Factors influencing household participation in solid waste management (Case study: Waste Bank Malang)

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Abstract. Solid waste management is very important measure in order to reduce the amount of waste. One of solid waste management form in Indonesia is waste banks. This kind of solid waste management required high level of participation of the community. The objective of this study is to explore factors influencing household participation in waste banks. Waste bank in Malang City (WBM) was selected as case study. Questionnaires distribution and investigation in WBM were conducted to identify problems of participation. Quantitative analysis was used to analyze the data. The research reveals that education, income, and knowledge about WBM have relationship with participation in WBM.

1. Introduction
Solid waste management is an important environmental measure related to sustainable development. The amount of waste in Indonesia has increased year by year along with population growth, welfare and people's lifestyle [1]. One of the strategies implemented by the Ministry of Environment to reduce the amount of solid waste is establishment of Waste Banks in 250 cities by 2014 [2]. Based on this background, there are large opportunities to study about Waste Bank development and its prospect in Indonesia. There are various characteristics and community behavior in Waste Banks. However, studies related to Waste Bank in Indonesia are very limited, for instance, waste bank prospect, problems in developing waste bank and community empowerment in waste bank.

A waste bank in Malang City, East Java Province, Indonesia called Bank Sampah Malang or Waste Bank in Malang (WBM) was selected as location of study. The objectives of this research is to identify factors influencing participation in WBM. Finally, problems of BSM participation are identified and some recommendations to improve BSM participation are proposed.

It is expected that the result of research can be one strategy in Municipal Solid Waste Management (MSWM) and infrastructure provision. In particular, the result of this research can improve WBM management and contribute to promote Waste Bank system in other areas.

2. Overview of Solid Waste Management in Indonesia and Waste Bank in Malang (WBM)
Solid waste management in Indonesia is regulated nationally in Law of Republic of Indonesia No. 28 Year 2008. Based on the law, waste reduction can be done through reduce, reuse, and recycle measure. Waste management process according to that law consists of waste separation, waste collection, waste transportation and transfer, waste treatment, and disposal.

Waste separation and reduction is still new paradigm in Indonesia. Only limited households who have applied waste separation and waste reduction measure. On the other side waste generation increases year by year due to population growth. Lack of waste infrastructure become a problem because of the
condition. Waste infrastructure is very limited compared to waste generation that has to be managed. Most people still apply old paradigm of solid waste management, that is collect-transport-and dispose.

One of government policy to reduce the amount of waste was waste bank concept. Waste bank is a concept in which people can get money by waste separation and then transfer the waste to the ‘bank’. The bank then process the waste to get new good or just sell the waste to other industries. This process will generate money, and the participants in waste bank can get money from the bank. One of big and success waste bank in Indonesia is waste bank in Malang.

WBM was launched on July 2011[3]. There are several types of group member in BSM as shown in Table 1. NON includes waste dealers who are belonging to private firm. The number of kinds of recyclable materials to be collected by BSM are 69 and the main categories are plastics, paper, glasses, and metals. All members must separate their waste by themselves in accordance with the categories defined by BSM.

Recyclable materials discharged from COM and SCH are stored in a temporary storage site, called a WBM unit. Generally, WBM units are located near schools or in the residential area of COM. The administrators of COM and SCH are responsible for checking appropriate separation and record the savings report. The recyclable materials which has been stored in the WBM unit is transported to the WBM by WBM staffs based on the arranged schedule. Several COM make handicraft products using the stored recyclable materials. For example, plastic bags and photo frames are made from plastics waste and cardboard, respectively. These products are sold in the WBM unit, WBM office or at exhibitions.

IND and NON can bring their recyclable materials to the WBM office. IND can save their profits in their accounts. NON can only receive cash by way of compensation for their recyclable materials.

Table 1. Types of groups in WBM

| Abbreviation | Explanation |
|--------------|-------------|
| COM          | A group consists of min. 20 members and 3 administrators |
| SCH          | A group consists of min. 40 members and 3 administrators in school |
| IND          | A person do not belong to any group, but they register in BSM individually |
| NON          | A person do not register as member in BSM. Only receive cash as compensation for their recyclable materials. |
| INS          | The recyclable materials are generated from activities in institution |
| WAD          | Private firm which buy recyclable materials from scavengers and bring it to BSM |

The recyclable materials carried to WBM office are separated into 100 types from 69 kinds of types. The selling prices of plastics to factories are different depending on type and cleanliness. WBM shreds and washes plastics to gain higher profit. The recyclable materials collected by the WBM is sold to factories who produce recycled products [4].

3. Methods

3.1. Aspects and variables

Based on previous studies ([6],[7],[8],[9],[10]), there are several variables explored in this study. The variables are classified into personal attributes and knowledge. Personal attributes consist of Gender, Age, Family size, Occupation, Education Background, Monthly Income, Activity in Community Organization. Knowledge aspects consist of Knowledge about 3R and Information about WBM. In this study motivation to participate in WBM was also explored. Motivation explored are Environmental Awareness, Health Concern, Financial Motive, Follow Others, Other Reasons. Table 2 explains aspects and variables used in this study.
Table 2. Aspects and Variables

| Aspect        | Variables                                      |
|---------------|------------------------------------------------|
| Personal      | Gender, Age, Family size, Occupation, Education Background, Monthly income, Activity in Community Organization |
| Knowledge     | Knowledge about 3R, Information about WBM      |

3.2. Method of data collection and analysis

Data used in this study was primary data collected by distributing questionnaire. In this research, stratified random sampling technique was used to categorize respondents based on the characteristics [5]. In total, there were 381 questionnaires distributed. Respondents are divided into two types: (1) People join WBM (JOIN); and (2) People do not join WBM (NOT). The number of questionnaires collected were 211 for JOIN and 170 for NOT. The data from questionnaire were analyzed by descriptive analysis and association analysis.

4. Results and discussion

4.1. Results

The result of analysis shows that for personal attributes, only education background and monthly income show significant difference between JOIN and NOT groups. For knowledge aspect only information about WBM show significant difference between JOIN and NOT groups. The rest have no difference between group.

Education level of JOIN were lower than that of NOT. Sixty four percent of NOT have education from university and that ratio is higher than that of other groups. Mann-Whitney U test show significant (medium to large) difference of education background distribution between JOIN and NOT (probability = 0.000; effect size: -0.31333). There was a tendency that people with high education do not join WBM.

Although WBM have already conducted campaign in Malang City through many media, there were 51% of high income respondents do not know about WBM. Beside conducted campaign in other media, WBM officer have already conducted campaign in community organizations for all level of income, even though only one third of high income respondents experienced this campaign, lower than others income level.

Crosstab analysis for 3R knowledge shows that most of people from JOIN knows about 3R (Reduce, Reuse, and Recycle) concept. Most respondents know about this concept from campaign in communities, television, and their neighbors.

Crosstab analysis for WBM information shows that 64% of NOT group, do not know about WBM. It is an indication that the campaign from WBM is not enough and the improvement of method is necessary. Most people get information about this program from campaign in communities (46%), neighbors (17%), and friends (8%). Although campaign in community organization succeed, the announcement should be focused on those who not actively participate in local communities.

Chi Square analysis indicates that there was a strong difference of BSM information between JOIN and NOT. Information about WBM is an important factor which associated with participation in WBM. Related to motivation to participate in WBM, 52% and 27% of respondents answered that environment and economic benefit respectively are their main motivation in participating in WBM. The percentage of invitation from other people, such as neighbors, family, or friend was 11%. Environment concern and economic benefit were chosen by half of respondents as their motivation participating in WBM. This result showed that financial and environmental concern are important aspects for participation in WBM. This result shows that not only financial benefit, but also environmental concern should be emphasized in WBM campaign.
In this study, lack of knowledge about WBM information are determined as reasons for not participate in WBM. Moreover, it is found that improvement of campaign method is required to increase WBM participation. Training of Trainers (ToT) for WBM unit administrators, city event participation, publication of success stories in mass media, should be conducted/improved. In cooperation with local government of Malang City, universities, community organizations, and mass media, campaign of WBM could reach all level of residents in Malang.

Participants in WBM are dominated by people from lower education background and income. It is actually related to the main reason participating in WBM, that is economic profit. People from lower education background and income use WBM as a mean for increasing their income. By participating in WBM, people can get extra money. People from higher education background and income, feel that the extra money from WBM is not very important, especially when it is compared to the effort to separate and manage the waste. People from JOIN group with higher education and income has motivation related to environmental concern.

Knowledge about WBM is important related to participation in WBM. People who join WBM knows it better than those who not join. If knowledge about WBM is compared to education background and income, it can be concluded that people from lower education and income have better knowledge about WBM. It is because they have enough time and willing to receive information about WBM.

5. Conclusions
Target group for participants in WBM can be focused on lower education and income group. It means that infrastructure and facilities for WBM can be developed with focus on the location of housing from lower education and income. People from lower education and income have motivation related to economic benefit in participating in WBM. In order to increase participants in WBM, campaign is very important. Campaign can be done by using media or community organisation.

Further investigation about cost and benefit aspect, human resources, social conflicts, and government policy related to BSM system are interested to be identified as a consideration to waste bank development in other areas.

6. References
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