

Quantitative Analysis of the Impact of Awareness Raising Activities on Residents' Waste Separation Behavior in Indonesia

— Evidence from an Aid Project in Balikpapan City —

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Abstract: We conducted a quantitative analysis of the impact of awareness raising activities on residents' waste separation behavior, focusing on a pilot project for waste reduction conducted in Balikpapan City. The results show that the awareness raising activities led to a significant increase in the separation of organic waste. However, there is no evidence that these activities resulted in any significant differences in terms of the separation of salable items and other waste. A comparison among small communities confirmed that there was a large difference in terms of the impact that the activities had on organic waste separation. It is necessary to conduct a more detailed analysis of factors affecting the degree of impact of the awareness raising activities by reviewing the results at the small community level.

Key Words : Waste Separation, Awareness Raising, Indonesia, Balikpapan City

1. Introduction

In Indonesia, waste amounts have increased rapidly along with economic growth, and many cities are having to rely on open dumps to dispose of their waste because sanitary landfill sites have not yet been developed. In many cities, the capacities of existing final disposal sites are approaching their limits, but securing land for new waste disposal sites is becoming difficult because of opposition from local residents and urbanization. Given this, many cities are under pressure to dispose of their waste properly and reduce it.

In order to tackle the issues described above, JICA has been running a technical cooperation project since October 2013 in cooperation with Indonesia's Ministry of the Environment and Forestry and Ministry of Public Works and Public Housing, both of which have worked to establish a legal system and policies for waste reduction and appropriate waste management and to apply them to waste management in local cities. The project includes the provision of

assistance in preparing regulations and waste reduction plans in local cities and implementing pilot projects (PP) aimed at reducing waste in the target areas. Balikpapan City, which is located on the east coast of the island of Borneo, is one of the target cities for the implementation of the PP (Fig. 1). The abovementioned ministries are considering expanding waste separation and recycling activities to other cities by utilizing the results of the Balikpapan PP. Therefore, evaluating the impact of the PP in the context of the ministries' strategy for waste reduction is a meaningful exercise.

This research has been conducted to analyze



Fig. 1: Location Map for Balikpapan City

the impact of awareness raising activities on residents' behavior in terms of household waste separation, which has been newly introduced in Balikpapan City.

2. Waste Treatment before the PP Started

The PP target area, which is located to the southeast of the kelurahan (sub-district) of Gunung Bahagia, consists of 13 small neighborhood community associations (RT). As of March 2015, it had a population of 3,779 and 810 households.

Fig. 2 shows the process for household waste collection and disposal before the PP started. Residents disposed of household waste at the seven temporary dumping stations (TPS) in the PP area. Waste was often scattered in the vicinities of most of these TPS, and although disposal was allowed only from 18:00 until 6:00, the TPS always contained waste. Waste in the TPS was collected by small dump trucks owned by the Department of Cleansing, Parks and Cemetery (DKPP) for Balikpapan City and then transported to the waste transfer station (TPS-3R). After that, the collected waste was transferred to a large dump truck for transportation to the final disposal site (TPA). salable items were extracted by DKPP workers at TPS-3R and then sold to recycled goods traders.

In Balikpapan, salable items are collected at waste banks. Instead of paying for the salable

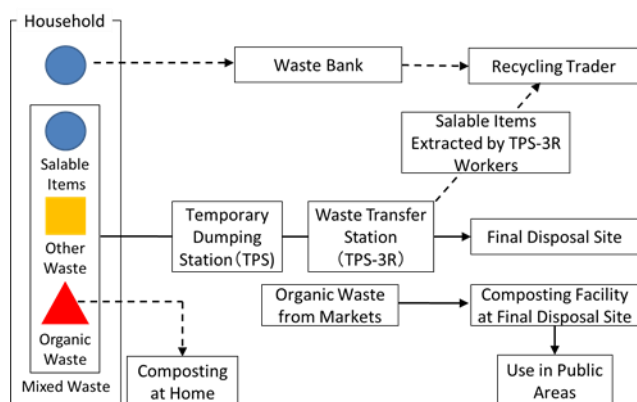


Fig. 2: Waste Collection and Disposal Process before the PP Started

items that the residents bring on each occasion, these banks adopt a system where they issue residents with something similar to bank passbooks on request, and then update the passbooks with deposits equal to the value of the items. The residents can then withdraw their deposits later upon request. One waste bank office has been established by the DKPP in the PP area.

Two families in the PP area are using organic waste to make compost at home. The DKPP is also making compost at the TPA site using organic waste from the markets.

3. Overview of Waste Separation Activities in the PP Area

Balikpapan City set a goal of reducing the amount of waste disposed at the TPA by 20%. To achieve this, the city is implementing the necessary measures based on an action plan that includes both community-based activities and the city government's efforts to introduce waste separation in the home and operation of an intermediate treatment facility for waste reduction.

Based on the action plan, residents in the PP area started separating their waste on April 13, 2015. Household waste is now separated in the home into three categories: Organic Waste, Salable Items, and Other Waste. Residents put Organic Waste and Other Waste into the appropriate plastic bags as designated by the city government and dispose of the bags at waste stations, which are waste collection points that have been newly set up by residents in each RT. The plastic bags for Organic Waste are disposable, while the bags for Other Waste are reusable and bigger than the bags for Organic Waste. After DKPP workers transfer the Other Waste to a dump truck, they leave the bags at a waste station. Residents are required to use the bags repeatedly. The waste disposal time is from 7 to 9 a.m. Organic Waste is collected five days a week (Mon., Tue., Wed., Fri., and Sat.), and Other Waste is collected once a week (Thu.).

Residents are encouraged to bring Salable Items to the waste bank themselves.

Environmental volunteers have been put in charge of raising the awareness of residents in order to establish household waste separation in the PP area. The environmental volunteers who were appointed by the Environmental Agency (BLH) of Balikpapan City have led community beautification activities. The BLH conducted training to improve the awareness raising skills of the environmental volunteers. Five members were selected from each RT to participate in the training. After the training, the environmental volunteers held meetings to explain how to separate waste in the home and to decide on the location of the waste stations in each RT. The environmental volunteers were also in charge of distributing the plastic bags designated by the city government.

4. Measurement of the Impact of Awareness Raising Activities

The Cluster Randomized Control Trial method was used to measure the impact of awareness raising activities in the PP area. Firstly, we divided the 13 RTs into the following 3 groups based on the features of each RT: RTs in a residential zone; RTs in a residential/commercial mixed zone; and RTs in a zone including schools and a kindergarten. After that, the RTs in each group were randomly organized into 2 groups: 6 RTs in areas where environmental volunteers implemented awareness raising activities ("With AR" areas) and 7 RTs in areas where only very limited awareness raising activities were undertaken ("Without AR" areas). The number of households in the "With AR" areas was 369 (1,731 people), and the number in the "Without AR" areas was 441 (2,048 people). Fig. 3 shows the location of each RT in the PP area.

The awareness raising activities conducted in the PP area were divided into two types: activities implemented in both the "With AR" areas and the "Without AR" areas and activities

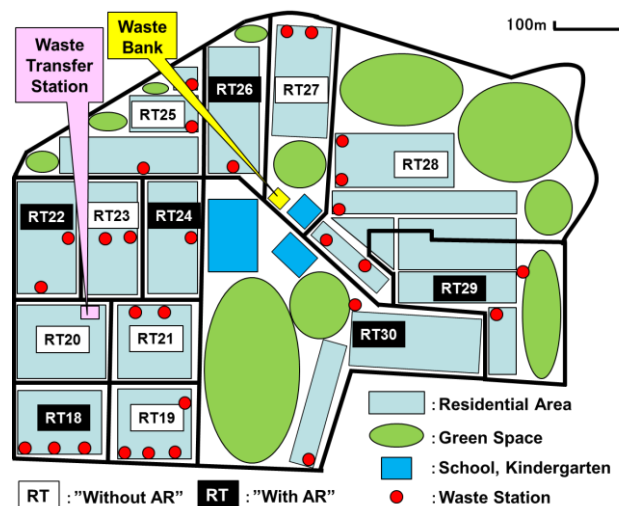


Fig. 3: Map of the PP Area

implemented only in the "With AR" areas. Environmental volunteers responded to questions about waste separation from residents in both the "With AR" areas and the "Without AR" areas. Waste bank staff informed residents who brought Salable Items to the waste bank whether the items were buyable or not. The activities implemented only in "With AR" areas were (1) the conducting of patrols at the waste station by environmental volunteers during a designated week each month; (2) the holding of monthly meetings attended by environmental volunteers in the "With AR" areas, representatives of the RTs in the "With AR" areas, the DKPP and the BLH to discuss progress in waste separation and issues to be improved; and (3) the holding of monthly meetings attended by environmental volunteers and residents from each RT in the "With AR" areas to discuss issues based on the results of the meeting mentioned in (2) above.

A study of the waste amount and composition (WACS) was implemented before the PP started (study period: February 9–15, 2015). Seven households per RT were randomly selected for this study. Based on the results of this study, it has been confirmed that the average waste amount is 1.90 kg/person/week for Organic Waste, 0.30 kg/person/week for Salable Items; and 0.86 kg/person/week for Other Waste, while

the waste composition rate is 62.1% for Organic Waste, 9.8% for Salable Items and 28.1% for Other Waste.

WACS were also implemented in both the “With AR” areas and the “Without AR” areas 1 week after the PP started and then again 6 months after it started (study period: April 20–25 and October 27–November 2, 2015). A total of between 27 and 38 target households were selected from each RT (“With AR” areas: 210 households; “Without AR” areas: 247 households). Surveyors visited the target households to ask the residents to dispose of waste during the study period in the same way as they had 1 week before. However, they also explained to them that they should dispose of Salable Items using a standard plastic disposal bag and to put the bags in front of their houses in order to distinguish these items from other waste. When the surveyors collected the bags, they wrote the household number on the bag. After that, they measured the weight of each bag as well as the weight of Organic Waste, Salable Items and Other Waste in each bag. Awareness raising activities in the “With AR” areas started the week after the first WACS had been implemented.

5. Results

Table 1 shows the amount of properly separated waste based on the results of the WACS that were implemented 1 week and 6 months after the PP started. In areas where awareness raising was conducted, the amount of properly separated Organic Waste 6 months after the PP started tended to be higher than the amount 1 week after the PP started. On the other hand, in the “Without AR” areas, the amount of Organic Waste 6 months after the PP started was significantly lower than the amount 1 week after the PP started. The amount of Salable Items 6 months after the PP started decreased significantly in both the “Without AR” areas and the “With AR” areas. The amount of Other Waste 6 months after the PP started increased significantly in the “Without AR” areas but not in the “With AR” areas.

Table 2 shows the ratio of properly separated waste. The ratio of properly separated Organic Waste was more than 70%, as shown in the data for both 1 week and 6 months after the PP started. Moreover, the ratio was found to have increased due to the awareness raising activities because it decreased 4.2% in the “Without AR” areas but increased 7.3 % in the “With AR” areas 6 month after the PP started. On the other hand,

Table 1: Amount of Properly Separated Waste

	Without AR	With AR
1 week after PP started (Organic Waste)	4.852 (3.909)	5.088 (4.419)
Change 6 months after PP started	-0.553 * (-0.648)	0.630 (3.519)
1 week after PP started (Salable)	0.672 (1.308)	1.081 (2.646)
Change 6 months after PP started	-0.554 ** (-0.867)	-0.796 ** (1.657)
1 week after PP started (Other Waste)	0.852 (1.372)	1.341 (1.964)
Change 6 months after PP started	0.608 ** (0.703)	-0.296 * (-0.518)

Amount of Properly Separated Waste:

Amount of waste in the designated disposal bag taken out on the designated day(s) of the week

Unit: kg/week/household; (): Standard Deviation; *: P<0.05, **: P<0.01

Sample size: “Without AR”=247, “With AR”=210

Table 2: Ratio of Properly Separated Waste

	Without AR	With AR
1 week after PP started (Organic Waste)	78.1	73.3
Change 6 months after PP started	-4.2	7.3
1 week after PP started (Salable)	20.3	25.1
Change 6 months after PP started	-15.4	-12.9
1 week after PP started (Other Waste)	37.3	48.6
Change 6 months after PP started	14.3	10.4

Ratio of Properly Separated Waste: (Amount of waste in the designated disposal bag taken out on the designated day(s) of the week) / (Total amount of waste in the designated disposal bag)

The data for the Salable category show the percentage of the total salable items in general disposal bags. Unit: %

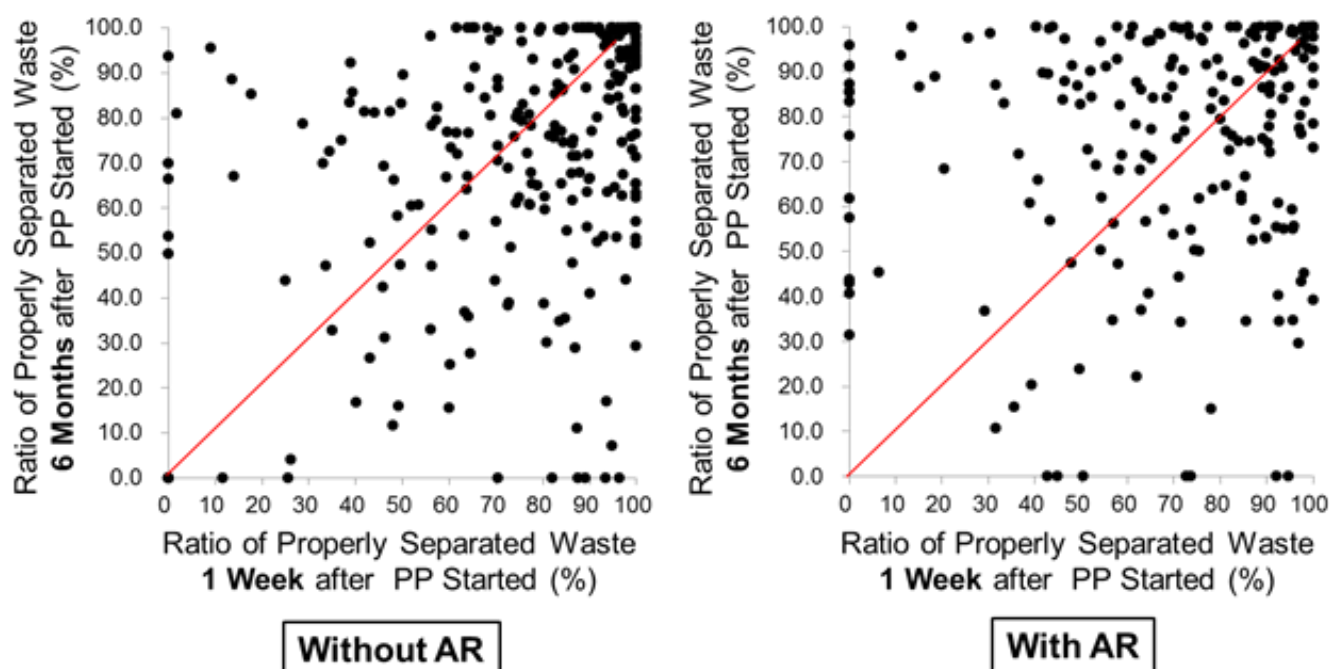


Fig. 4: Ratio of Properly Separated Organic Waste for Each Household

the ratio of properly separated Salable Items 6 months after the PP started decreased more than 10% in both the “With AR” areas and the “Without AR” areas. Furthermore, the increase in the ratio of properly separated Other Waste was greater in the “Without AR” areas than in the “With AR” areas. Therefore, the awareness raising activities had a significant impact on waste separation for Organic Waste, but a limited impact on waste separation for Salable Items and Other Waste.

Fig. 4 shows the ratio of properly separated Organic Waste for each household. It has been confirmed that the data obtained varied greatly among the various households and that there are households in the “With AR” areas for which the ratio of properly separated waste increased compared with the “Without AR” areas.

Fig. 5 shows the change in the properly separated waste ratio for each RT in the “With AR” areas. It confirms the different degree of impact that the awareness raising activities had

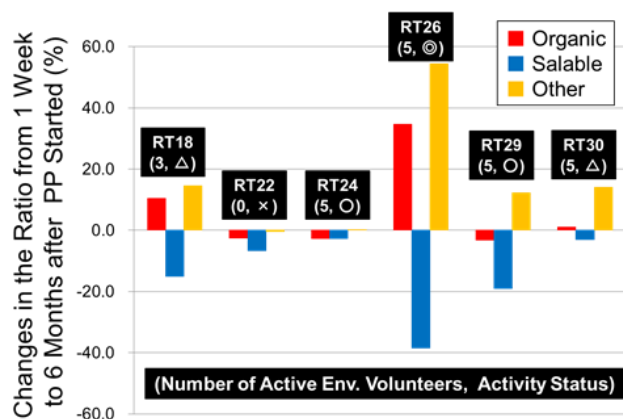


Fig. 5: Changes in Properly Separated Waste Ratio for Each RT in the “With AR” areas

among the RTs. In particular, the ratios for Organic Waste and Other Waste in RT26 are considerably higher than the ratios for other RTs. It has also been confirmed that a relationship exists between the increased ratios for Organic Waste and Other Waste and the activity status of the environmental volunteers.

6. Conclusion

In terms of the impact of introducing household waste separation, the ratio of properly separated waste 6 months after the PP started was higher than the results for the WACS study conducted before the PP started. Organic Waste accounted for 62.1% of the total household waste before the PP started. In comparison with the results for the WACS implemented before the PP started, the ratio of properly separated Organic Waste 6 months after the PP started increased by about 11.8% in the “Without AR” areas and 18.5% in the “With AR” areas based on the results shown in Table 2. Salable Items accounted for 9.8% of total household waste before the PP started, and the ratio of properly separated Salable Items 6 months after the PP started increased by 2.4% in the “With AR” areas. These are the quantitative results with regard to the impact of the introduction of waste separation.

The separation of Organic Waste was promoted by the awareness raising activities

conducted by environmental volunteers in the PP area, but the impact of these activities was limited for Salable Items and Other Waste. A comparison between RTs in the “With AR” areas has confirmed that there is a large difference in terms of the impact that the awareness raising activities had on the separation of Organic Waste. Active environmental volunteers were also confirmed to have had a significant impact on the separation of Organic Waste in RTs. It is necessary to conduct a more detailed analysis of factors affecting the degree of impact of the awareness raising activities by reviewing the results at the RT level.

It is advisable that the city government discuss the proper separation and collection of Salable Items and Other Waste with residents based on the results of the PP and that they prepare an improvement plan that reflects the opinions of the residents, especially in terms of the number of collection times and the designation of disposable bags for Other Waste. With regard to promoting the collection of Salable Items, it is desirable that the city government encourage residents to use waste banks. It has been reported that the waste separation awareness and behavior of residents using waste banks in Balikpapan City differed from that of residents not using waste banks (Murase *et al.*, 2015). Although the quantitative impact of waste bank activities on waste reduction has been small in Balikpapan City, it is advisable for the city government to prepare an improvement plan for the PP taking into consideration the impact that waste bank activities have on residents’ awareness and behavior.

Reference

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