

Sustainability of waste bank and contribution of waste management

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Abstract. The challenges facing the city solid waste management (SWM) are increasing and complex because, in a new paradigm, solid waste is not only an environmental issue but also an economic and social issue. Therefore, the involvement of all stakeholders both the government and non-government in SWM is crucial. One of the roles of society as a part of city waste management is through the waste bank. This research is carried out by using a mix methods approach, for mapping and identifying the existing condition of the waste bank, a quantitative method is used and for designing waste bank development, a qualitative approach is used. Data collections were carried out by cluster purposive sampling method and to design the development of WB was done by a focus group interview. The result of this research shows that waste bank contributes to reducing recyclable waste up to 99,3 tons per day or 6,7% of the total generation of waste. To ensure sustainability, the waste bank must be integrated both in municipal waste management and in economic activities that affect the circular economy and the governments must pay attention of finance (incentives), procurement of facilities and infrastructure, as well as human resources training.

1. Introduction

Municipal solid waste management (SWM) in the urban area is a complex issue due to the changing lifestyle of people, rapid urbanization, and under-estimated contributors and stakeholders [1]. The complexity of SWM problems, on one hand, is caused by the generation of waste that increases with more varied waste characteristics, while on the other hand environmental capacity decreases. In addition to the presence of waste especially in developing countries like Indonesia, this is not only environmental issues but also social and economic problems, for instance waste used as a source of income. Meanwhile, the performance of waste management decreases due to the inability of anticipating the heap of various waste characteristics. This inability to manage urban solid waste consists of failures in the following areas: inadequate services, inadequate financing, inadequate environmental controls, poor institutional structures, inadequate understanding of complex systems, inadequate sanitation [2]. Therefore, integrated solid waste management (ISWM) involves all stakeholders of waste management and becomes an option that needs to be done in SWM in the world [3].

Stakeholders of waste management in the city can be classified based on their roles namely a group of waste producer, a group of waste management, and a group of people who affected by in waste management. A group of waste management generally classified into two groups namely government and nongovernment. The government usually pointed out a unit of the region who is given responsibility in management. One of the units involved in the management of waste is the role of society. Community



linkages in SWM involve two things: (a) society as producers of waste that generate both heaps in quantity and waste characteristics [4]; and (b) related to the participation of SWM as individual or group (collective) [5]. The role of society as an individual of waste management is very important particularly related to human behavior as the key to sustainable SWM [5]. In the meantime, the role of society collectively is important especially in developing countries which budget for waste management is limited compared with heaps of waste that increasing. One of the social roles in waste management collectively, especially in Indonesia, is a waste bank and it is now growing rapidly in the cities.

The establishment of the waste bank was obviously supported by the spirit of the people in recycling the garbage in Bantul Jogjakarta as an effort of 3R (Reduce, Reuse, Recycle) implementation as mentioned in Law No 18 of 2008 about Waste Management. Then KLKH (Ministry of Environment and Forestry) issued regulation No 13 of 2012 regarding Operation Procedure of Reduce, Reuse, and Recycle through the waste bank. The regulations mentioned that a waste bank is a place for sorting and collecting the garbage which can be recycled and/or reused that has economic value. However, waste bank establishment is still involuntarily so that the sustainability aspect is still being questioned. Then, generally, the waste bank is still partial, not yet integrated with the system of city waste management.

Former research engaged in the waste bank had discussed a lot about how to plan waste banks and understand supporting factors as well as the obstacles [5]. Then, the other researchers studied that the waste bank contributes to the environmental, social and economic context. The social contribution of the waste bank is to give new activity for the society as customers, cultivate an attitude of environmental care, strengthen good relationships and as additional income for the daily needs of the people [5]. In addition it has contributed of community economic it become as addition to necessary Income, gluing relationships among residents, fostering attitudes to care for the environment [6]. In the environmental context, the contribution of a waste bank in Bandung can reduce the individual generation rate about 0,07 – 0,2 kg/person/day [7]. Related with the sustainability of waste bank, it can be measured with the independence of the waste bank [4]. The independence instruments of waste banks consist of economy instruments, social instruments, education instruments, and technology instruments [4]. Inefficient appropriation issues of waste bank essentially lie within the following areas: enforcement or monitoring processes, the lack of sufficiently strict rules and regulations pertaining to the waste bank, and incomplete information, i.e. educational values that communities possess in order to effectively carry out waste bank activities [4]. Meanwhile, the idea to measure the sustainability of waste bank is by the adaptability process by using an ordinal scale of color which is influenced by effectiveness, efficiency, customer behavior, and customer reason to participate in the program of waste bank [4].

Base on previous research that describes above, the problem is how to upgrade waste bank performance and how to integrate the waste bank with the formal municipal solid waste management system so that it will be resulting synergy between waste bank activity and city waste management overall. The objective of this study is how to upgrade the waste bank performance both technical capability and networking development capability.

2. Methodology

This research is carried out by using a mixed methods approach, quantitative and qualitative. The location of the study was conducted in all areas of Bandung City. For mapping and identifying the existing condition of the waste bank, a quantitative method is used and for designing waste bank development, a qualitative approach is used. Data collections of a waste bank collected using a questionnaire that consists of 4 question groups: respondent identity, community-based waste treatment, and counseling. The sampling unit for distributing questionnaires is the KK (family head) whose choose using the cluster purposive sampling method when each sub-district took 1 unit of a waste bank as a sample with the number of samples calculated using the Solvin formula [7].

On the other hand, to design the development of waste bank is done by a focus group of an interview (FGI) by inviting stakeholders who have capacity and capability in decision making in waste management in Bandung. Stakeholders who participated in FGI are as follows (Table 1).

Table 1. FGI participants.

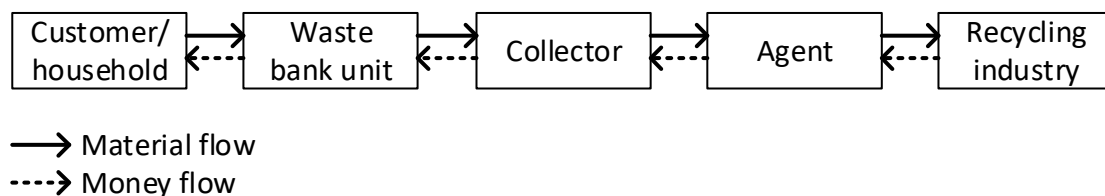
Stakeholders	Number of Participants	Remarks
Government	4 persons	Dinas LHK, PD Kebersihan, Dinas CK, Bappeda
Legislative Representative	1 person	Komisi C
Academics	4 persons	Private & University
NGO	4 persons	YPBB, LPTT, Hijau Lestari, waste bank Resik
Practitioner & Society	10 persons	

3. Result and discussion

This research is carried out by using a mix-methods approach, quantitative and qualitative. For mapping and identifying the existing condition of the waste bank, a quantitative method is used and for designing waste bank development, the qualitative approach is used. Data collections of a waste bank are carried out by cluster purposive sampling method where each sub-district took 1 unit of a waste bank as a sample.

3.1. Waste bank business process

Based on this survey, the waste bank business activity started by depositing certain garbage (type 1 sorting process) from the people who become customers of its neighborhood unit. The garbage deposited then being noted down in the saving book of customer-owned. The waste bank then sorted with more specific kinds of recyclable waste (sortation level 2). The materials sorted into four groups i.e. plastics, papers, metal, bottle/shard, residue. After that, the waste bank sells recyclable material which sorted as periodically to the collector or junk dealer and some time to the agent. In the level of a junk dealer, recycled garbage is usually more specific and even for plastic have been enumerated then it is sold to the recycling industry, or being a mixture of the raw material of a particular industry. This flow of activities is shown in Figure 1 below.

**Figure 1.** The waste bank business flow.

3.2. General characteristic of the waste bank

Waste bank of Bandung city is generally established in the base of an initiative of society that cares about the environment. Therefore, when it operates its business, the waste bank takes place regarding the society initiative both individually and collectively. Based on the survey, the area used for the waste bank is from private land (57%), public facility (27%), government property (10%), and rented land (7%). The physical condition of the waste bank building is very various and still cannot meet the standards mentioned in KLHK regulation No 13 of 2012. Based on this survey, waste bank building is permanent (43%), not special building (40%), and not permanent building (17%). Physically, a waste bank in Bandung City generally not ideal if compared with standard waste bank building as mentioned of KLHK regulation No 13 of 2012.

The quality of human resources in the management of waste banks, especially the head of the waste bank can be seen from his or her educational background. Generally head of the waste bank graduated from senior high school (63%), bachelor's degree (17%), diploma (10%), and junior high school (10%). Based on the background of the study, the quality of the human resources head of waste bank is already well.

3.3. A bank performance

The waste bank collected recyclable waste from the source of the household. The collection can be done in two ways: (1) by picking up to the source, and (2) the people who become the customers come to waste bank for deposit. The receiving of deposits from recyclable waste to waste banks can be carried out at a particular time or daily office hours. The range of services can be RT, RW or even kelurahan scale depending on the capabilities and facilities available. Based on the results of a survey of waste bank service areas in Bandung City are RW area (67%), Kelurahan area (27%), and RT area (6%). The number of customers is different. The number of waste banks customers <26 is 27%, 26 – 50 is 20 %, 51- 75 is 10% and 76-100 is 13%. Therefore, the average number of customers is below 50.

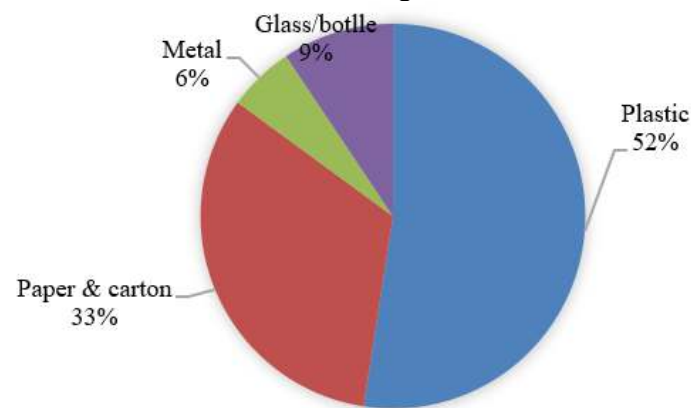


Figure 2. Composition and kinds of recyclable waste collected of WB.

Kinds of waste collected by the waste bank is generally the same as collected by informal business sector collectors such as scavenger and a Junk. These kinds of waste are classified into 4 groups: (a) plastic, (b) paper, boxes, and cardboard, (c) metal, and (d) glass. Even waste bank generally collects recyclable waste once in a week (Figure 2). Financially, the average gross income of each waste bank is IDR 1 Million per month (which is not yet deducted by operating costs).

To know the performance of recyclable waste collected by waste banks overall, based on this survey in the society that the number of household heads becoming the customers is 13%, or around 101.934 heads of family (KK) (1 household heads family = 1 customer). If the waste generation is 0,63 kg/person/day, composition recyclable waste is 23% and efficiency level 80% so recyclable waste collected by the waste bank is 99,3 tons per day or 6,7% from the total generation of waste.

3.4. Problems of the waste bank

To find out the problem faced by the waste bank, based on the field observation and FGI results are as follows:

3.4.1. Facilities and infrastructure problem. The main problem of the waste bank is, particularly about place availability. The place which used for a waste bank still usually used as public facility or jointed with the neighborhood office (RT or RW office). In any case, waste bank place that uses private land or mosque beside the operational support facilities are still very minimal for sortation facilities, cart collectors, and others.

3.4.2. Sales problem. Recycling waste collected by the waste bank is currently sold to collectors, dealers or central waste banks. Traders and dealers are established informal sector business actors who have a network with scavengers, and not all waste banks have adequate access to them. Besides that, the presence of collectors and dealers is also sometimes not known with certainty of the existence and location of its operations. Most of the collectors and dealers in the city of Bandung are currently using the land for their operations illegally, so their existence is often mobile. Meanwhile, there are only 2

central waste banks in Bandung so that they cannot accommodate waste banks at the RW level from all regions in Bandung. This is why the waste bank does not have sales certainty.

3.4.3. Financial problem. The revenue of west bank is generally very minimum, it caused by some factors, such as the amount of recyclable waste collected compared to scavengers are generally low, the sales price is determined by collectors and agent who have cooperated with scavengers, waste bank not further processing of material, etc., therefore the price is low.

3.5. Sustainable development of a waste bank. To ensure the operation of a sustainable garbage bank, the following things need to be done:

3.5.1. Incentive and improvement of capacity. One of the important things related to the sustainability of waste banks is the certainty of meeting operational costs. The fulfillment of the operational costs of the waste bank unit just from the sale of materials is not enough, therefore subsidies must be added. For this reason, a minimal amount of managed waste and subsidies is very important. Subsidies are given as a consequence of Law 18 of 2008 that people who can reduce waste can be given incentives.

To illustrate the capacity calculation of waste bank if the number of customers improved become 250 customers per waste bank, the assumption of 1 customer is 1 household, 1 household consists of 3 persons, 1 person produces 0.63 kg of waste and the composition of recyclable waste is 23% hence waste bank capacity is 113.4 kg per day or 2.2 tons per month. If purchasing price and selling price use standard price of a mixture of waste and the difference between purchasing price and selling price is 150%, so the profit of waste bank is IDR 660,767 per month. According to Law No. 18 of 2018, people who can reduce waste can be given an incentive, and for this case assumed the incentive is IDR 250 per kilogram. More results in the Calculation are shown in Table 2.

Table 2. The calculation of production cost of waste bank.

Component of cost	Quantity	Piece	Unit Cost	Sub Total	Total
Direct labor wage					IDR 1.838.640
- Cart man	10	Rit/person/month	IDR 75.000	IDR 750.000	
- Sorting staff	2177,28	kg/month	IDR 500	IDR 1.088.640	
Direct material					IDR 2.504.780
- Purchasing material	2177,28	kg/month	IDR 1.000	IDR 2.177.280	
- Fuel	50	liter/month	IDR 6.550	IDR 327.500	
Indirect costs					IDR 983.333
- Rent of place			IDR 500.000	IDR 500.000	
- Depreciation			IDR 333.333	IDR 333.333	
- Administration			IDR 150.000	IDR 150.000	
Total Cost					IDR 5.326.753
Revenue					IDR 5.987.520
- Sale of recyclable material	2177,28	kg/month	IDR 2.500	IDR 5.443.200	
- Subsidiary/ Incentive	2177,28	kg/month	IDR 250	IDR 544.320	
Unit cost					IDR 2.447
Profit					IDR 660.767*

*for a waste bank who just collects recyclable waste

Networking business development. Currently, the activity of waste bank after collecting recyclable waste is selling it to collectors who have business networks of the informal sector. For the future, waste bank must be designed as part of a circular economy system. There are many definitions of circular economy. Circular economy is production and consumption of goods through closed loop material flows that internalize environmental externalities linked to virgin resource extraction and the generation of waste (including pollution) [9]. Therefore the government must make a regulating and expending of waste trade markets and building renewable resources industrial parks aim to increase the productivity and economic benefits of waste utilization [10]. To guaranty the continuous operation of waste bank, it is necessary to build waste bank central in the district area. For this reason, the waste bank which takes place in the neighborhood then mentioned as the waste bank unit. In waste bank central all waste is to

be sorted specifically and after packed based on kinds of garbage then it is sold to an intermediate recycling center to produce as semi-finished material, and then sold to the recycling center to produce as the end product. The network business development of waste banks is shown in Figure 3.

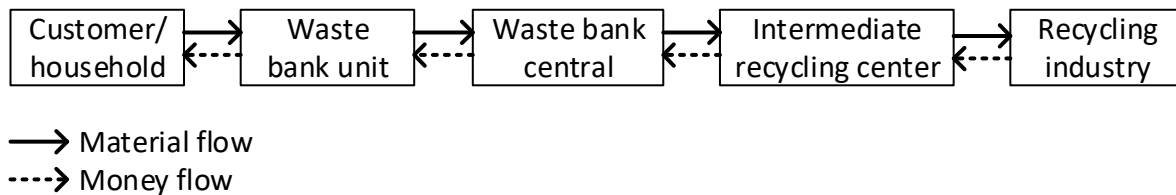


Figure 3. Networking development of waste bank business.

4. Conclusion

In an increasingly complex situation like in the present, the involvement of stakeholders in waste management is very important. Waste management is not only carried out by the government but also all communities including entrepreneurs. One of the community groups involved in waste management is a rapidly growing waste bank in the community. The role of garbage banks in the reduction of waste in the city of Bandung is currently 6.7% of total waste with an average reduction performance of 7.9 kg per waste bank/day. To make the waste bank sustainable, the waste bank needs to be given a subsidy of IDR 2,500 per kg and capacity is increased to 113.4 kg per waste bank per day. In addition to making the price of materials and material distribution stable, it is necessary to create a central waste bank with capacity adjusted to the limit of the central waste bank.

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