good that pick up in the morning or evening.

The waste from Sungailiat City in the form of organic and inorganic waste which reaches an average of 60 M3 / day is disposed in Kenanga landfill which covers an area of 6.1 Ha (planned for expansion to 13 Ha) The wastes come from domestic waste, among others: local government housing, Cluster area of simple house (RSS), Kampung Jawa, and Nangnung. Sungailiat landfill management uses a controlled landfill system (once a week heap system). Waste management activities in Kenanga

landfill is supported by 5 bulldozers, monitoring wells, compost houses, office buildings, garbage recording boards, garbage gas pipes and landfill site plan boards. In its realization, the Bangka Regency Government targets the landfill to be free of waste by 2035. This is in line with the concept of zero waste.

The equipment available in Bangka Regency in managing existing waste are garbage carts, garbage motorbikes, garbage pick-ups, dump trucks, and arm roll trucks. The landfill itself has several heavy equipment such as bulldozers, excavators, and garbage trucks. The incinerator is still not available in this area.

Regarding work safety, there is a health social security program for waste transporting workers as well as making maximum efforts to carry out waste transportation based On Standard Operating Procedures (wearing helmets, masks, etc) but in reality some workers have not implemented the SOP due to low self awareness.

Figure 3. Kenanga Landfill

3.2. *Formal Document/Law*

In the National context, the government made JAKSTRANAS (included in Regulation No 97 of 2017) that need to be implemented in province level and also regency level. In local context, the Government of Bangka Regency, Bangka Belitung Islands Province, made a Jaksrada document as announced by the central government (included in Regulation number 43 of 2018 about the waste management & strategy in Bangka Regency). From the targets listed in JAKSTRADA, it is clear that waste management now and future are not only about handling the waste that has already emerged, but also how to reduce and handling source of waste generation. Therefore, JAKSTRADA has changed the waste management paradigm from a collect-transport-waste pattern to 3R (Reduce, Reuse, Recycle). This document will be implemented from 2018 to 2025 and has target to reduce 30% of household waste, and handling 30% of household waste. It is stated that the financial thing can be from Regional Revenues and Expenditures Budget (APBD) or other sources. The content of the document listed the programs planned to reduce and handle the waste. The programs of reducing waste are limitation of plastic use, *adiwiyata* school, limitation of disposable cutlery, composting in several level, biodigesting, waste bank, 3 R (reduce, reuse, recycling), and collecting waste by informal sector. On the other hand the programs to handle the waste are waste separation from the TPS/TPS3R, central waste bank, public facilities, waste collection from TPS/TPS3R, waste transportation to landfill, waste processing, and utilisation of methane gas.

3.3. *Stakeholders*

Waste management is carried out by the Environmental Department of Bangka Regency. In collaboration with stakeholders, there are several related stakeholders such as Minister for Public Works and Human Settlements, Department Of Housing And Settlement Area, Development Planning Agency at Sub-National Level, Ministry of Environment and Forestry, PT. Refined Bangka Tin and the Environmental Department of Bangka Regency. In addition, it is assisted by non-private stakeholders such as scavengers and waste banks.

3.4. *Community participation*

Solid waste management is also directed to increase community participation in the management of the clean river movement and the clean Friday movement. It has been done by involving all levels of society from neighborhood or village level, the world of education, and government agencies. The role of schools in waste management is very important because it provide waste processing infrastructure to prevent environmental pollution. Students are also educated to keep the environment clean, instill the younger generation to be more responsible to environmental cleanliness and motivate them to compete in creating a clean and healthy environment. Then, the participation of the community in utilizing recycled waste into economic value products is carried out by Non-Organic Waste Recycling Training for members of family welfare development in sub-districts in Bangka Regency.

3.5. *Strategies Recommended*

After conducting interviews and observations related to waste management in the city of Sungailiat, basically there are several aspects that suitable with the context of Integrated Sustainable waste management, but they need to improve another program listed in relation to physical and non-physical aspects. There are several factors that become a strength factors in solid waste management of the city of Sungailiat such as the availability of Regional Regulations related to solid waste, regional technical institutions that handle solid waste, district sanitation documents, cooperation with stakeholders (ministries, NGOs), the existence of Corporate Social Responsibility (CSR) from private sector (PT. Refined Bangka Tin), and availability of basic

infrastructure. The existence of people who increasing concerned about the environment (It can be from students, NGOs, and the society), it can be an opportunity to maximize solid waste management in this city.

Beside that, Integrated Sustainable Waste Management system need integration between national and local sector in term of the regulation (related to funding). Funding is one of the most important aspects related to the facilities and human resource. After that, there are several things that need to be improved in term of the real technical implementation, such as the separation process (related to people's awareness), the number of processed waste (related to TPS 3R & waste bank), as well as landfill facilities & infrastructure.

Firtst, increasing the people's awareness is important to increase the percentage of separated waste from the source. Government can tighten the rules regarding this issue whether it is from the household or TPS. The pattern of sorting organic and non-organic waste in this area has not been carried out optimally, especially from households and TPS. In addition, TPS has not been able to reach all urban communities and the capacity of the landfill is decreasing, while the waste that is accommodated is getting more and more along with the increase in population and the level of community consumption which is increasingly diverse. The awareness and participation of the community in sorting organic and non-organic household waste are low and also the habit of littering and burning the litter from households still exists. Moreover, lack of socialization to the public through the media and limited funds for waste management from the district.

Then the number of processed waste is still under the good percentage that need to increase the number of waste processed and increase the number of TPS 3R. Collaboration is needed between the government and non-government sector for example added the TPS 3R and the waste bank with their internal society. Beside that, 'Compost Chang' system can help to make the organic waste become compost from household level [10]. Next is about the the condition of the landfill which need to be improved, it can be seen from the lack of supporting facilities and infrastructure for landfill operations, such as malfunctioning of the leachate reservoir, and others.

There are several strategies that can be carried out in the city of Sungailiat such as increasing community involvement, commitment and awareness (especially in sorting waste from its source), decreasing the use of plastics from household (collaboration with business enterprise), change the people's paradigm, increasing the participation of NGOs, applying the 'Compost Chang ' consept, conducting collaboration with non-formal sector, improving landfill infrastructure, improving waste disposal facilities by providing TPS to separate the types of organic and inorganic waste, utilizing social media for information dissemination, adding more recycling center, improve the institutional system (related to funding) and monitoring compliance with the implementation of waste management.

4. Conclusion

Basically, there are several aspects that are suitable for the context of Integrated Sustainable waste management, but need to improve another program listed in relation to physical and non-physical aspects. The waste management system based on the ISWM concept already exists in this area (in term of the basic regulation) such as the availability of Regional Regulations related to solid waste, regional technical institutions that handle solid waste, district sanitation documents, collaboration with stakeholders (ministries, NGOs), the existence of CSR from the private sector, and availability of basic infrastructure but need to add another aspects such as integration between national and local sector in term of the regulation (related to funding), separation process (related to people's awareness), the number of processed waste (related to TPS 3R & waste bank), as well as landfill facilities & infrastructure. Beside that other important things are changing the people's paradigm, decreasing the plastic used, adding 'Compost Chang ' system [10], collaborated with non-formal sector, maximizing the use of social media for disseminating information, adding recycling areas, and monitoring compliance with the implementation of waste management. If it can be improved, the waste in this city can be managed and the amount of waste dumped into landfill can be minimized to enhance better life for society and sustainability of the environment.

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