Factors Influencing the Resource Separation Behavior by the Waste Bank System in Malang City, Indonesia

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Factors Influencing the Resource Separation Behavior by the Waste Bank System in Malang City, Indonesia

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Abstract

In 2011, a household resource recovery system from households was introduced in Malang city, Indonesia; this system was called Bank Sampah Malang (BSM). This system would contribute to the reduction of the volume of household waste carried to final disposal sites in the city. However, there are few studies on household resource recovery systems. In this study, a survey was conducted to obtain demographic information on the participants, their motivation for joining the BSM, and its inconvenience. It was found that reducing the number of categories of BSM resources could be an important strategy in reducing the burden of participating in the BSM.

Keywords: Household waste, Recycling, Waste Bank, Questionnaire survey, Waste separation

1. INTRODUCTION

Due to the increase in the quantities of waste brought about by urbanization and economic growth, a shortage of a space for waste dumping has become a serious problem in developing countries[1]. Environmental concerns such as river and groundwater contamination and air pollution from final disposal sites has become a serious problem[2]. As in many developing countries, in Indonesia, untreated waste is dumped at final disposal sites lacking liner systems and effective leachate control equipment. Due to financial problems, the municipalities in Indonesia cannot afford to install effective waste treatment technologies such as an incineration facilities to reduce landfill waste. Therefore, the minimization of household waste generation by resource recycling is one of the most reliable strategies.

Waste separation between resources and residual waste is a very useful practice for recycling. However, the practice of waste separation in households is a significantly unusual habit in Indonesia. There are few studies on waste separation and recycling activities in developing countries[3,4]. Marshall and Farahbakhsh revealed that the informal recycling sectors play a key role in resource recovery from household waste[5]. Charuvichaipong and Sajor mentioned that household habits of waste separation and pilot activities were important in introducing recycling systems; they did this by investigating recycling activity at households in Thailand[6]. Also, the relationship between recycling activity was investigated by the informal sectors and an attitude of households toward separation of waste[7]. However, there still does not exist an effective recycling system to recover resources from households in developing countries, especially operating on a large scale.

In Malang city, Indonesia, the Waste Bank, also called Bank Sampah Malang (BSM), was launched in November 2011. Because resources are recovered from household waste and recycled at recycling facilities, this activity contributes to a decrease in the amounts of waste carried to final disposal sites. BSM is one of the largest Waste Bank systems in Indonesia and over a thousand households are participating in this system. Therefore, BSM could be the best model to promote the Waste Bank system for resource recycling from households in other cities in Indonesia, as well as in other developing countries. However, information on the detailed activity of the BSM has been significantly limited. In this paper, the current activity of the BSM is reported through interviews with the BSM office and with participants in the program. The characteristics of the participants in the BSM and general awareness of this activity were investigated in order to propose a promotion strategy to increase the number of participant in the BSM.

2. BANK SAMPAH MALANG (BSM)

2.1 Outline of BSM

The population of Malang city was about 820,000 in 2013 and 400 tons of household waste were carried to a final disposal site every day. In 2011, the BSM was launched in Malang city; it is one of the largest waste bank systems in Indonesia. The goals of the waste bank are as follows[8].

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1. Reduction of household waste carried to a final disposal site
2. Establishment of waste separation in households
3. Promotion of the 3R practice
4. Keeping the environment beautiful
5. Practice of environmental education
6. Improvement in standards of living and expanded employment

2.2 Types of participation and kinds of resources

Figure 1 shows a material flow diagram illustrating BSM activity. Malang city (via the Department of cleansing and gardens, the Department of electricity generation, and the Department of education), volunteer environmental organizations, and consulting groups operate the BSM. There are 71 kinds of resources (BSM resources) collected by the BSM. Some examples of prices of BSM resources are shown in Table.1. The BSM resources are categorized into four major groups of materials: paper, plastics, glasses and metals.

There are four ways to participate in the BSM: as a Community (COM), a Public education facility (SCH), Public institution (INS), or Individual person (IND). COM consists of a minimum of 20 households and one leader for the management of the community. SCH includes elementary schools and junior high schools, and does not include senior high schools or universities and colleges. INS includes senior high schools, universities, and colleges, municipal facilities of Malang city, and private companies. SCH and INS consist of a minimum of 40 teachers or workers. IND are individual households that have not yet registered in COM. As of July 2014, 357 COM, 175 SCH, 32 INS and 668 IND were registered the BSM. The BSM collects resources from COM, SCH and INS typically twice a month. In case of inadequate separation of BSM resources, the resources are separated again by of BSM staff. For example, when a cap and label are not removed from a PET bottle in households, the cap and label are separated at the BSM office. Some plastics are divided into dirty and clean plastics. The clean plastics have already been washed by participants in their homes to remove residue. The dirty plastics are washed by water with chemicals at the BSM office. Plastics discharged as clean plastics and washed plastics at the BSM office are crushed into small pieces and sold to recycling facilities.

2.3 Savings

Table 1 shows prices of BSM resources per weight in 2014. These prices are changed periodically in accordance with the prices of the BSM resources provided by recycling companies who recycle them. The prices are different according to whether the materials are collected by BSM staff from participant's homes (BSM-collection), or whether participants bring them to a BSM office by themselves

(Carry-in). The price for Carry-in is higher than BSM-collection.

COM and IND can choose methods to take deposits as cash or saving for their BSM resources. Typically SCH exchange BSM resources for education tools such as writing materials and notebooks. People who are not registered in BSM (NOT) also can bring resources from their households to BSM office by themselves and can take cash as deposits. NOT cannot save their profits from BSM resources as savings and cannot use the BSM-collection service.
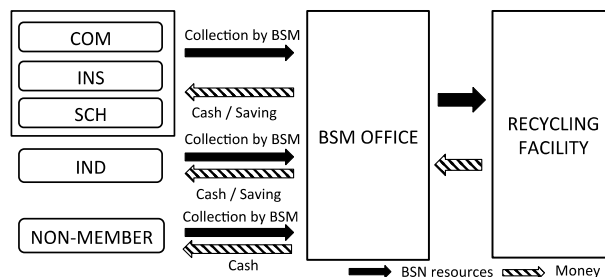

Fig.1 Matrial flow

3. METHODS

In this study, COM was targeted to investigate for BSM groups. In 2014 May and June, a survey was conducted by sending questionnaires to 190 households from the 11 COMs in Malang city. The leaders of the 11 COMs were asked to select households in their COMs to participate in the survey. The selected households in the COMs who agreed to the survey were gathered at the leader's house and instructed to answer a questionnaire. Questionnaires were collected from each household. Questions were asked to ascertain family structure, the job of the head of the family, total income per month, motivation for joining the BSM, and current recycling activity (Table 2).

4. RESULTS OF THE SURVEY

4.1 Characteristics of households

The average number of family members per family was 3.28 people. About 41 % of heads of households had graduated from junior high school as their final education and 28 % of those had graduated from elementary school. Nationally across Indonesia, in 2011, 29 %, 19 % and 22 % of workers had graduated from elementary school, junior high school, and senior high school, respectively (Public welfare and working association Indonesia KSBSI). Therefore, compared to average Indonesian workers, the heads of

Table 1. Prices of BSM resources per weight in 2014 (IDR)

TYPE	BSM collects		Carry on directly		TYPE	Participant		Non-participant	
	Cash	Save	Cash	Save		Cash	Save	Cash	Save
PLASTICS					PAPER				
Clear PP	2,200	2,400	2,400	2,600	Book	1,500	1,650	1,650	1,800
Clear PP (dirty)	1,100	1,300	1,300	1,500	HVS Paper	1,500	1,650	1,650	1,800
Screen printing PP	300	400	400	500	Newspaper	1,700	1,850	1,850	2,000
Packaging of instant	200	300	300	400	Cement sack	1,700	1,850	1,850	2,000
Kresek/naso	200	300	300	400	Magazine/Duple	400	500	500	600
PE (Clean)	1,050	1,150	1,150	1,250	Cardboard	1,300	1,400	1,400	1,500
PE (Dirty)	550	650	650	750	Mixed paper	800	900	900	1,000
Packaging of Sunlight	400	500	500	600	Scrap paper	900	1,000	1,000	1,100
Packaging of Bimoli	450	525	525	600	ZINC				
PP Cups (Clean)	5,500	6,000	6,000	6,500	Zinc (Omplong)	1,300	1,500	1,500	1,700
PP Cups (Dirty)	4,300	4,500	4,500	4,700	Zinc	500	650	650	800
Ale-Ale Cups	2,100	2,300	2,300	2,500	IRON				
PET Clear Bottle (Clean)	4,400	4,700	4,700	5,000	Iron (super)	2,700	2,900	2,900	3,100
PET Clear Bottle (Dirty)	3,600	3,800	3,800	4,000	Iron	1,550	1,700	1,700	1,850
PET Color Bottle (Clean)	2,600	2,800	2,800	3,000	ALUMINIUM				
PET Color Bottle (Dirty)	2,100	2,300	2,300	2,500	Slender Cop/Seker	10,500	11,500	11,500	12,500
PP Color	2,400	2,600	2,600	2,300	Antenna/Pan	9,500	10,000	10,000	10,500
PP Black	1,200	1,350	1,350	1,500	Aluminum can	9,000	9,500	9,500	10,000
HDPE Blowing	2,400	2,600	2,600	2,800	Plate	9,500	10,500	10,500	11,500
Jerry can	3,600	3,800	3,800	4,000	Elbow	14,100	14,300	14,300	14,500
Cable cover	800	1,000	1,000	1,200	Aluminum bottle	3,100	3,300	3,300	3,500
Paralon Pipe	700	800	800	900	Bronze	5,500	6,000	6,000	6,500
LDPE Infusion	4,100	4,300	4,300	4,500	Stainless Monel	12,000	13,000	13,000	14,000
Carpet / Plastic gutter/Rain coat	550	625	625	700	GLASS				
Gallon cap	2,100	2,350	2,350	2,600	Small bottle	100	100	100	100
Color Bottles cap	2,100	2,350	2,350	2,600	Marjan bottle	100	100	100	100
PET Rope	600	700	700	800	Orson bottle	100	100	100	100
Water hose	950	1,100	1,100	1,250	Soy sauce bottle	350	450	450	550
Sack volume 50 kg	250	325	325	400	gasoline bottle	500	650	650	800
Sack volume 25 kg	150	225	225	300	Beer bottle	500	650	650	800
Sack volume 10 kg	100	175	175	250	Softdrink bottle	150	200	200	250
Broken sack	250	325	325	400	Broken glass	75	75	75	75
Hard plastic	550	650	650	750	BRASS ACUU COPPER				
Hard plastic (Clear)	2,450	2,600	2,600	2,750	Brass	32,000	33,500	33,500	35,000
CD/DVD/MP3/Play	2,600	2,800	2,800	3,000	Small battery	6,000	7,000	7,000	8,000
Gallon	3,100	3,300	3,300	3,500	Big battery	13,000	14,000	14,000	15,000
					Big battery 50 Jet	18,000	19,000	19,000	20,000
					Copper	47,000	48,500	48,500	50,000
					Copper (Super)	57,000	58,500	58,500	60,000

households in this study were well educated. About 52 % of respondents who produced primary income were temporary workers or part time workers. About 51% of respondents' income was under 1,500,000 Rp per month; 27 % of respondents were at the middle class income level (from 1,500,000 to 3,500,000 Rp), and only 2 % of were at the upper class income level of over 3,500,000 Rp per month. The average income in the East Java prefecture in 2012 was 1,270,000 Rp

(Government of Indonesia). Regarding the source of information by which they had joined the BSM, 36 % of respondents had heard of it via TV, 28 % of respondents had been contacted by campaigns in their communities, and neighborhoods and families constituted 20 % of information sources, respectively. Concerning waste handling methods, about 70 % of respondents put their residual waste into the garbage bin in front of their house, and the residual waste was

Table 2. Survey questions

Demographic information of respondents	Family structure (number of persons)
	Education background
	Job type
	Main income
Handling of waste	Method of disposing of residual waste
Inconvenience of BSM activity	Too many types of garbage (MANY)
	Too much time for separation (TIME)
	Too much time for transportation (BRING)
	Difficulty of storing garbage in the house (STORE)
	Price of resources too low (PRICE)
Concerns regarding financial benefit from BSM	Economic benefit
	Contribution to family finance
About BSM activity	Duration
	Source and type of BSM resources
	Frequency
	Motivation

carried to temporary storage sites (TPS) managed by Malang city. About 19 % of respondents brought the residual waste to TPS by themselves. Then the waste was carried to a final disposal site by the Malang city cleansing department. About 33 % and 25 % of respondents had participated in the BSM for more than 2 years and for 1 to 2 years, respectively. The remaining respondents had participated for less than a year.

Plastic including PET bottles and paper were collected by 35 % and 34 % of respondents respectively. On the other hand metals and glasses were collected by only 9 % and 7 % of respondents, respectively.

4.2 Inconvenience of BSM

(1) Burden score of BSM activity

Figure 2-6 shows the histograms of answers related to the inconvenience of BSM activity. The scores ranged from 5 for strongly agree, 4 for agree, 3 for partly agree, 2 for disagree and 1 for strongly disagree.

The average score for MANY (Too many types of garbage) was the highest and the value was 4.0 (Figure 2). Almost all respondents felt that the number of BSM resource items is too many due to their scores greater than 3. The score of TIME (Too much time for separation) was the lowest with 3.1, and about 60% of participants assigned it a score of greater than 3 (Figure 3). The respondents feel that time spent for separation between residual waste and BSM resources is not large. The score for BRING (Too much time for transportation) and STORE (Difficulty of storing garbage in the house) were 3.4 and 3.5, respectively. Because people do not have the habit of keeping
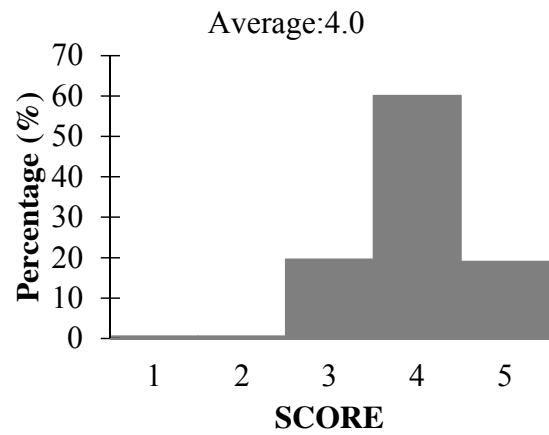

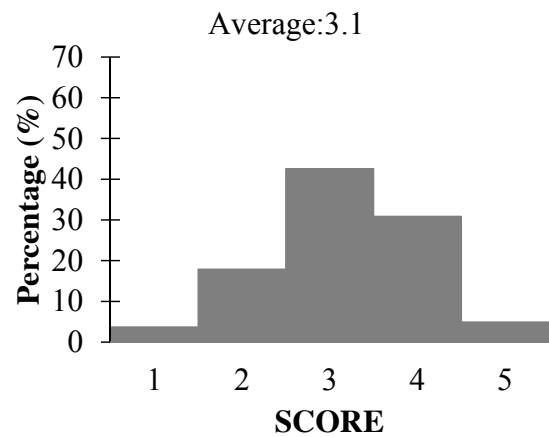Figure 2. Answers related to the inconvenience of BSM activity (MANY)

Figure 3. Answers related to the inconvenience of BSM activity (TIME)

garbage in their houses at every moment in Indonesia, most of respondents feel that keeping BSM resources in their houses is difficulty (Figure 4,5). The score for PRICE (Price of resources is too low) was 3.4 and more than 80 % of respondents who answered gave this a score of greater than 3. This result suggests that the respondents feel that the prices of BSM resources per weight are lower than they expected (Figure 6).

Table 4. Correlation between the scores for inconvenience

	MANY	TIME	BRING	STORE	PRICE
MANY	1.000	-0.067	-0.188	-0.077	0.080
TIME		1.000	0.444	0.187	0.199
BRING	*	**	1.000	0.274	0.146
STORE		*	**	1.000	0.181
PRICE		*		*	1.000

(** 1% of significance,* 5% of significance)

Average:3.5

Figure 5. Answers related to the inconvenience of BSM activity (STORE)

Average:3.4

Figure 4. Answers related to the inconvenience of BSM activity (BRING)

(2) Correlation between the scores

Table 4 shows the correlations between the scores of inconvenience. There is a correlative relationship between BRING and STORE with 1% of significance. Because BSM resources should be brought to the community leader's house and participants cannot carry them at their own convenience, the participants have to keep their resources for a while. Therefore, the amount of BSM resources brought to the leader's house at one time becomes larger and the participants feel a burden to bring the large amount of resources. TIME and STORE have a significant correlation with 5% of significance and BRING and TIME also have significant correlation with 1 % of significance. The more time is required for the participants who separate their waste precisely, the larger the amount of BSM resources that must be stored in their houses, and transportation of larger amounts of BSM resources can be inconvenient. Correlation between MANY and TIME was not significant with 5% significance. This result indicates that the number of BSM resource is too many for respondents but they do not spend much time on BSM activity. Because respondents might recover only resources that are easy to separate, they feel less burdened by having to separate BSM resources.
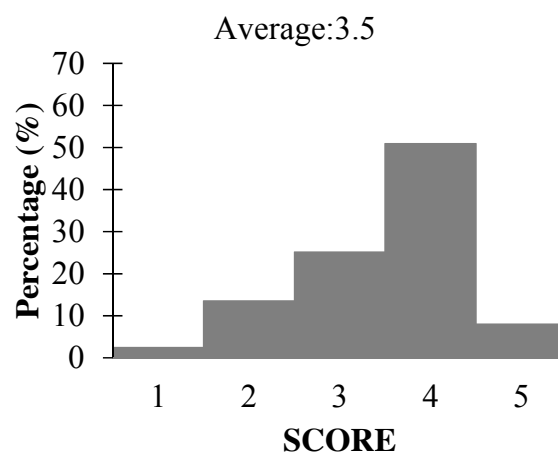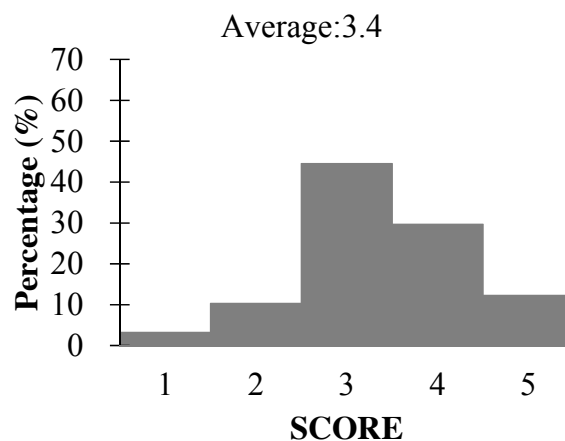
Average:3.4

Figure 6. Answers related to the inconvenience of BSM activity (PRICE)

Table 5. Scores of PRICE with different income

Income level （Rp/month）	Score of PRICE
<1,500,000	3.5
1,500,001 - 3,500,000	3.2
3,500,000 <	3.0

Table 5 shows the score of PRICE with different income levels. Respondents who are categorized in lower income levels tend to feel that BSM prices are low. For households of low income level, the savings from the BSM may be an important income source. Because lower class respondents might expect to obtain larger profit from BSM activity than high class respondents, the lower class respondents are not satisfied with the savings from the BSM.

4.4 Motivation for joining the BSM

Participants were asked about their motivation for joining the BSM. Multiple answers were permitted. About 58 % of all respondents gave economic benefit as one of their motivations, 54 % of respondents were concerned about environmental problems, and 35% of respondents were concerned about the health aspects of improvement of the environment. Thus, economic benefit is not the only important factor for participating in the BSM; environmental concerns are also important. In promotional activities to encourage people to participate in the BSM, the aspects in which the BSM can improve the environment should be emphasized.

5. Conclusion

The results can be summarized as follows:
1) The score of inconvenience for MANY was the highest. Therefore, reducing the number of categories of BSM resources would be an efficient improvement to increase the numbers of households participating in the BSM.
2) Economic benefit is the most important motivation for the participants. The BSM can encourage participants to wash their BSM resources to obtain higher benefit before the collection.

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