

## Research Article

# Transition from Waste Management to Resource Management: A Potential of Waste Bank Program in Indonesian Cities

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- 3Rs
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**Abstract**

The Government of Indonesia has introduced its Waste Bank Program aiming to increase the awareness of the 3Rs (Reduce, Reuse and Recycling) and encourage behavior change such as waste separation at source, promotion of waste reduction and recycling activities at the community level. Based on a sample survey carried out in three selected communities and the organization of a multi-stakeholder workshop on Community-based Solid Waste Management in Surabaya City in April, 2016, this study identified that sample communities with more active Waste Bank Program have more awareness of the negative impacts of improper waste management and the city's current waste management system than other communities. However, the knowledge and awareness of the 3R activities as well as city waste management policies and regulations are limited in all sample communities. Further, participation of members in waste separation activities at source, involvement in waste recycling and composting and environmental friendly lifestyles for waste reduction are also limited. Thus, in order to maximize the full potential of the Waste Bank Program in establishing a resource management system, it is essential to introduce more a holistic environmental awareness and communication strategy that is capable of drawing out personal behavior change as well as a sense of responsibility and desire to take action. Further, the Waste Bank Program should be integrated into the city's waste management system to overcome the existing weaknesses and threats, including securing funding for initial costs and capacity building programs, improvement of waste information systems and coordination among related sectors.

**ABBREVIATIONS**

CBOs: Community-based Organizations; CSR: Corporate Social Responsibility; ITS: Institut Teknologi Sepuluh Nopember; KEMENLHK: Kementerian Lingkungan Hidup dan Kehutanan; MRF: Material Recovery Facility; MSW: Municipal Solid Waste; MSWM: Municipal Solid Waste Management; NGOs: Non-governmental Organizations; RT: Rukun Tetangga; 3Rs: Reduce, Reuse, and Recycle; SWOT: Strengths, Weaknesses, Opportunities and Threats; UNEP: United Nations Environment Programme

**INTRODUCTION**

In recent years Municipal Solid Waste Management (MSWM) has become one of the most serious environmental and public health issues in developing countries [1,2]. Indonesia is no exception with rapid urbanization and changes in lifestyles and consumption patterns having resulted in a remarkable increase in both the volume and diversity of waste generation. According to the Director of the Waste Management of the Ministry of Environment and Forestry (Kementerian Lingkungan Hidup dan Kehutanan or KEMENLHK), the country's waste problem has reached to a level where the declaration a national

state of emergency could be justified due in part of the lack of infrastructure and poor environmental awareness [3]. Approximately 175,000 tonnes of Municipal Solid Waste (MSW) is generated by the population of 250 million daily nationwide, amounting to the 64 million tonnes per year. However, the coverage of MSW collection in big cities is only about 70% and even lower in other cities. Moreover, about 90% of the collected waste is disposed at open dump sites without prior waste sorting bringing negative impacts to the environment and preventing the implementation of a circular economy at both local and national levels [4].

At the global level, there is a growing consensus away from waste management towards resource management as part of the circular economy to achieve more sustainable and inclusive growth [5-7]. The Global Outlook on Sustainable Consumption and Production Policies (2012) and the Global Waste Management Outlook (2015), two milestone reports of the United Nations Environment Programme (UNEP), emphasize the importance of the circular economy to keep added value in products for as long as possible and eliminate waste [1,8]. These reports further recognize that the transition to a more circular economy requires

change throughout the value chain, from product design to new business and market models, from new ways of turning waste into a resource to new modes of consumer behavior. This implies a systemic change and innovation not only in the production side, but also in the consumption side by motivating people to change their lifestyles towards better resource management through active participation in 3Rs (waste reduction, reuse, and recycling).

In line with this global paradigm, KEMENLHK has introduced the 3Rs in its Waste Management Law No. 18/2008 and the Ordinance of State Minister for the Environment No. 13/2012 aiming to reduce the amount of MSW generated at source, rather than collect and transport to landfill sites [9]. In order to increase the awareness and practical implementation of 3R activities, KEMENLHK has further introduced the Waste Bank Program (called Bank Sampah in Indonesian) as a new strategic program at the community level. Under this system, community members (customers) bring their non-organic (recyclable) waste to the waste banks in the community where it is deposited. Transactions are recorded in a bank book that the customers hold or alternatively in lists kept by the respective waste banks. The waste banks later sell their collected materials to mobile agent dependent on the volume of waste gathered. The incentive is that money would then be transferred to members' bank books that can be withdrawn when needed after a contribution of 15% for operational costs [10]. According to KEMENLHK, the waste bank concept is now fast growing with waste banks now established in 129 cities nationwide. The number of waste banks across Indonesia has increased to 2,861 serving 175,413 customers and managing 5,551 tonnes of waste monthly. The transaction value has also jumped to Rp.34.4 billion (\$2.48 million) a month [11].

Based on a sample survey carried out in three selected communities or neighborhoods (Rukun Tetangga or RT in Indonesia) in Surabaya City, one of the pioneer cities in implementing the Waste Bank Program, this paper analyses the level of success of waste banks in achieving their original objectives of (1) increasing the awareness of 3Rs and MSWM system and (2) behavior changes towards waste separation at source and promotion of waste reduction and recycling activities among residents at the community level. The study also aims to identify the key opportunities and challenges in implementing the Waste Bank Program and its expansion within the city based on the results of the multi-stakeholder workshop that was organized with the participation of representatives from Waste Banks (both managers and customers), community leaders, non-governmental organizations (NGOs), academic and city staff.

## MATERIALS AND METHODS

### Data collection

Both primary and secondary survey methods were used in collecting the required data. General information relating to the existing waste management system, policies and strategies at both city and national levels are collected through secondary information. Structured interviews and field observations were used to gather primary data in Surabaya City. The city is divided into 31 Districts and 163 sub-districts for its administrative functions. Each sub-district has an average of 55 communities

which are responsible for managing their primary waste collection by organizing a community-based organizations (CBOs). Among them, three communities (Figure 1) were selected from (1) Gundih, (2) Keputih, and (3) Kertajaya, after consulting the city staff for the field survey considering their level of participation in the Waste Bank Program, assurance of the CBOs to support the data collection activities, similarities with other communities in the city, time limitations and financial constraints. Gundih was the community defined as having the most active waste bank with 90% of respondents to the survey being members. Keputih was less active with 50% of respondents being members and Kertajaya the least with 25% of respondents being members.

A sample of 28 households was selected from each community (covering approximately 50% of households considering the average size of the community that is about 40-60 households) using the simple random sample method for the interview. The interviewees are the representatives of the households (both male and female who are over 18 years old) available when the researchers have visited the selected houses to conduct the survey during the period of January to March 2016. Each household was asked total eight questions including four on the awareness of 3R and MSWM system and another four questions related to behavior on waste separation at source, waste reduction and recycling activities, using a structured interview with exactly the same questions in the same order (Table 1). The data obtained from the household survey is later aggregated and used for the comparison between different communities.

In addition to household survey, a multi-stakeholder workshop was organized on 14 April 2016 at the Institut Teknologi Sepuluh Nopember (ITS) in Surabaya inviting representatives from Waste Banks (both managers and customers), leaders of CBOs, non-governmental organizations (NGOs), academic and city staff to discuss and identify the key opportunities and challenges in implementing the Waste Bank Program and its expansion within the local MSWM system in Surabaya using the SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis.

### Data processing and analysis

The specific test considered in this study for data analysis is called the Analysis of Variance (ANOVA) and is a test of hypothesis that is appropriate to compare means of a continuous variable in three or more independent comparison groups [12,13]. The calculation of ANOVA is characterized as computing a number of means and variances, such as (i) calculating a Total Sum of Square (SST), (ii) calculation of Total Sum of Square Within (SSW) and Between (SSB) the groups, and (iii) Hypothesis Test with F-Statistic. At the end of the ANOVA hypothesis test, the Observed Value of F is compared with the Critical Value of F determined from tables. The critical value of F is a function of the degrees of freedom of the numerator and the denominator and the significance level ( $\alpha$ ). If  $F \geq F_{\text{critical}}$ , the null hypothesis is rejected. The data analysis shows that the Observed Value of F (6.980) is higher than the critical Value of F (3.4668) in the significance level ( $\alpha$ ) of 0.05 according to the F Table. Hence, the statistical significance of the statistical hypothesis testing was attained rejecting the null hypothesis.

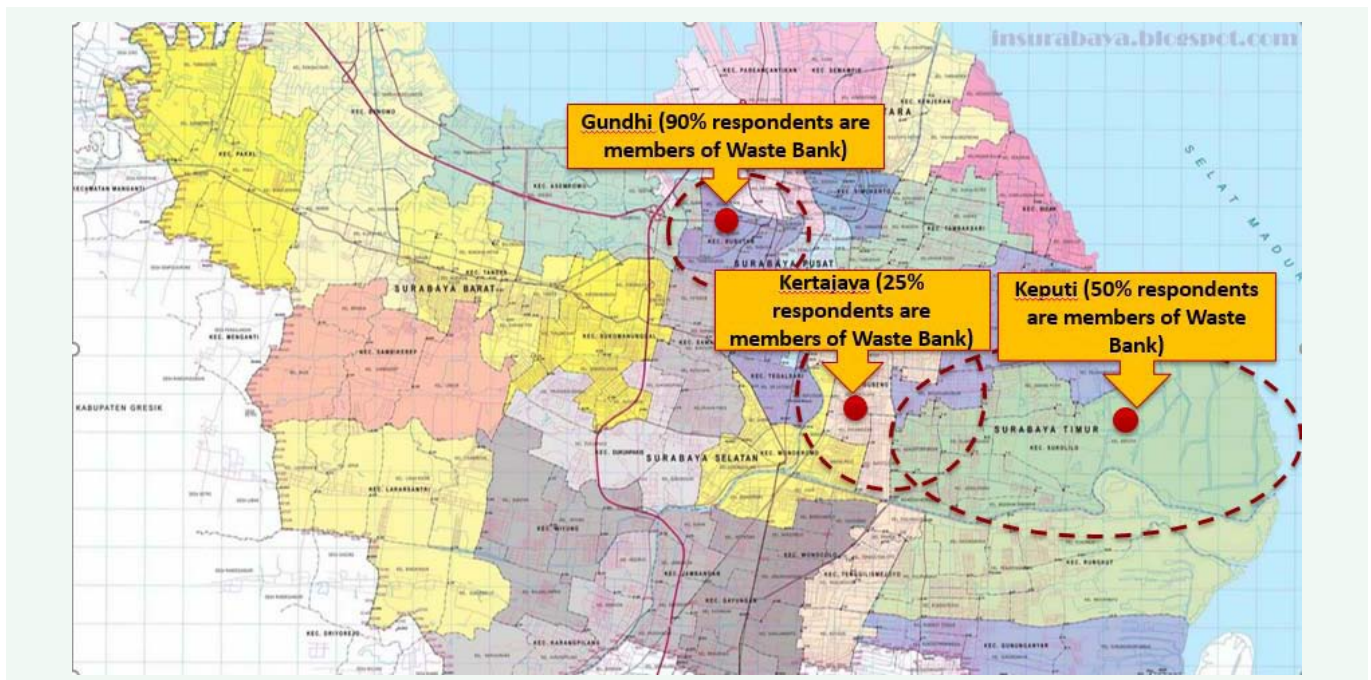


Figure 1 Location map of the sample communities in Surabaya City.

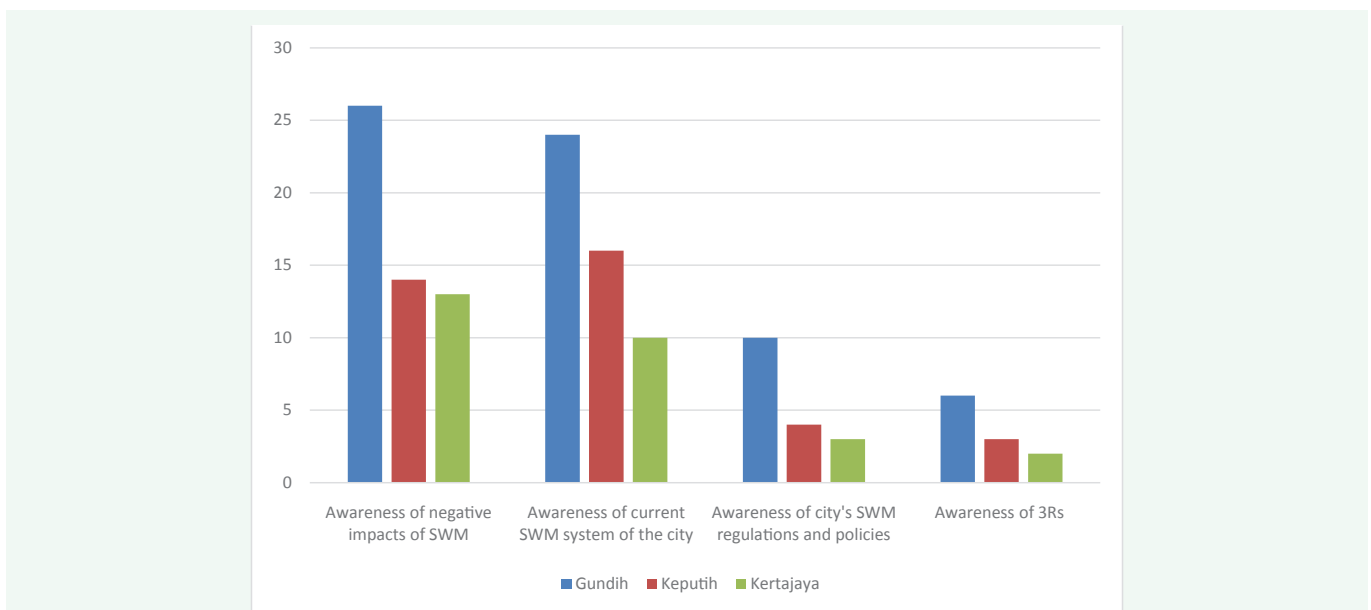


Figure 2 Comparative analysis of awareness of negative impacts of improper waste management system, awareness of current waste management system, awareness of city regulations on waste management and awareness of the 3Rs between the sample communities.

## RESULTS AND DISCUSSION

### Awareness of current MSWM system, its impacts and 3R activities

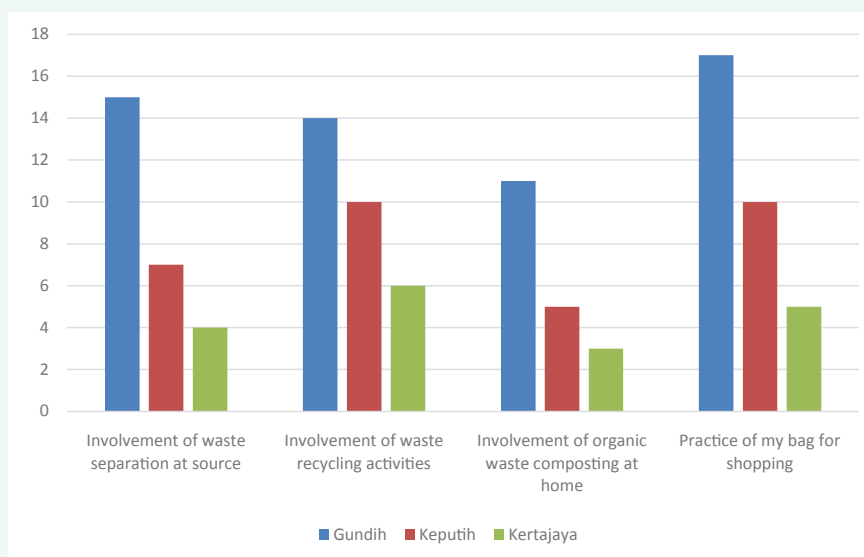
Raising awareness about the problems and motivating community members to take responsive actions is required for adopting lifestyle changes that are environmentally friendly [14]. Awareness is a prelude to informed action. In democratic societies, action towards sustainable development will ultimately

depend on public awareness, understanding and support [15]. In this regards, awareness of the current waste management system, knowledge about the negative impact of the improper waste management to the environment and the city regulation is essential for the community to be motivated to take action.

As shown in Figure (2), the survey results found that 93% respondents in Gundih are aware of the negative impacts of improper waste management. In contrast, only 50% respondents in Keputih and 46% respondents in Kertajaya are known with

**Table 1:** The structure of the household questionnaire.

Questions	Responds		
	Gundih (total 28 respondents)	Keputih (total 28 respondents)	Kertajaya (total 28 respondents)
(1) Community awareness			
1.1. I am aware about the negative impacts of improper waste management	26	14	13
1.2. I am aware about the current waste management system in the city	24	16	10
1.3/ I am aware about the city's waste management regulations and policies	10	4	3
1.4. I am aware about the 3Rs	6	3	2
(2) Community behavior			
2.1. I separate waste at source	15	7	4
2.2. I do waste recycling	14	10	6
2.3. I do composting at home	11	5	3
2.4. I practice my bag for shopping	17	10	5



**Figure 3** Comparative analysis of involvement of waste separation at source, waste recycling activities, organic waste composting at home and practice of my bags for shopping between the sample communities.

the negative impacts of improper waste management system in the community. Causing bad smell, obstructing the walkways, and polluting the channels are the three negative impacts that the most widely answered by the respondents in all three sample communities to the additional request to list three negative impacts. These results highlight that the respondents in the community with a more active waste bank program have a more awareness about the negative impacts of improper waste management in the community. However, current awareness is limited to the local environmental issues affected to their daily life rather other global impacts such as climate change, resource limitations and economic costs.

In terms of awareness on the current waste management system in the community, about 86% of respondents in Gundih know about their community waste collection system while only 57% and 36% of respondents in Keputih and Kertajaya respectively are familiar regarding the community waste management system. The solid waste collection system in all sample communities is managed by respective CBOs recruiting collection staff using handcarts with a house to house service.

Operational and maintenance costs of the collection system is obtained from regular payment by community members. According to the remarks of community leaders about the payment for waste collection in the sample communities, the monthly payment for waste collection service is more reliable in Gundih than rest of the others. This suggests that people are willing to join the waste banks and pay for their services if familiar with their operation.

Further, the survey results show that only 36% respondents in Gundih are familiar with the city's policies and regulations on waste management, while 14% and 11% of respondents in Keputih and Kertajaya respectively have heard about it. The survey results also show that all sample communities are not highly aware of the 3Rs which is a strategy to manage solid waste generation into new resources, reduce pollution, and optimizing natural resource utilization under the waste management system in the city and promotion of waste banks. According to the results, only 21%, 11% and 7% of respondents know about the 3Rs in Gundih, Keputih and Kertajaya respectively. Community meetings, community information boards and the



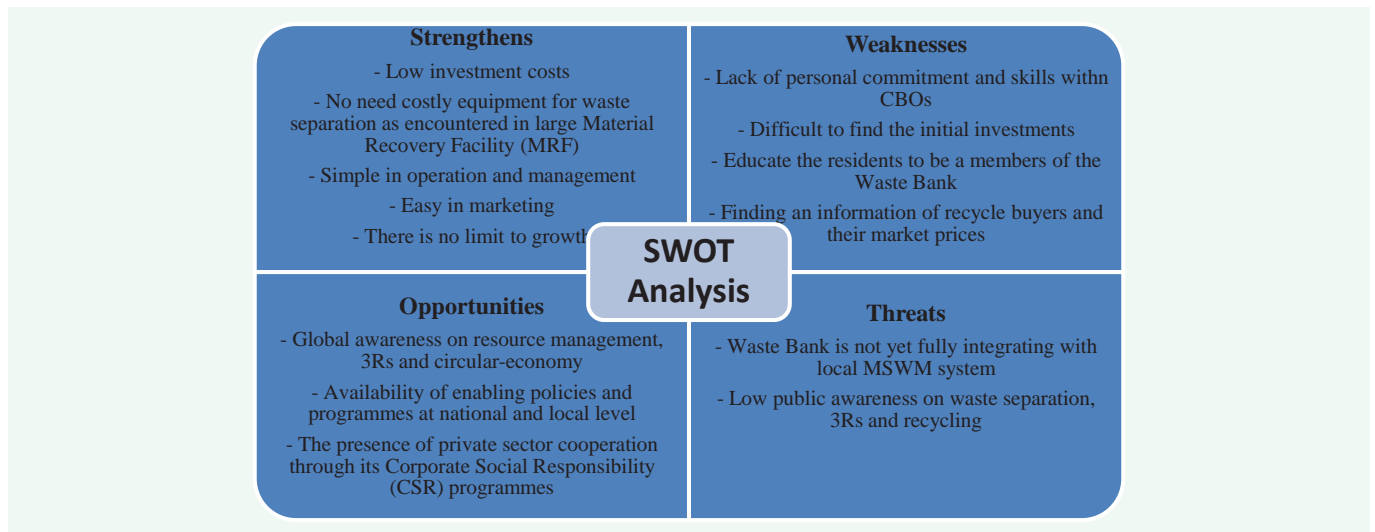


Figure 4 A summary result of SWOT analysis.

community leaders have played an important role in spreading the information about waste management policies and 3Rs into the community members, it is however noticed that those efforts are often directly linked to motivate action to control or solve the specific problems rather sensitizing people about the city's overall environmental and development policies.

### Behavior changes to waste separation at source and promotion of waste reduction and recycling activities among residents at community level

Figure 5 shows the survey results regarding waste separation, practice of waste recycling and composting and sustainable lifestyle activities. According to the results, 54% respondents in Gundih involved in waste separation at source which is essential for the effective operation of waste banks and recycling. In contrast, about 25% and 14% respondents of Keputih and Kertajaya are practicing waste separation at source. This result indicates that the respondents in communities with active waste banks are participating more in waste separation at source rather than others. However, being a member of a waste bank and having awareness raised regarding waste separation do not guarantee securing community participation. Observations show that effective waste storage, collection and treatment systems and infrastructure are also necessary for effective operation of the waste separation and collection system.

Further, the results show that 50% respondents in Gundih are involved in recycling their separated dry waste while 36% and 21% of respondents in Keputih and Kertajaya respectively are doing so. The results also found that 39% respondents in Gundih are practiced home composting from their separated wet waste against 18% and 11% respondents in Keputih and Kertajaya. This shows that still a low participation of respondents in all sample communities are engaging in waste recycling and composting activities, though CBOs have undertaken some awareness programs on the subject. According to Kumar and Nandini (2013) [16], due to people's busy schedule in their daily life, they only want to dispose their mixed solid waste rather than separate waste. The lack of willingness to recycle is caused

by low awareness, responsiveness, time, and less information. However, observation also found that community participation in recycling and composting activities is also dependent on the effectiveness of technologies and their immediate benefits. Some of respondents reported that the designs of the recyclable items that are promoted by the CBOs are not of marketable value and it is difficult to find customers. In addition, some respondents said that they are not interested in waste separation and recycling, due to a lack of time and economic benefits. Regarding compost, most families found that finding a space to make household compost is a challenge. However, in Keputih where the waste collection service is not available, some respondents highlighted the importance of composting in reducing the amount of wet waste to be collected. Indonesia, the second largest polluter of plastic waste in the oceans after China, has introduced a new tax system of a charge of 200 Rupiah (USD 0.014 at time of writing) on plastic bags in supermarkets and convenience stores in 23 cities (including Surabaya) since February 2016 aiming to reduce the use of plastic [17]. Thus the community's behavior changes towards the reduction of plastic bags by bringing their own bag (my bag) when they are shopping is ideal situation. The data shows that more respondents in Gundih (61%) and Keputih (36%) are using my-bag for shopping than the respondents in Kertajaya (18%).

### Key challenges and opportunities in implementing and expansion of the waste bank program

The study also aims to identify the key opportunities and challenges in implementing Waste Bank program and its expansion within the local MSWM system in the city based on the results of the multi-stakeholder workshop that was organized with the participation of representatives from waste banks (both managers and customers), community leaders, NGOs, academic and city staff on 14 April 2016 at ITS in Surabaya. SWOT analysis was used to understand the internal and external factors, including strengths, weaknesses, opportunities and threats for identifying the best strategies in increasing the expansion of waste banks in the city (Figure 4).

The workshop participants identified a number of key strengths of waste banks as an effective strategy for MSWM in the city. The start of waste banks can be done with a low investment, requiring only a sheltered place to store the collected materials prior to sending to buyers and simple tools such as a scales to measure the weight of the collected waste. The operating costs are also low and waste banks can be operated by two persons (director and teller). There is no need for costly equipment for waste separation as required in large material recovery facilities (MRF). This low-cost and simple operation can help to easily spread waste banks in Surabaya and other cities in Indonesia.

However, the workshop participants identified some weaknesses of the existing Waste Bank Program such as a lack of personal commitment and skills among staff of the CBOs, difficulties in finding the initial investment needed though the total amount is low, educating people to become a member of the waste bank and getting the correct information about buyers of recyclables. According to previous studies, at the beginning of waste bank development, the leaders of waste bank officially get the credit on their personal account to start Waste Bank Programs (Singhirunnsorn et. al., 2012). There cyclable materials that has been collected and remitted will be sold to a recycling buyers. Members then receive money in exchange for their solid waste. It was also identified that the savings of the waste bank is not attractive for middle and high income families and educating them to become a member of the waste banks is also a challenge than the communities with lower-middle class residents. Another weakness that is identified by the workshop participants is a lack of information about the potential cost-effective trade opportunities. For instance, the staff of waste banks often do not know the best prices and buyers for their collected materials and this results in less competition and cheaper prices for their collected recyclable materials.

Workshop participants also identified some external factors (opportunities and threats) for the effective implementation and expansion of waste banks in the city. The paradigm shift towards more circular economy and promotion of 3Rs is one of the key opportunities that can be utilized for the effective implementation of the waste bank and creating awareness on how can waste to be transformed from unwanted materials into valuable resource. Also, the existing national and local policies and regulations such as the Waste Management Law No. 18/2008 and the Ordinance of State Minister for the Environment No. 13/2012 are provided regulatory guidance to establish the 3Rs and Waste Banks. In addition, participants identified that the existence of competitions such as the Adipura Program (awarded to schools and cities in Indonesia that successfully manage their environment) at the national level and the Free from Waste (Merdeka dari Sampah) and Surabaya Green and Clean Program at the city level are also an opportunity to expand waste banks by encouraging communities because the achievement of Waste Bank operation is one of their assessment criteria. The potential extra support from the private sector through corporate social responsibility (CSR) programs for finding the initial costs and capacity building for establishment of Waste Banks is also identified as one of the best opportunities can be utilized, but its potential has not been fully explored. Regarding the threats, there is a lack of coordination among the relevant departments of

Surabaya City (executing agency of city's Cleansing Department (Dinas Kebersihan dan Pertamanan or DKP), waste banks and the private sector. While the concept of waste banks is an idea of the national government, it is not yet clearly strategically integrated into the city's overall MSWM system. Further, the participants identified that the low public awareness of waste separation, 3Rs and recycling also threatens the successful operation of waste banks in the community.

## CONCLUSION

According to this study, waste banks can be identified as one of the effective community programs for fostering the transition from waste management to resource management policies and practices at the local level in Indonesia. The establishment and operation of waste banks are easy with a small investment, space and simple tools and have great potential in transforming the unwanted materials at households into more valuable resources. However, for the successful implementation of the waste banks, increasing the awareness of the 3Rs and changing the behavior to waste separation, recycling and sustainable lifestyles are required.

The results of this study showed that the respondents in the sample communities with an active waste bank have more awareness than others about the existing waste management system and the negative impacts of the improper waste management thanks to the environmental communication programs of the community leaders. But, their knowledge and awareness on the 3R activities and waste management policies of the city and national levels are very limited in both active and non-active communities. In addition, the participation of members in waste separation activities at source, involvement of waste recycling and composting and environmental friendly lifestyles for waste reduction are also limited.

Thus, in order to maximize the full potential of waste banks in establishing the resource management system, it is essential to introduce more holistic environmental awareness and communication strategies that are capable of drawing out personal behavior change. In order to provoke behavior change, it is also necessary to create a sense of responsibility and desire to take action. Further, this study identified that for effective expansion of the Waste Bank system in the city, it should be integrated into the city's overall MSWM system and established mechanisms to overcome the current weaknesses and threats, such as securing initial costs and capacity building programs with the private sector through their CSR programs, improvement of waste information system and coordination among related sectors. Finally, the authors suggested conducting further research to understand the economic, social and environmental benefits of waste banks in the future.

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## REFERENCES

1. UNEP, ISWA. The Global Waste Management Outlook. 2015.
2. Premakumara DGJ, Maeda T. Municipal Solid Waste – The Burgeoning Environmental Threat, Routledge Handbook of Environment and Society in Asia, edited by Paul G. Harris and Graeme Lang, Routledge, NY. 2015; 176-196.
3. Jong HN. Indonesia in State of Waste Emergency. The Jakarta Post. 2015.
4. The Government of Indonesia. Country Analysis Paper (Draft) – Indonesia, Fourth Regional 3R Forum in Asia, Hanoi, Vietnam, UNCRD. 2013.
5. Wilson DC. Development Drivers for Waste Management. Waste Manag Res. 2007; 25: 198-207.
6. Ministry of the Environment. History and Current State of Waste Management in Japan. 2014.
7. European Union. Being Wise with Waste: the EU's Approach to Waste Management, Belgium. 2010.
8. UNEP. The Global Outlook on Sustainable Consumption and Production Policies. 2012.
9. Purba HD, Meidiana C, Adrianto DW. Waste Management Scenario through Community Based Waste Bank: A Case Study of Kepanjen District, Malang Regency, Indonesia. 2014.
10. Temesi Recycling. Waste Banks. 2015.
11. Nainggolan H. Facing Desperate Waste Problems, Indonesia Hustles to Find Answers. 2015.
12. Freedman DA. Statistical Models: Theory and Practice, Cambridge University Press. 2005.
13. Gelman A. Analysis of variance? Why it is more important than ever. The Annals of Statistics. 2005; 33: 1-53.
14. Neelima BN, Utama RR. Mass Media and Climate Change, International Journal of Research. 2014; 1.
15. UNESCO. 50 Years for Education. 1997.
16. Kumar M, Nandini N. Community Attitude, Perception and Willingness towards Solid Waste Management in Bangalore City, Karnataka, India. Int Journal of Envi Sci. 2013; 4: 87-95.
17. Avantika C. Indonesia bag levy aims to cut pollution: Country second only to China in terms of plastic pollution. 2016.

### Cite this article

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