

Community-Based Waste Management in Magelang Municipality, Indonesia

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1. Introduction

In Magelang Municipality, Indonesia, solid waste is collected and transported to a dumping site. However, the Magelang Municipality and its citizens have begun to realize the importance of recycling waste. Magelang Municipality consists of 3 subdistricts, 17 villages, and 190 Rukun Warga (RW)—a community administration comprising 100 to 500 households. Magelang Municipality trains the leaders in RWs to establish community-based waste management (CBWM) to reduce improper waste dumping and environmental load from dumping sites. Although CBWM has been employed in several RWs, the information on the waste flow and the type of management is limited.

This research investigated the characteristics of CBWM and evaluated the performance of the CBWM in Magelang Municipality. The analysis revealed the factors contributed to the performance of CBWM.

2. Outline of CBWM program in Magelang Municipality

The population of Magelang Municipality was 130,386 living in 43,901 households in 2014. The amount of waste generated in Magelang Municipality was estimated to be 87.4 tons/day in 2014 according to a Magelang Municipality report. However, the Environmental Agency of Magelang Municipality reported that only 41 tons/day¹⁾ of waste was discharged at temporary disposal sites where the waste was stored until transported to a dumping site. Therefore, only about half of the waste was collected by Magelang Municipality and the rest was recycled by CBWM and scavengers or dealt with improperly, such as burned and illegally dumped into a river or roadside.

Three different types of CBWM are used in Magelang Municipality: Kampung Organik (KO), Waste Bank (WB), and Sodaqoh Sampah (SS). Households can participate in more than one type of CBWM. SS participants pay a fee to the SS manager; these participants generally do not separate their wastes, leaving SS managers to separate recyclable wastes from residue wastes. The SS managers recover recyclable wastes such as papers, metals, plastics, and glasses from households and transport the residue wastes to a temporary storage site. The SS managers rarely record recyclable waste that they collected.

KO recovers organic waste from households to compost it. The product is utilized as organic fertilizer by KO participants. Typically, few KO participants work during the summer season because of the decrease in gardening activity due to the low precipitation. In this research, no data about KO were obtained.

WB participants separate their wastes into recyclable and residue wastes themselves. Recyclable wastes are stored at the WB manager's house or WB warehouses. The WB managers record the weight of collected recyclable waste and provide deposit money to the WB participants for their recyclable waste. The WB managers save the price margin of recyclable waste between buying and selling²⁾. When WB participants also participate in SS, residue waste is collected by the SS manager. However, when the households participate only in WB, the

residue waste might be disposed to a temporary storage site or dumped illegally on roads or in rivers.

Recyclable wastes from SS and WB are sold to the private waste buyers and/or WB co-op (“koperasi”). A WB co-op was established by WB facilitators commissioned by Magelang Municipality to advise WB managers. SS managers and WB managers separate waste into more detailed categories, such as newspaper, cardboard, iron cans, and aluminum cans. The categories are defined by the WB co-op and private waste buyers. The price list of recyclable wastes depends on the waste buyers.

3. Research Method

There are 47 WB and 105 SS waste management organizations in Magelang Municipality. In this research, 47 WB organizations serving 2012 households and 4 SS organizations serving 184 households were investigated. The waste flow in Magelang Municipality was estimated based on an Environmental Agency report from 2014. Data were collected from the WB and SS managers between June and August 2015, including the amounts of waste generated and the number of households in the organizations, types of recyclable wastes, kinds of facilities, and kinds of support from Magelang Municipality (e.g., training and facilities). Data on CBWM income from the revenue of recyclable wastes were also gathered. The effect RW leaders' policy on households' participation was estimated. The amount of waste and composition was determined from Magelang Municipality's Environment Agency's annual report.

4. Results and Discussion

The analysis indicated that approximately 60.2 tons/day of waste were generated from households in Magelang Municipality. The amount of recyclable waste (e.g., papers, plastic, glasses, and metals) was 16.2 tons/day. The potential amount of recyclable waste in households was estimated to be 0.369 kilograms/day/household.

The WB collected 0.12 kilograms/day/household of recyclable waste, and about 1.48% of all recyclable waste from all households was recovered by WB. Meanwhile, SS collected approximately 0.20 kilograms/day/household of recyclable waste. Total income from selling recyclable waste via the WB system was Rp 9,322,000/month; the average income per participant was Rp 4,600/month.

Figure 1 shows the composition of recyclable waste collected by WB and SS. Paper was the predominant recyclable waste collected by both WB and SS, followed by plastics, metals, others such as textiles and tires, and bottles and glasses. The percentage of metals was higher in WB (11%) than in SS (4%). Because metals are relatively valuable, some households who participated only in SS sold the metals to private buyers.

Magelang Municipality has commissioned 20 WB facilitators to take charge of training WB managers to record the amount of waste collected by the participants and promote the number of household participating in WB. Magelang Municipality provides the necessary equipment (e.g., carts) for

bringing the waste and scales for measuring the weight of the waste in accordance with the report from WB. Figure 2 shows the relationship between the support from Magelang Municipality and the amount of recyclable waste. The amount of recyclable waste collected by WB-trained facilitators and supports was the highest at 0.14 kilograms/day/household.

Figure 3 shows the relationship between support from Magelang Municipality and the percentage of WB participants in RW. This percentage, with the support of training and equipment, was highest at 27.3%. Well-trained WB managers could encourage people to participate in WB. The training program might improve households' awareness of waste management, thereby leading them to participate in WB.

Some RW leaders support WB in mandating or asking (voluntary) households to participate in WB. The percentage of RW leader-mandated participants was higher than voluntary participants (Figure 4). Although only about only 30% of households agreed to the mandatory order to participate in WB, the RW leaders might be able to help increase the number of households participating in WB.

5. Conclusion

1. The amount of recyclable wastes (e.g., papers, plastics, glasses, and metals) in Magelang Municipality was estimated as 16.2 tons/day.
2. Recyclable garbage managed by WB in Magelang Municipality totals about 0.24 tons/day. This amount is 1.48% of estimated recyclable waste among all municipality households.
3. Magelang Municipality support affects households' participation in WB.
4. RW leaders' support affects households' participation in WB.

References

- 1) Environment Agency of Magelang Municipality, 2014. Laporan Akhir Sampah Tahun 2014, Magelang.
- 2) Wijayanti, D.R. and Suryani, S., 2015, Waste Bank as Community-based Environmental Governance: A Lesson Learned from Surabaya, Bandung, Science Direct. Procedia-Social and Behavioral Sciences 184 (2015) 171-179.

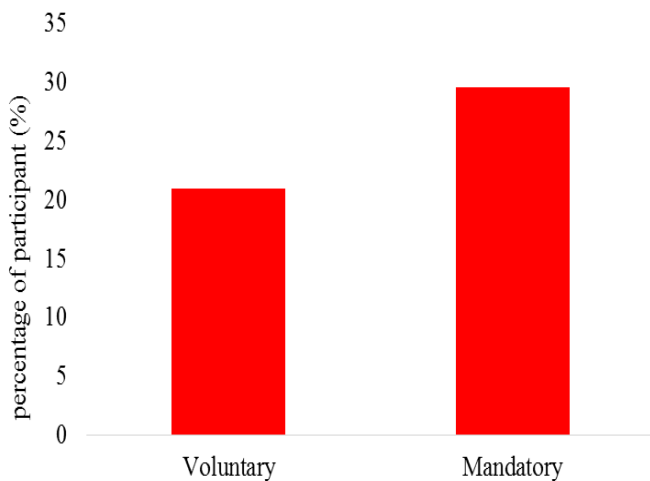


Figure 4. Relationship between RW support and percentage of WB participants in RW

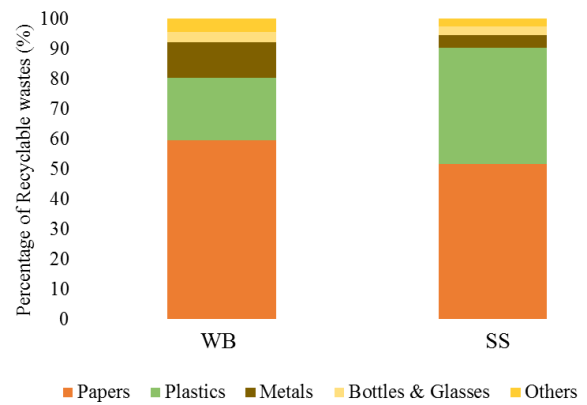


Figure 1. Percentage of recyclable waste collected by WB and SS systems

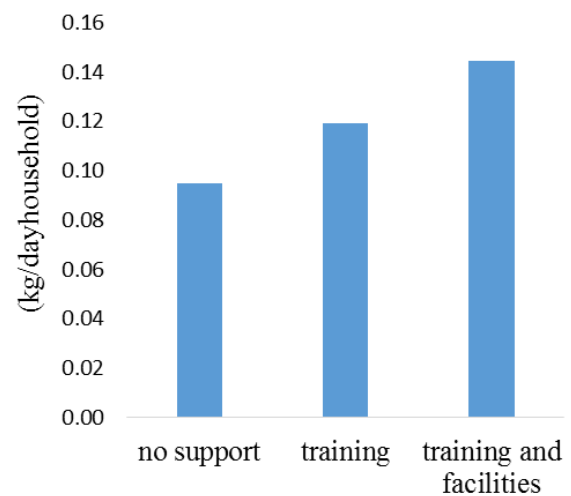


Figure 2. Relationship between government support and the weight of collected waste by WB system

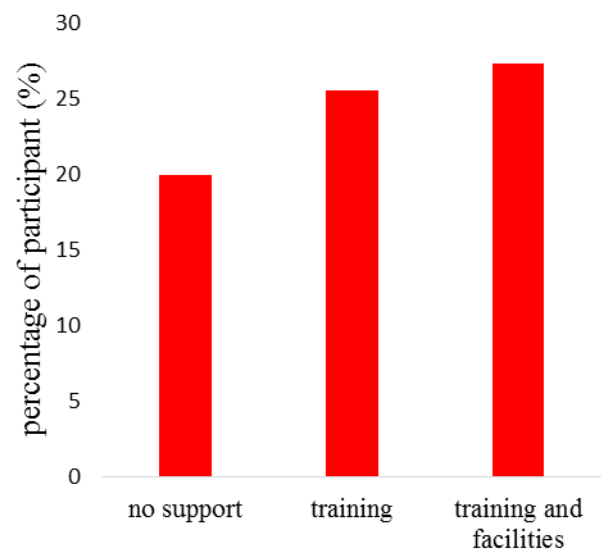


Figure 3. Relationship between warehouse facilities and the percentage of WB participants in RW