

Waste Management Based on 3R in Mutiara Waste Banks Bekasi City Indonesia

Ahmad Kholil^{1,*}, Budiaman², Mirtawati³, Aam Amaningsih Jumhur¹

¹Department of Mechanical Engineering Education, Universitas Negeri Jakarta, Indonesia

²Department of Social Science Education, Universitas Negeri Jakarta, Indonesia

³Department of Mathematics and Natural Science, Universitas Assafiyah, Jakarta, Indonesia

Abstract Mutiara Waste Bank is part of neighbourhood RT. 05 RW. 13, Jakamulya Village, Bekasi City, which innovates in the waste bank activities. This waste bank applies 3R through the application of Mini Incinerators to burn garbage, plastic crushing machine, and composter tubes to produce liquid fertilizer. The purpose of Program to increase community participation in waste management with the concept of 3R (reuse, recycle, reduce). Based on the results of the implementation of the program, it can concluded that the 3R operational key a community-based solid waste management for direct community waste management as a plus manager. Without this public system, it impossible for garbage to overcome entirely or sustainably. Cultivating proper waste disposal methods ranging from the household environment to the 3R an effective method at the community level which will eventually make the community independent in managing their waste. Managing the 3R into the maximum utilization of organic and inorganic waste a communal-based waste management program that will cut the distribution chain of waste from neighbourhood to landfill.

Keywords Waste management, Waste bank, Mutiara

1. Introduction

The classic problem of waste has continued to be the cause of some problems such as flood, dirty environment and has an impact on poor health of the society. A good life will emerge when there is a condition that is in harmony with the environment but many people do not realize the importance of harmony with nature and the environment. The behavior that appears in the community is by burying or burning trashes. The condition is far from harmonious with nature. The development of waste management model collect-haul-dispose waste has not been the solution of the problem of waste. It is based solely on the uncomfortable attitude towards waste and the creation of final disposal place, but the waste problem has not been solved [1].

What is a ‘waste bank’? Waste banks – or “bank sampah” as they are called in Indonesian – can be found in neighborhoods across Indonesia – on Sulawesi, Kalimantan, Java. At waste banks, the waste created by the household is divided into two categories – organic and non-organic. Organic waste gets turned into compost, while non-organic waste is divided further into three categories: plastic, paper,

plus bottles and metal. The vast majority of eco-friendly households in Indonesia keep three bins or three large garbage bags in their homes; over time they began separating their waste into three different sections. Once their three bins and garbage bags are filled up, they bring their haul to a neighborhood waste bank where they then “make a deposit”. Like a regular commercial bank, you open up an account with your local waste bank. Periodically, you make deposits with your non-organic solid waste, which are weighed and given a monetary value, based on rates set by waste collectors. This value is saved in your account from which, like a regular bank, you can withdraw. The basic principles of waste banks remain the same across provinces: collect, save, earn, change behavior, and enjoy a clean neighborhood [2].

In the Indonesian context, waste management mandated in Law No. 18 of 2008 which changed the paradigm collect-haul-dispose into a treatment that relies on waste reduction and handling [3]. Management of solid waste and facilities in handling household waste is regulated by Minister of Public Works No. 03/PRT/M/2013 [4]. The 3R Model (Reduce, Reuse, Recycle) is an alternative to solve the waste problem. The development and strengthening of public awareness through the local community will resolve waste problems with waste bank management model.

Bekasi City has waste management and processing in Sumurbaru Landfill, Bantargebang District. This landfill has an area of around 12.4 hectares. Of the 5 existing zones, 4

* Corresponding author:

ahmadkholil@unj.ac.id (Ahmad Kholil)

Published online at <http://journal.sapub.org/env>

Copyright © 2018 The Author(s). Published by Scientific & Academic Publishing

This work is licensed under the Creative Commons Attribution International

License (CC BY). <http://creativecommons.org/licenses/by/4.0/>

zones have closed due to the garbage load has mounted with around 10 hectares. At present, the still functioning zone 5 around 2.4 hectares. It planned that there would a land acquisition for zones 6, 7 and 8.

The volume of waste in Bekasi City reaches 2,286,625 m³ per day. With a population of 2,554,499 people (2013), it estimated that the waste produced per person per person reaches 0.64 kg per person per day. Meanwhile, the waste transport service carried out by the Bekasi City Sanitation Department only able to serve no more than 55.45%. That means there around 44.25% of garbage still scattered in the city of Bekasi every day. If calculated, the waste that transported to Sumurbatu TPA every day only 914,650 kg per day or only serves as much as 1,416,470 people in Bekasi City. The impact of non-optimal waste management the Jakamulya Village which always flooded due to garbage and Situ Wo which cannot accommodate water. Efforts to manage waste from its source have carried out with a waste bank but not yet optimal.

At Jakamulya Village, every hamlet (RW) has a Waste Bank, management of new waste to sort waste to reused into compost and recycled plastic waste into handicraft products but cannot market. Garbage that cannot reused and recycled must reduced but cannot do, one way to reduce landfill at the source waste burning, but burning garbage in residential areas will have an impact on respiratory tract infections.

The Mutiara Waste Bank is part of neighbourhood RT. 05 RW. 13, Jakamulya Village, Bekasi City, which innovates in the waste bank activities. This waste bank applies 3R through the application of Insenerators to burn garbage, plastic crushing machine, and composter tubes to produce liquid fertilizer. The effort aims to optimize the management of waste in the environment.

2. Literature Review

The term waste bank consists of two words. Bank is an intermediary institution that has a function as a place to save and lend money and also financial transactions. Waste is defined as all unwanted or unusable material, which is usually discarded by its owner [5]. Waste bank is a campaign for handling waste by buying back waste in terms of a deposit like banking system [6]. Waste bank operates like a bank which people in a community, subdistrict, and district can use to deposit their garbage or extract money from the value of the garbage the provide to the facility [7]. The management model of waste bank is almost the same as the commercial banks where there are customers, bookkeeping and its management, in commercial bank, customer deposits money but in waste bank customers deposit is waste that has an economic value, while waste bank managers need to be creative and innovative, and have an entrepreneurial spirit in order to increase income. Waste bank working system based on household, by giving rewards to people who managed to sort and deposit the waste.

Participation in community-based waste management a high level of participation because by decisions taken by local people (bottom up), where community involvement in waste management driven by their determination and awareness of the meaning of their involvement. The role of external parties only provides stimulus/support according to the needs decided by the local community. Community participation exists in the whole process of waste management, starting with decision making in identifying problems and needs, planning programs, implementing programs, and evaluating and enjoying the results of the program [8].

In community-based waste management, the intervention or stimulus from external parties not taboo as long as it done as part of the process of fostering and developing the capacity of the community, and encouraging the growth of potential in the community. Interventions provided must by the proportion of community needs so as not to cause dependence. So that the sustainability of the program occurs where the community can manage development programs independently, with or without intervention from external parties. This approach is also known as Participatory Rural Appraisal (PRA) which a manifestation of the social learning process [8].

Community-based waste management approach is based on the concept of cooperatives. The purpose of this approach is to make changes in the communal waste management, in terms of source segregation, recovery of recyclable materials, and storage before collection [9]. Under this approach, a community project can create a sense of belonging and involve all members of the community to participate. In many projects, community organizations have been established in the form of cooperatives [10].

Community-based waste management as an approach to waste management that is based on the active participation of the community [11]. Government and other agencies are just as motivator and facilitator. According to Douglas *et al* [12] stated that environmental management requires facilitation and implementation of community-based efforts as a strategy to empower and increase their access to environmental resources are important, especially land, infrastructure, and services. Community-based waste management is very important because the activities are performed by members of the community itself. They make decisions related to their own lives. It would be more effective if tailored to local needs and priorities and their capacity [11].

The definition of 3R consists of reuse, reduce, and recycle. Reuse means reusing waste that can still used for the same function or other functions. Reduce means reducing everything that results in garbage. Moreover, Recycle means reprocessing (recycling) waste into useful new goods or products. Do 3R every day. Managing waste with the 3R system can done by anyone, anytime, anywhere, and at no cost, what we need only a little time and care. The following 3R activities that can done at home, school, office, or in other public places.

Examples of daily activities reuse

- Choose a container, bag or object that can be used several times or repeatedly. For example, use a napkin from cloth instead of using a tissue, using a battery that can charge
- Reuse containers or packages that have empty for the same function or other functions. For example, used beverage bottles used again as a place for cooking oil.
- Use electronic storage devices that can be deleted and rewritten.
- Use the blank side of the paper to write.
- Use e-mail to send letters.
- Sell or provide sorted waste to parties who need

Examples of activities reduce every day:

- Choose products with recyclable packaging.
- Avoid using and buying products that produce large amounts of waste.
- Use products that can refill. For example, stationery that can be refilled again).
- Maximize the use of electronic storage devices that can be deleted and rewritten.
- Reduce the use of disposable ingredients.
- Use both sides of the paper for writing and photocopying.
- Avoid buying and using unnecessary items.

Examples of activities recycle every day:

- Choose products and packaging that can be recycled and easily decomposed.
- Waste paper into paper or cardboard again.
- Do organic waste processing into compost.
- Do non-organic waste processing into useful items.

3R activities; simple can be done by anyone, anywhere, anytime and does not require a hefty fee. However, from this pure 3R, it can have a significant impact on the handling of waste which often becomes a problem around us.

3. Research Method

The research method used by researchers in this study is a qualitative approach with a type of descriptive research. This research was held at the Waste Management Center (TPS) 3R at the Waste Bank which is located in Pondok Surya Mandala Housing, RT 05 RW 13, Jakamulya Village, South Bekasi District, Bekasi City, Indonesia. The focus in this study is limited to the study of the implementation of 3R TPS management in managing waste by sorting waste to reuse means reusing waste that can still be used for the same function or other functions, reduce means reducing everything that results in waste being interpreted as well as reducing the pile of garbage and recycle means reprocessing waste into useful new goods or products. Data acquisition results in the research location will be described and analyzed using interactive analysis models.

4. Result and Discussion

Broadly speaking, community-based waste management activities with the 3R concept in RT 05 RW 13 Jakamulya Urban Village can be carried out through the following study: (1) identification of social characteristics of the community that influence participation; (2) analyzing the capacity of community participation in community-based waste management with the 3R concept; and (3) analysis of benefits obtained by the community from community-based waste management activities with the 3R concept. Figure 1 shows the state of the people's commitment to manage waste from its source in order to support Indonesia's free of waste a good faith of the right people.



Figure 1. Statement of Jakamulya's citizens' commitment to waste management

a. Analysis of the Influence of Community Social Character in Participating

Community-based waste management activities with the 3R concept have been implemented by almost all communities of RT 05 RW 13, Jakamulya Village, Bekasi City. The history of the community RT 05 RW 13 Jakamulya which indeed has the nature of & "guyub" making the process of extracting community participation run smoothly. The people of RT 05 RW 13 Jakamulya have the spirit of working together and achieving in community activities long ago. This can be seen from the formation of the RW Waste Bank as a pioneer of the City of Bekasi. This raises enthusiasm at the RT level to bring up the Waste Bank in the management of community-based waste. The establishment of the Mutiara Waste Bank in RT 05 RW 13 is a concrete manifestation of the community in realizing a clean environment. Community involvement in waste management driven by their determination and awareness of the meaning of their involvement [8]. Community knowledge of waste bank activities, including collection, transportation, community participation, prices or economic value of waste and recycling activities. Factors that encourage participation in waste banks, among others are motivation and environmental conscious behavior [13].

b. Analysis of Community Participation

Waste Management Activities The application of the 3R concept in RT 05 RW 13 Jakamulya currently underway, the community has already done waste sorting, composting, and ended with burning trash using an environmentally friendly generator. This means that the community in RT 05 RW 13

Jakamulya already understands the purpose of the 3R concept. By applying the 3R concept, waste can be utilized to the maximum extent possible. Organic waste can be processed into compost, and chemical waste can be used again as useful goods, crafted or managed by the Waste Bank utilizing enumeration technology to get added value. As well as waste that is not used, it is burned with an environmentally friendly incinerator. The community understands the purpose of implementing the 3R concept to reduce waste from the source, to reduce environmental pollution due to untreated waste. Garbage that is not sorted is challenging to decompose because it contains artificial ingredients that have not decayed by nature, and can even contain hazardous and toxic ingredients that can reduce public health.

Waste bank is one of community-based waste management system that enables public to actively participate in managing their environment. Waste management has several instruments to stimulate community manage their waste independently in their household and equally exchange it into saving. The instruments have to ensure the mutualism relation that the public get real profit and benefit in participation process [14].

c. Analysis of Benefits of Waste Management Activities

By the principle of participation, that waste management activities with the 3R concept depart from the needs of the community so that in its implementation it must be able to provide benefits to the community as an indicator of the success of activities. The benefits of waste management activities with the 3R concept carried out by the RT 05 RW 13 Jakamulya community seen from the public health sector include the volume of waste produced by the community, the physical condition of the surrounding environment, and the level of public health.

The benefits of waste management activities with the 3R concept carried out by the RT 05 RW 13 Jakamulya community viewed from the economic sector include income derived from waste management, savings in expenses obtained from waste management, additional funds for operational waste management activities, and job creation. The benefits felt by the community from waste management activities with the 3R concept not only seen in the public health sector and the economic sector but also in the psychological sector. The benefits of waste management activities with the 3R concept carried out by the RT 05 RW 13 Jakamulya community seen from the psychological sector include: level of public awareness of waste management, improvement of quality of life, lifestyle changes related to waste management, community satisfaction on waste management as an achievement, and efforts to carry out replication of waste management activities. Figure 2 shows weighing activities at the Mutiara Waste Bank.

Waste Bank as community-based environment governance has instruments that can establish self-reliance in a community. Economic independence formed by livelihood support from the profit and intellectual independence formed

by sorting and managing waste in a domestic environment [14].



Figure 2. Weighing activities at the Mutiara Waste Bank

Based on the results of this study, the management of Waste (TPS) 3R in Mutiara Waste Bank runs quite optimally. This based on the data obtained when the research shows that waste management with method 3 R done as follows:

i. Reuse

Reuse itself means reuse, the TPS in the Mutiara Waste Bank, Bekasi City uses the remaining ingredients from vegetables and fruit peels for compost use. Compost process by activating bacteria in the vats for the process of making Liquid Organic Fertilizers. In the reuse activities in waste management, residents of RT 05 RW 13 of Pondok Surya Mandala Housing in Bekasi City provided 5 POCs provided in 5 areas to accommodate residents to reuse organic materials (vegetables and fruits) left to become organic fertilizer liquid, after the fertilizer collected, the fertilizer used by residents to fertilize their plants in the house. Figure 3 shows liquid organic fertilizer from organic garbage. Fertilizers are used by residents to fertilize the plants and the remainder is sold as a waste bank income.



Figure 3. Liquid organic fertilizers

ii. Recycle

Recycle recycling goods, recycling activities in waste management, residents of RT 05 RW 13 Housing Pondok Surya Mandala Bekasi City chopping plastic bottles and glasses. Mutiara Sampah Bank received a grant from the Bekasi City Partnership Program in the form of a plastic crushing machine. This recycle activity makes the environmental community of Pondok Surya Mandala Housing in Bekasi City benefit from the sale of plastic chopped. Figure 4 shows a plastic crushing machine that is working on chopping plastic bottles and cups. The work was carried out by a group of PKK mothers. The production capacity of the machine is 100 kg/h, at this time has not been fulfilled because of the limited number of plastic bottles and cups collected.



Figure 4. Plastic crushing machine

iii. Reduce

Reduce means we reduce the use of ingredients that can damage the environment. Reduce also means reducing the pile of garbage that produced by citizens. The method of reducing the piles of people's waste by burning it using a mini-generator without fuel. Using incinerators through an organized combustion process to reduce solid waste so that it ash-shaped and neutralization and solidification of burnt ash can reduce waste mass by 70% - 80% and reduce the volume to 80% - 95%. The destruction of domestic waste which usually carried out by burning in incinerators, still often experiences problems namely air emissions from the incinerator which can pollute the air if it does not have good air control. The negative impact due to incomplete combustion results, which produce levels of CO₂ and particulate ash directly into the free air. The generator used able to overcome this problem because of the incinerator designed with a water scrubber system. Figure 5 shows the

implementation of the use of mini incinerators to burn unsorted waste.



Figure 5. Mini incinerators implementation

In order to optimize TPS management, the Mutiara Waste Bank Bekasi City coordinates with the Environmental Office of the Bekasi City so that the implementation becomes more active.

5. Conclusions

Based on the results of the study, it can be concluded that the implementation of TPS management in the Bekasi City-based 3R Mutiara Waste Bank had implemented optimally. This can be seen in the role of the Mutiara Waste Bank which has carried out the entire series of waste sorting processes by the 3R method. The application of Mini Incinerator to burn garbage, plastic crusher and composter tubes to produce liquid fertilizer can optimize the activities of the waste bank according to the 3R concept. Therefore this activity benefits the environment and enhances the economy of the community.

ACKNOWLEDGMENTS

Thanks to the Head of LPPM UNJ which has provided an opportunity to complete this Regional Partnership Program (PKW) scheme, as well as to the Director of Research and Community Service of the Ministry of Research Technology and High Education who has provided this grant.

REFERENCES

- [1] D. Wulandari, S. H. Utomo, and B. S. Narmaditya, "Waste Bank: Waste Management Model in Improving Local Economy," *Int. J. Energy Econ. Policy*, vol. 7, no. 3, pp. 36–41, 2017.
- [2] R. Salim, "Waste Not, Want Not: 'Waste Banks' in Indonesia," *The World Bank*, 2013. [Online]. Available: <http://blogs.worldbank.org/eastasiapacific>.

- [3] UURI, "Undang-Undang Republik Indonesia Tentang Pengelolaan Sampah," no. 18, 2008.
- [4] Anonim, "Peraturan Menteri Pekerjaan Umum nomor 3 tahun 2013 tentang Penyelenggaraan Prasarana dan Sarana Persampahan dalam Penanganan Sampah Rumah Tangga dan Sampah Sejenis Sampah Rumah Tangga," *Kementerian Pekerj. Umum, Jakarta*, 2013.
- [5] T. Pinheiro, "Waste Banks and Trading Platforms Make Waste a Valuable Resource," *Worldwatch Institute Europe*, 2015. [Online]. Available: <http://www.worldwatch-europe.org>.
- [6] M. Pariatamby, A., Tanaka, *Municipal Solid Waste Management in Asia and the Pasific Island: Challenges and Strategic Solutions*. Singapore: Springer-Verlag., 2014.
- [7] M. E. Friedberg, E., Hilderbrand, *Observing Policy-Making in Indonesia*. Singapore: Springer Nature Singapore Pte Ltd, 2017.
- [8] Y. Puspitawati and M. Rahdriawan, "Kajian Pengelolaan Sampah Berbasis Masyarakat dgn Konsep 3R di Kelurahan Larangan Kota Cirebon," *J. Pembang. Wil. Kota*, vol. 8, no. 4, pp. 349–359, 2012.
- [9] C. Visvanathan, "Environmentally sound waste management in Asia," *Asia 3R-Conference*, pp. 1–39, 2006.
- [10] W. Singhirunnusorn, W., Donlankorn, K., Kaewhanin, "Contextual factors influencing household recycling behaviours: A case of waste bank project in Mahasarakham municipality.," in *Procedia Social and Behavioral Sciences*, 2012, p. 688–697.
- [11] A. S. Suryani, "Peran bank sampah dalam efektivitas pengelolaan sampah (studi kasus bank sampah Malang)," *Aspirasi*, vol. 5, no. 1, p. 71–84., 2014.
- [12] K. Douglas, M., Lee, Y.S., Lowry, "Urban poverty and environmental management in Asia," *Asian J. Environ. Manag.*, vol. 2, no. 1, pp. 1–10, 2010.
- [13] A. F. Widiyanto, "Community participation in bank of garbage: Explorative case study in Banyumas regency Kabupaten Banyumas," pp. 367–376.
- [14] D. Retno and S. Suryani, "Waste Bank as Community-based Environmental Governance: A Lesson Learned from Surabaya," *Procedia - Soc. Behav. Sci.*, vol. 184, no. August 2014, pp. 171–179, 2015.