Resources, Conservation and Recycling 102 (2015) 153–162

Contents lists available at ScienceDirect

Resources, Conservation and Recycling

journal homepage: www.elsevier.com/locate/resconrec

Community participation in household solid waste reduction in Surabaya, Indonesia

Yeny Dhokhikah[a,c,*], Yulinah Trihadiningrum[a], Sony Sunaryo[b]

[a] Department of Environmental Engineering, Institut Teknologi Sepuluh Nopember, Indonesia
[b] Department of Statistics, Institut Teknologi Sepuluh Nopember, Indonesia
[c] Department of Civil Engineering, Universitas Jember, Indonesia

ARTICLE INFO

Article history:
Received 6 March 2015
Received in revised form 17 June 2015
Accepted 22 June 2015

Keywords:
Community participation
Household solid waste reduction
Eastern Surabaya

ABSTRACT

The goal of this study was to examine the community participation in household solid waste (HSW) reduction and the influencing factors in eastern Surabaya. The research was conducted in three districts, namely Sukolilo, Rungkut, and Tenggilis Mejoyo. The HSW sampling for SW composition analysis was performed over eight consecutive days. Survey concerning community involvement in HSW reduction was conducted in 300 households using stratified random sampling technique. The questionnaires were distributed during HSW sampling for generation rate and composition measurements.

Results of this study showed that average HSW generation rate in eastern Surabaya was 0.33 kg/capita/day. The HSW composition was dominated by food waste (64.19%), followed by plastics (10.79%), paper (9.24%) and used diapers (6.97%). The socio-economic characteristics had less influence than the supporting factors on sorting, recycling and composting activities.

This study suggested four strategies to support the community participation on HSW reduction in eastern Surabaya. These strategies were: to intensify the HSW reduction training programs; to intensify the information dissemination through mass media and campaign; to increase the number of environmental cadres; and to optimize the existence of waste bank and its function.

1. Introduction

Population, industrialization, urbanization, and economic growth are the factors causing the increase in solid waste (SW) generation in developing countries (Dhokhikah and Trihadiningrum, 2012). Household solid waste (HSW) has become a serious problem in large cities with high population density. Surabaya, one of the highly populated metropolitan cities in Indonesia, faces this problem, which is primarily caused by the lack of land to serve as the final disposal site, lack of funds, and facilities. This population generates 3982.25 cubic meters of SW each day (Sanitation Working Group Surabaya, 2010). In 2005, Surabaya organized its first annual green and clean competition, which was followed by more than 500 neighborhood associations (Rukun Tetangga). This program aims to promote the importance of SW reduction at the source. SW reduction was initiated by the closing of the final disposal site (FDS) in Keputih at the end of 2001. In this year the Cleansing Agency of Surabaya City and Unilever Indonesia Corporation supported the initial SW reduction program (Trihadiningrum, 2006).

Indonesia has some legal instruments that support the reduction of HSW at source. Regulation on waste management is stated in Act No. 18 of 2008 Article 29. It mentions about the ban of waste management which causes environmental polluting, illegal dumping and open burning. In addition, Government Regulation No. 81 of 2012, confirmed the importance of reduction, reuse, and recycle (3R) of HSW. Additionally, there is also a ministerial regulation on 3R through a waste bank, namely the Regulation of the Minister of Environment of the Republic of Indonesia No. 13 of 2012. Theoretically, the presence of several legal instruments governing 3R makes the problem of SW management easier to solve, but in reality there are some constraints in implementation of 3R. The implementation of 3R needs the community participation, the collaboration between government, community, private sector, and non-government organizations (NGOs), and among the members of the community.

Community participation is a key factor attaining the goal of solid waste management (SWM) (Chung and Poon, 2001; Sukhor et al., 2011). In developing countries, community participation plays an important role in achieving SW management (Dhokhikah

* Corresponding author.
E-mail address: yenydhokhikah@yahoo.com (Y. Dhokhikah).

http://dx.doi.org/10.1016/j.resconrec.2015.06.013
0921-3449/

and Trihadiningrum, 2012; Mongkolnchaiarunya, 2005; Zurbrugg et al., 2004). In developing countries with large population, the human resource is the potential resource for development. Human resources play the key role in SW management in developing countries.

Environmental knowledge is strongly correlated with environmental activity (Yencken et al., 2000). Additionally, environmental knowledge is connected to improving the citizens' attitude toward the environment (Barraza and Walford, 2002). Environmental education can support environmental actions and generate awareness, concern, and recognition of the effect of citizens' activities (Salequzzaman and Stocker, 2001). On the other hand, regulatory knowledge does not automatically imply that citizens will adopt these actions. Although many citizens state that they are willing to recycle waste, in reality they do not automatically recycle because of several situational reasons (Corraliza and Berenguer, 2000; Borsgstede and Biel, 2002)

Environmental cadre is defined as a person from a local association or outside of the neighborhood associations that provides the public with environmental counseling and guidance, such as how to segregate the HSW and how to compost the decomposable waste. Environmental cadre is typically found in each neighborhood associations, and in the village or district. The existence of environmental cadre can support the dissemination of information about environmental issues, and can improve attitude, behavior and actions toward the environment. In order to improve the community's level of knowledge, the environmental cadre has to spread out to community to motivate, guide, counsel about sorting, recycling and composting HSW at source.

Waste bank is a bank that is established by the community. Waste bank receives recyclable waste from community (as the customer/client of the waste bank). The waste bank accepts recyclable waste, such as plastic bottles, plastic glasses, newspaper, magazines, books, plastic bags, corrugated paper, office paper, electrical wires, aluminum cans, ferrous cans, and worn shoes, among others, from clients. Different types of SW materials have different prices per kilogram. Each type of SW is weighed and then its weight is recorded. Each client obtains a deposit book, which contains the type of waste, weight, price per kilogram and total amount. Currently, there are more than 20 waste banks in Surabaya (Ministry of Environmental, 2012). They can minimize the volume of HSW from sources before transporting to the temporary disposal site (TDS).

The primary goal of this study is to determine community participation in HSW management in Surabaya, Indonesia. The working objectives of this research are as follows: (a) to determine the generation rate and characteristics of HSW in eastern Surabaya, (b) to identify the socio-economic characteristics of the respondents in eastern Surabaya, (c) to determine the influence of supporting factors on community participation in sorting, recycling and composting activities, and (d) to analyse the influence of socio-economic characteristics and supporting factors on HSW reduction (sorting, recycling and composting).

2. Materials and methods

Surabaya is the capital city of East Java Province and recorded a population of more than three million people in 2013. The city has five regions (centre, north, east, south and west); encompassing 31 districts (*kecamatan*) and 160 villages (*kelurahan*) (Statistic Center Board, 2012). This study was conducted in the eastern region of Surabaya, East Java Province, Indonesia. Eastern Surabaya covers an area of 91.18 km^2. The population was 746,532 in 2011 and the population density was 72,297 people per square kilometre. Eastern Surabaya consists of seven districts, 42 villages, 390 community associations (Rukun Warga) and 2538 neighborhood associations (Statistic Center Board, 2012).

Fig. 1. The map of Indonesia.

From 2006 to 2013 Surabaya received Adipura, a national award for clean cities. Surabaya was also awarded the ASEAN Environmentally Sustainable City Award in 2011, and the Environmentally Sustainable City (ESC) Award in 2012. These awards were presented to the city with the best implementation of sustainable environmental regulations. In addition, Surabaya received the City-net award in the category of the best participatory city in the Asia-Pacific region in 2012 (Surabaya City Government, 2014).

2.1. Description of the three districts

Eastern Surabaya was chosen as the study area because it has economic and population growth rates higher than other regions. The number of public and private universities, colleges and academies, industrial and commercial areas increase in the last decade, following the rapid growth of public housing towards the east coast. Eastern Surabaya consists of seven districts. The selected districts were based on the population density, which the density was based on INS (Indonesia National Standards) 19-2454-2002 (INS, 2002). The first district was Sukolilo, which covered an area of 23.68 km^2 and was divided into seven villages, 67 community associations and 361 neighborhood associations. The number of residents in this district was 100,148 with a population density of 4230 people/km^2. The second district was Rungkut with an area of 21.08 km^2, consisting of six villages with 73 community associations and 394 neighborhood associations. This district was occupied by 111,286 inhabitants, with a population density of 5280 people/km^2. The third district was Tenggilis Mejoyo, which covered 5.52 km^2, and had 25 community associations and 156 neighborhood associations. This district was populated by 76,154 residents, with a population density of 13,796 people/km^2 (Statistic Center Board, 2012). Fig. 1 shows the map of Indonesia, and Fig. 2 shows the map of Surabaya and the study area.

2.2. Sampling method

The survey sample size was based on statistical principles. Households were sampled according to the stratified random sampling method. The selected districts were chosen by the population density, which Sukolilo was the least dense (43 people per hectare), Rungkut was of low density (53 people per hectare), and Tenggilis Mejoyo was of medium density (138 people per hectare). The selected households had various socio-economic levels and other characteristics including gender, age, education background, and family income. There were three socio-economic levels (high, middle and low) which were based on the type of dwelling. Determining the type of settlement was based on INS 19-3242-2008, with the provisions of a luxury, medium, and simple residential house, with size types over 70 m^2, between 45 and 54 m^2 and 21 m^2 - respectively (INS, 2008).

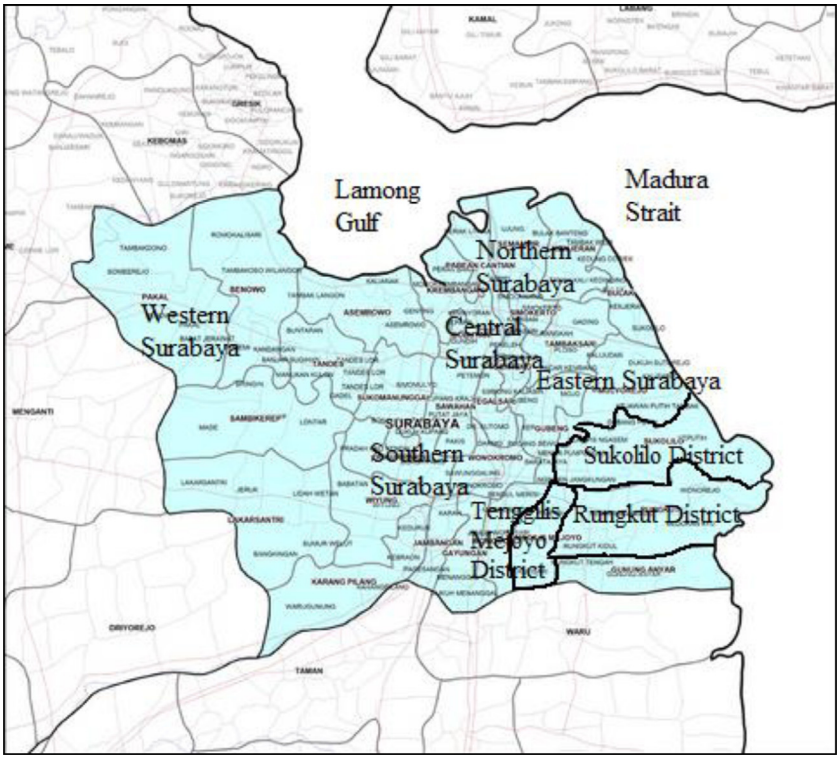

Fig. 2. The map of Surabaya and the study area (Sukolilo, Rungkut and Tenggilis Mejoyo District).

The sampling HSW was conducted in June 2013. The quantity of samples was measured based on Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste ASTM D 5231-92 -1994 (Standard Test Method, 1994), with the minimum weight of 100 kg each sample. We assumed that the HSW generation rate was 0.3 kg/capita each day and the household members were 4 people. The HSW generation for a semi-permanent dwelling ranged from 0.3 to 0.35; and for a permanent dwelling ranged from 0.35 to 0.4 (Public Work Department, 1993). One hundred householders were selected for HSW sampling and survey for each district. Sampling was carried out in eight consecutive days. The respondents were asked to collect their daily HSW into waste bags which were distributed one day prior to collection. The collected HSW was used to determine the generation rate and the composition.

The collected HSW was transported to temporary disposal site (TDS) for measuring the weight of HSW, to determine the HSW density, and to classify the composition of HSW. The HSW sample was weighed using a balance of 50 kg capacity.

2.3. Survey on community participation

We communicated with selected respondents to gain their consent to contribute to the survey. Each selected respondent was given an invitation letter to become respondent and a questionnaire. Each respondent was visited for questionnaire check and collection. The number of respondents for survey was calculated using Slovin's Formula. The number of respondents in each district was 100. The Slovin's Formula was as follows (Setiawan, 2007):

$$n = \frac{N}{N \times d^2 + 1} \quad (1)$$

where n = number of sample; N = total population; d = error margin = 0.10. For further calculation of sample size was shown in Table 1.

Table 1
Sample size in each district based on Slovin's Formula.

Name of district	Population	Number of household	Sample size (households)
Sukolilo	100,148	25,037	100
Rungkut	111,286	27,822	100
Tenggilis Mejoyo	76,154	19,039	100

Interviews were conducted after collecting the answered questionnaires from the respondents. The questionnaires were reviewed to gain data on a wide variety of issues related to community participation in SW reduction.

3. Data analysis

A regression method was applied to explain the relationship between a response variable and one or more predictor variables. The respondents selected were asked their activity to sort the HSW, to create unique handcrafted goods, and to compost HSW. The activities of respondents in sorting HSW; creating unique handcrafted goods, and composting were given the value of "1", while their activities in not sorting HSW, creating handcrafted goods, and composting were given the value of "0". Furthermore, data from the questionnaires were compiled and processed by binary logistic regression.

Data were processed by determining predictor variables such as socio-economic factors; and supporting factors. The predictor variables were the following:

(1) The socio-economic characteristics included

(a) Gender (X_1) had two categorical variables, where $X_1 = 1$, if the respondent was male, and $X_1 = 2$, if the respondent was female.
(b) Age (X_2) had four categorical variables, where $X_2 = 1$, if the respondent's age was less than 35 years old, $X_2 = 2$, if the respon-

dent's age was between 36 and 50 years old; $X_2 = 3$, if the respondent's age was between 51 and 65 years old; and $X_2 = 4$, if the respondent's age more than 65 years old.

(c) Educational background (X_3) had six categorical variables, where $X_3 = 1$, if the respondent never graduated from elementary school or was uneducated; $X_3 = 2$, if the respondent only graduated from elementary school; $X_3 = 3$, if the respondent graduated from junior high school; $X_3 = 4$, if the respondent graduated from senior high school; $X_3 = 5$, if the respondent graduated from academy or diploma; $X_3 = 6$, if the respondent was undergraduate or post graduate.

(d) Family income (X_4) had eight categorical, where $X_4 = 1$, if the family income was less than Rp 500,000; $X_4 = 2$, if the family income ranged from Rp 500,000 to Rp1500,000; $X_4 = 3$, if the family income ranged from Rp1500,000 to Rp2500,000; $X_4 = 4$, if the family income ranged from Rp2500,000 to Rp3500,000; $X_4 = 5$, if the family income ranged from Rp3500,000 to Rp5000,000; $X_4 = 6$, if the family income ranged from Rp5000,000 to Rp7500,000; $X_4 = 7$, if the family income ranged from Rp7500,000 to Rp10,000,000; $X_4 = 8$, if the family income more than Rp10,000,000.

(2) The supporting factors included

(a) The level of the respondents' knowledge consisting of mechanisms of SW sorting, recycle, compost degradable HSW, treat HSW into biogas, and animal feed, definitions of compost and biogas, and the process of recycling and composting. The responses were composed of three choices on scale ranging from "low level of knowledge", "sufficient knowledge" to "high level of knowledge". The level of knowledge was the fifth predictor variable (X_5). The respondents' knowledge has an influence on HSW sorting, recycling and composting behaviour (Ramayah et al., 2012; Troschinetz and Mihelcic, 2009).

(b) Information from mass media (electronic or print media) about classifying, segregating and handling SW (including decomposable and recyclable wastes). The information from mass media was the sixth predictor variable (X_6). X_6 had two categorical variables, where $X_6 = 1$, if the respondent never got information from mass media about 3R; and $X_6 = 2$, if the respondent ever got the information from mass media about 3R.

(c) HSW reduction training included activity of educational and trainings of SW sorting, recycling, and composting conducted by local government; private sector or NGOs. HSW reduction training was the seventh predictor variable (X_7), which had two categorical variables. If the respondent never got HSW reduction training, the value of X_8 was 1. If the respondent ever got at least once HSW reduction training, the value of X_8 was 2.

(d) Environmental cadre—the present of cadres in the community providing motivation and counselling in HSW reduction. The environmental cadre was the eighth predictor variable (X_8) and had two categorical variables. If there was no environmental cadre in the respondent's area, the value of X_8 was 1. If there was at least one environmental cadre in the respondent's area, the value of X_8 was 2.

(e) The availability of waste bank to accept recyclable waste from the customer, and resell the waste to an agent. The existence of waste bank was the ninth predictor variable (X_9) and had two categorical variables. If there was no waste bank in the respondent's area, the value of X_8 was 1. If there was a waste bank in the respondent's area, the value of X_8 was 2.

Additionally, the response variables were the following:

Table 2
HSW compositions in eastern Surabaya.

Type of waste	Average of weight (%)
Food waste	64.19
Plastics	10.79
Paper	9.24
Used diapers	6.97
Garden waste	3.37
Wood	0.92
Textiles	0.82
Glass	0.79
Metals	0.51
Rubber	0.35
Hazardous waste	0.33
Residual	1.73

(1) Sorting activity (Y_1)—activity of respondents to classify the SW into decomposable or recyclable waste.

(2) Recycling activity (Y_2)—activity of respondents to create unique handcrafted goods from recyclable waste, such as pencil cases, bags, wallets, purses, and flowers.

(3) Composting activity (Y_3)—activity of respondent to convert decomposable waste into compost.

Logistic regression was applied to process public opinion about the public acceptance in a recycling scheme (Keramitsoglou and Tsagarakis, 2013), source separation (Zhang et al., 2012). SPSS 17.0 software was used for these regressions. The logistic regression model was as follows (Hosmer and Lemeshow, 2000):

$$g(x) = \beta_0 + \beta_1 X_1 + \cdots + \beta_p X_p \quad (2)$$

$$\pi(x) = \frac{e^{[g(x)]}}{1 + e^{[g(x)]}} = \frac{e^{\beta_0 + \beta_1 X_1 + \cdots + \beta_p X_p}}{1 + e^{\beta_0 + \beta_1 X_1 + \cdots + \beta_p X_p}} \quad (3)$$

β_0 = the vector of parameter to be estimated; β_p = the coefficient of predictor variables; X_p = a vector of predictor variable observations; $\pi(x)$ = the conditional mean. The interpretation of binary logistic regression model was used Odd Ratio (OR). OR's formula was shown as follows:

$$\text{OddsRatio} = \exp^B \quad (4)$$

4. Results

4.1. The composition of HSW in eastern Surabaya

The average of HSW generation rate in eastern Surabaya was 0.33 kg each day per capita. Generation rate of HSW in Sukolilo, Rungkut, and Tenggilis Mejoyo district were 0.39 kg/capita/day, 0.31 kg/capita/day and 0.29 kg/capita/day–respectively. Generation rate of HSW in Sukolilo district was the highest, and was followed by Rungkut and Tenggilis Mejoyo district. The compositions of the HSW in eastern Surabaya were dominated by food waste (64.18%), plastics (10.79%), paper waste (9.24%) and used diapers (6.97%). The composition of HSW in eastern Surabaya is shown in Table 2.

Food waste consisted of the discarded raw vegetables, fruit peels, fruit seeds, expired bread or groceries. Plastics waste consisted of wrapping plastic, medicine bottle, shampoo and liquid soap bottle, cosmetics container, plastic bag, food packaging, Styrofoam food packaging, and other plastic waste. Paper waste contained wrapping paper from newspaper or laminated paper, office paper, milk cartons, paper wax, and other paper waste. Used diapers contained of baby diapers and sanitary napkins. Garden waste was from yard trimmings. Glass waste contained of used bottles of perfume, vitamin, tomato ketchup, and medicine. Woods

Fig. 3. HSW composition in eastern Surabaya, (a) food waste, (b) paper waste, (c) used diapers, (d) glass, and (e) woods.

Table 3
Socio-economic characteristics of the respondents in eastern Surabaya (n = 300).

Socio-economic characteristics	Criteria	No of respondents	Percentage (%)
Gender (X_1)	Male	98	32.7
	Female	202	67.3
Age (in years old) (X_2)	<35	52	17.3
	36-50	90	30
	51-65	121	40.3
	>65	37	12.3
Educational background (X_3)	Uneducated	6	2
	Elementary School	33	11
	Junior High School	26	8.7
	Senior High School	102	34
	Academy Diploma	16	5.3
	University Graduation	117	39
Family Income (X_4)[a]	Less than Rp 500,000 (< US$ 50)	13	4.3
	Rp 500,000-Rp 1,500,000 (US$ 50-150)	56	18.7
	Rp 1,500,000-Rp 2,500,000 (US$ 150-250)	62	20.7
	Rp 2,500,000-Rp 3,500,000 (US$ 250-350)	36	12
	Rp 3,500,000-Rp 5,000,000 (US$ 350-500)	43	14.3
	Rp 5,000,000-Rp 7,500,000 (US$ 500-750)	40	13.3
	Rp 7,500,000-Rp 10,000,000 (US$ 750-1,000)	21	7
	Up to Rp 10,000,000 (>US$ 1,000)	29	9.7

[a] US$ 1 = Rp 10,000 in 2013.

waste consisted of coconut shell and bamboo packaging. Fig. 3 shows the HSW composition in eastern Surabaya.

4.2. The socio-economic characteristics of the respondents in eastern Surabaya

The socio-economic characteristics of the households are shown in Table 3. Of the respondents, 63% were female and 37% were male. The ages of the respondents ranged from less than 35, 36 to 50, 51 to 65 and up to 65, which were 17.3%, 30%, 40.3% and 12.3% of respondents, respectively. The educational background of respondents in university graduation, senior high school and elementary school were 39%, 34% and 11%, respectively. The family income of the respondents ranged from Rp500,000 to Rp10,000,000. The largest percentage of the respondents (20.7%) had a monthly income of between Rp1,500,000 and Rp2,500,000, and 18.7% of respondents earned a monthly income of between Rp500,000 and Rp1,500,000. Only 4.3% had an income less than Rp500,000, and 9.7% had income higher than Rp10,000,000.

Table 4
Supporting factors in HSW handling (n = 300).

Supporting factors	No of respondents	Percentage (%)
Level of knowledge about HSW handling and reduction		
a. Low level of knowledge	55	18.3
b. Sufficient knowledge	154	51.3
c. High level of knowledge	91	30.3
Information obtained from media mass about HSW handling		
a. Never	117	39
b. Ever, at least obtained one information	183	61
Received training and educational program		
a. Never	150	50
b. Ever, at least received one training	150	50
Existence of EC		
a. None	191	63.7
b. One or more person	109	36.3
Existence of WB in their residences		
a. Not available	230	76.7
b. Available	70	23.3

4.3. Supporting factors towards the community participation in sorting, recycling and composting activities

Table 4 shows the five supporting factors in HSW reduction, including the respondent's level of knowledge, information of HSW handling and reduction gained from mass media, participation in education and training, the existence of environmental cadre and the availability of a waste bank. The first supporting factor was the level of the respondent's knowledge. The percentage of the respondent's knowledge level of "low level of knowledge", "sufficient knowledge" and "high level of knowledge" was 18.3%; 51.3%; and 30.3%, respectively. The second supporting factor was the information from mass media. The percentage of respondents gaining knowledge of HSW reduction from television, radio, newspaper, magazines and other media was 61%. In contrast, 39% of respondents never received information about HSW handling and reduction. The third supporting factor was the training program on HSW handling and reduction. The percentage of respondents obtaining education and training was 50%, which was the same as those that did not receive training. The fourth supporting factor was the existence of environmental cadre. Only 36.3% of respondents indicated the availability of environmental cadre and 63.7% answered that environmental cadre was not available in their neighborhood. The fifth supporting factor was the existence of a waste bank in their neighborhood. Only 23.3% of respondents indicated that there was an available waste bank, while 76.7% of the respondents replied that there was no waste bank.

Table 5
Description of sorting, recycling and composting HSW activities (n = 300).

Respondent's activity in sorting, recycling and composting HSW	No of respondents	Percentage (%)
Activities of sorting the HSW		
a.Implemented	143	47.7
b.Not implemented	157	52.3
Reason for sorting the HSW		
a. Self awareness	74	51.7
b. Command from leader of neighborhood association/community association	35	24.5
c. Profit from selling dry HSW use for community needs	8	5.6
d. Increase the family income	13	9.1
e. Others	13	9.1
Reason for not sorting the HSW		
a. Laziness	51	32.5
b. No time	60	38.2
c. Do not know the procedure	29	18.5
d. Lack of space	8	5.1
e. Others	9	5.7
Willingness to sort the HSW		
a. Willingness	98	62.4
b. No willingness	59	37.6
Recycling the HSW to create unique handcrafted goods		
a. Implemented	15	5
b. Not implemented	285	95
Reason of recycling the HSW to unique handicraft		
a. Self awareness	8	53.3
b. Command from leader of neighborhood association/community association	5	33.3
c. Follow friend	1	6.7
d. Others	1	6.7
Reason for not recycling the HSW into unique handcrafted goods		
a. Laziness	135	47.4
b. No time	37	13
c. Do not know the procedure	91	31.9
d. Others	22	7.7
Willingness to recycle the HSW into unique handcrafted goods		
a. Willingness	121	42.5
b. No willingness	164	57.5
Activities of composting the HSW		
a. Implemented	27	9
b. Not implemented	273	91
Reason for composting the HSW		
a. Self awareness	9	33.4
b. Command from leader of neighborhood association/community association	12	44.4
c. Follow friend	1	3.7
d. Others	5	18.5
Reason for not composting the HSW		
a. Laziness	26	9.5
b. No time	126	46.2
c. Do not know the procedure	92	33.7
d. No space	12	4.4
e. Others	17	6.2
Willingness to compost the HSW		
a. Willingness	138	46
b. No willingness	162	54

The respondent's activity in sorting, creating unique handcrafted good from recyclable waste and composting HSW is shown in Table 5. The sorting activity was performed by 47.7% of respondents, but was not performed by 52.3% of respondents. The primary reason for sorting was "self-awareness" (51.7%), and the least popular reason given was "profit for community needs" (5.6%). On the other hand, the major reasons for not sorting were "no time" (38.2%) and "laziness" (32.5%). The percentage of respondents willing to segregate HSW was as high as 62.4%. This percentage was higher than that of respondent not willing to sort the HSW.

The activity of creating of unique handcrafted goods was only accomplished by 5% of the respondents in eastern Surabaya. The respondents' primary reasons for recycling were "self-awareness" (53.3%) and "command from leader of neighborhood associations /community associations (33.3%). The reasons given by respondents that did not treat recyclable waste of "laziness", "do not know the procedure", "no time" and "others" were 47.4%, 31.9%, 13%, and 7.7%, respectively. The percentage of respondents' willingness to create unique handcrafted goods was 42.5%. This percentage was lower than that of respondents' willingness not to recycle the HSW.

Composting was accomplished by only 9% of respondents, while it was not performed by 91% of respondents. The primary causes given for not composting HSW were "no time" (46.2%), and "do not know the procedure" (33.7%). The willingness to compost was indicated by 46% of respondents.

Table 6
Results from the binary logistic regression on sorting activity ($n = 300$).

		B	S.E.	Wald	df	Sig.	Exp(B)
Step	Age			22.457	3	0.000	
6[a]	Age (1)	2.035	0.447	20.689	1	0.000	7.653
	Age (2)	0.968	0.420	5.319	1	0.021	2.633
	Age (3)	1.113	0.519	4.604	1	0.032	3.042
	Level of knowledge			23.078	2	0.000	
	Level of knowledge (1)	0.768	0.392	3.831	1	0.050	2.155
	Level of knowledge (2)	1.943	0.434	20.002	1	0.000	6.981
	Environmental cadre(1)	0.588	0.317	3.442	1	0.064	1.800
	Waste bank(1)	1.518	0.404	14.093	1	0.000	4.564
	Constant	−2.766	0.509	29.473	1	0.000	0.063

[a] Variable (s) entered on step 1: gender, age, educational background, family income, level of knowledge, HSW reduction training, information from mass media, environmental cadre, and waste bank.

Table 7
Results from the binary logistic regression on creating unique handcrafted goods from recyclable waste activity ($n = 300$).

		B	S.E.	Wald	df	Sig.	Exp(B)
Step	Environmental cadre(1)	2.074	1.127	3.386	1	0.066	7.959
8[a]	Waste bank(1)	2.153	0.842	6.542	1	0.011	8.612
	Constant	-5.682	1.060	28.748	1	0.000	0.003

[a] Variable(s) entered on step 1: gender, age, educational background, family income, level of knowledge, waste bank, HSW reduction training, information from mass media, and environmental cadre.

4.4. The influence of socio-economic characteristics and supporting factors for HSW reduction

The results of the binary logistic regression on the community sorting activity are shown in Table 6. Based on the result, the influencing factors for the HSW sorting activity were age of respondent, the level of knowledge, the presence of an environmental cadre, and the waste bank availability because the significant values were 0.000; 0.000; 0.064; and 0.000, respectively. The significant values were less than 0.1 (10%), indicating that the variables highly influence the sorting activity.

Based on Eq. (2), the logistic regression model on sorting activity was as follows:

$$g(x) = -2.766 + 2.035\,\text{age}\,(1) + 0.968\,\text{age}\,(2) + 1.113\,\text{age}\,(3) + 0.768\,\text{level of knowledge}\,(1) + 1.943\,\text{level of knowledge}\,(2) + 0.588\,\text{environmental cadre}\,(1) + 1.518\,\text{waste bank}\,(1)$$

The probability of sorting HSW by respondent with the age of 36–50 years old was eight times more than it with the age of less than 35 years old. The probability of sorting HSW by respondent with the age of 51–65 years old was three times more than it with the age of less than 35 years old. The probability of sorting HSW by respondent with the age of more than 65 years old was three times more than it with the age of less than 35 years old.

The probability of sorting HSW by respondent with level of knowledge "sufficient knowledge" was two times more than it with the level of knowledge "low level of knowledge". Additionally, the probability of a respondent with the knowledge level indicated as "high level of knowledge" was seven times more likely to sort HSW than a respondent with the knowledge level of "low level of knowledge".

While the probability of sorting was two times higher when an environmental cadre was available than when there was no environmental cadre. In addition, the probability of sorting was five times higher when, a waste bank was available than when there was no waste bank.

The fitted model of sorting activity was used to estimate the probability on sorting activity. For example, respondent of 40 years old (=1) with high level of knowledge (=1), there were an environmental cadre (=1) and a waste bank in his area (=1). So, the probability of sorting activity was as follows:

$$g(x) = -2.766 + 2.035\,(1) + 0.968\,(0) + 1.113\,(0) + 0.768\,(0) + 1.943\,(1) + 0.588\,(1) + 1.518\,(1)$$

$$g(x) = 3.318$$

$$\pi(x) = \frac{e^{[3.318]}}{1 + e^{[3.318]}} = 0.965 \approx 0.97 = 97\%$$

On the other hand, if there were no an environmental cadre (=0) and a waste bank (=0), the probability of sorting was as follows:

$$g(x) = -2.766 + 2.035\,(1) + 0.968\,(0) + 1.113\,(0) + 0.768\,(0) + 1.943\,(1) + 0.588\,(0) + 1.518\,(0)$$

$$g(x) = 1.212$$

$$\pi(x) = \frac{e^{[1.212]}}{1 + e^{[1.212]}} = 0.77 = 77\%$$

The estimated logistic probability on respondent's sorting activity was 97%, if he was 40 years old with high level of knowledge, and there were an environmental cadre and a waste bank in his area. When there were not an environmental cadre and a waste bank, the estimated logistic probability on respondent's sorting activity was 77%.

Table 7 reports the results from the binary logistic regression on creating unique handcrafted goods from recyclable waste. The influencing factors for creating unique handcrafted goods from recyclable waste were the availability of environmental cadre and waste bank, because the significant values were 0.066 and 0.011, respectively. The significant values are less than 0.1 (10%), indicating that the variables exert substantial control over the recycling activity. The socio-economic characteristics had no significant influence in the respondent's activity in creating unique handcrafted goods from recyclable waste. The supporting factors influenced the respondent's activity in creating unique handcrafted

Table 8
Results from the binary logistic regression on composting activity ($n = 300$).

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 6[a]	Gender(1)	1.079	0.534	4.081	1	0.043	2.941
	HSW reduction training (1)	1.097	0.609	3.249	1	0.071	2.996
	Information from mass media (1)	1.690	0.764	4.888	1	0.027	5.419
	Environmental cadre (1)	1.191	0.504	5.584	1	0.018	3.292
	Constant	-5.872	0.980	35.924	1	0.000	0.003

[a] Variable(s) entered on step 1: gender, age, educational background, family income, level of knowledge, waste bank, HSW reduction training, information from mass media, and environmental cadre.

goods from recyclable waste, such as the presence of environmental cadre and waste bank.

Based on Eq. (2), the logistic regression model on recycling activity was as follows:

$$g(x) = -5.682 + 2.074 \ \text{environmental cadre}(1) + 2.153 \ \text{waste bank}(1)$$

The probability of creating unique handcrafted goods from recyclable waste by respondents with the presence of an environmental cadre was eight times higher than without an environmental cadre. In addition, the probability of creating unique handcrafted goods from recyclable waste by respondents having an available waste bank was nine times higher than without an available waste bank.

The fitted model of recycling activity was used to estimate the probability on recycling activity. For example, if there were an environmental cadre (=1) and a waste bank in respondent's area (=1). So, the probability of creating unique handcrafted goods activity was as follows:

$$g(x) = -5.682 + 2.074(1) + 2.153(1) = -1.455$$

$$\pi(x) = \frac{e^{[-1.455]}}{1 + e^{[-1.455]}} = 0.189 \approx 0.19 = 19\%$$

On the other hand, if there were no an environmental cadre (=0) and a waste bank (=0) in respondent's area, the probability of creating unique handcrafted goods was as follows:

$$g(x) = -5.682 + 2.074(0) + 2.153(0) = -5.682$$

$$\pi(x) = \frac{e^{[-5.682]}}{1 + e^{[-5.682]}} = 0.003 = 0.3\%$$

The estimation of probability on respondent's creating unique handcrafted goods activity was 19%, if there were an environmental cadre and a waste bank in respondent's area. On contrary, if there were not an environmental cadre and a waste bank, the estimation of probability on respondent's creating unique handcrafted goods activity was 0.3%.

The results from the binary logistic regression on composting are shown in Table 8. The influencing factors on the composting activity were gender, HSW reduction training, information from mass media, and the existence of environmental cadre, because the significant values were 0.043; 0.071; 0.027; and 0.018, respectively. The values of significant were less than 0.1 (10%), indicating that the variables exerted substantial control over the composting activity.

Based on Eq. (2), the logistic regression model on composting activity was as follows:

$$g(x) = -5.872 + 1.079 \ \text{gender}\ (1) + 1.097 \ \text{environmental training}\ (1) + 1.680 \ \text{information from mass media}\ (1) + 1.191 \ \text{environmental cadre}\ (1)$$

The probability for a female respondent to compost was three times higher than that for a male respondent. Additionally, the probability of composting for respondent who received HSW reduction training was three times more than that respondent who never received HSW reduction training. Additionally, the probability of composting for respondent who received information from mass media about 3R was five times higher than that respondent who never received information from mass media. In addition, the probability of composting by respondent with available environmental cadre was three times higher than that without environmental cadre.

The fitted model of composting activity was used to estimate the probability on composting activity. For example, if the respondent is female (=1), and has received HSW reduction training (=1), and information from mass media (= 1), with the presence of an environmental cadre (= 1), then the probability of composting activity was as follows:

$$g(x) = -5.872 + 1.079(1) + 1.097(1) + 1.690(1) + 1.191(1) = -0.815$$

$$\pi(x) = \frac{e^{[-0.815]}}{1 + e^{[-0.815]}} = 0 \cdot 307 \approx 0 \cdot 31 = 31\%$$

On the other hand, if female respondent (=1) never received HSW reduction training (=0) and information from mass media about 3R (=0), and there was not an environmental cadre in her area (=0), the probability of composting was as follows:

$$g(x) = -5.872 + 1.079(1) + 1.097(0) + 1690(0) + 1.191(0) = -4.775$$

$$\pi(x) = \frac{e^{[-4.775]}}{1 + e^{[-4.775]}} = 0.008 = 0.8\% \approx 1\%$$

The estimation of probability on respondent's composting activity was 31%, if female respondent ever received at least once HSW reduction training and there were an environmental cadre and a waste bank in his area. When there were not an environmental cadre and a waste bank, the estimation of probability on respondent's composting activity was 1%.

5. Discussion

The results of the study demonstrated that the HSW generation rate in eastern Surabaya was higher than that in 2006. The percentages of plastic and paper were higher than the values in 2006, in contrast to decomposable waste (food waste and garden waste), wood, textile, glass, metal and rubber (Trihadiningrum, 2006). Used diapers contributed 6.97% of the composition; no data about this contribution were included in previous studies. Similar to some cities in Asian developing countries, SW composition was dominated by biodegradable organics (ranged from 42% to 80%), and

recyclable materials such as paper (ranged from 3.6% to 30%), and plastics (ranged from 2.9% to 19.9%). The composition of recyclable materials tended to multiply as the result of the changing life style and the consumption of more packaged products (Dhokhikah and Trihadiningrum, 2012).

Based on Table 5, the reasons of respondent not sorting HSW were primary caused by lack of time, laziness, and not knowing the procedure of sorting HSW. The respondents' reasons were similar to previous studies which stated that the barriers to sort were "lack of time" (Grodziní ska-Jurczak et al., 2003), lack of space to save recyclables at home and scarcity of local facilities (Alexander et al., 2009; Hage et al., 2009; Martin et al., 2006; Perry and Williams, 2007; Timlett and Williams, 2008), as well as lack of a collection service (Grodziní ska-Jurczak et al., 2003).

The reasons of respondent not to recycle HSW in Table 5 were laziness, not knowing the procedure of recycle, and lack of time. They were similar to the previous studies which stated that the barriers of recycling were limited of time to do (Alexander et al., 2009; Grodziní ska-Jurczak et al., 2003; Martin et al., 2006), lack of incentive to recycle (Robinson and Read, 2005; Timlett and Williams, 2008), public attitudes toward recycling activities and their perceptions of the constraints in recycling (Alexander et al., 2009), assumption of "produce little waste" (Grodziní ska-Jurczak et al., 2003), apathy towards recycling (Robinson and Read, 2005), lack of public awareness and participation (Grodziní ska-Jurczak et al., 2003; Robinson and Read, 2005; Shaw et al., 2007; Singhirunnusorn et al., 2012), lack of enthusiasm and stimulus (Shaw et al., 2007).

Based on Table 5, the reasons of respondent not to compost were lack of time, not knowing the procedure of composting, and laziness. They were similar to previous studies which mentioned that the constraints of composting are lack of interest and lack of awareness in selling and promotion (Hoornweg et al., 1999; Zurbrugg, 2002). On the other hand, composting was the best answer for SWM, because it reduced the SW volume, supplied plant nutrients, and increased the soil quality (Körner et al., 2008; Mbuligwe et al., 2002). In addition, decentralized composting needs low technology and budget (Körner et al., 2008). Because of its benefits, composting is supported by local government, community, private sector and NGOs.

Table 6 indicated that environmental knowledge had a strong correlation with environmental behavior (Ramayah et al., 2012; Troschinetz and Mihelcic, 2009; Yencken et al., 2000) and with the improvement of the residents' attitude toward the environment (Barraza and Walford, 2002; Singhirunnusorn et al., 2012), and knowledge transfer could improve the SW management (Valaencia-Vazquez et al., 2014).

Based on Table 6, the predictor variables influencing the sorting activity were respondent's age, the level of knowledge, environmental cadre, and waste bank. Sorting activity was influenced by level of knowledge (Ramayah et al., 2012; Troschinetz and Mihelcic, 2009). Additionally, Table 7 shows that activity of creating unique handcrafted goods was influenced by environmental cadre and waste bank.

The existence of a waste bank encourages the community activities on HSW sorting and recycling (see Tables 6 and 7). Customers of the waste bank sell recyclable waste that has value, such as paper, plastic, metal, and glass. The waste bank provides deposit books to the customers, containing the type, amount and weight of the recyclable waste. The waste bank sets the price of each type of SW according to the agreement between the bank and the customer. Furthermore, the amount of money saved is obtained from the price of each type of waste or the number of units multiplied by the weight of the waste. The amount of money is recorded in the deposit book. The customers of waste bank take an advantage of sorting and recycling HSW, because they can gain money from selling recyclable waste.

The existence of a waste bank in Indonesia is supported by legal instrument, namely the Regulation of the Minister of Environment of the Republic of Indonesia No. 13 of 2012. Many waste banks were established in 2012 after the regulation was released. A waste bank also supported the creation of unique handcrafted goods in the community (Triwardani and Sarmini 2013; Purbasari, 2014), such as by supporting a training program. The key roles in reduction and recycling were the public awareness (Hotta and Aoki-Suzuki, 2014), and knowledge transfer (Valaencia-Vazquez et al., 2014). Training program can transfer knowledge and technology, and improve the community's level of knowledge, and increase their awareness in HSW reduction. In addition, level of knowledge can change the awareness to action. Furthermore, the function of waste bank is not only as a media for selling the recyclable waste, but also as a media or organization for transferring the knowledge and technology of HSW reduction and improving the community's level of knowledge.

Based on Table 8, gender, HSW reduction training programs, information from mass media, and environmental cadre influenced the composting activity. Information plays a key role in changing of the attitude toward SWM. Information about the environment can disseminate through mass media or electronic media, and many citizens can gain information from education and training. Similar to previous studies that environmental education can support pro-environmental actions and generate awareness, concern, and recognition of the effect of citizens' activity (Hotta and Aoki-Suzuki, 2014; Ramayah et al., 2012; Salequzzaman and Stocker, 2001; Sukhor et al., 2011). It was stated that the gender role was dominant in 3R implementation in other cities in Indonesia, because most of the cadres were women (Utami et al., 2008; Wardi, 2011). Similar to other developing countries, women were the key roles in HSW reduction in Yala, Thailand (Mongkolnchaiarunya, 2005).

Environmental cadres influence the community participation on HSW reduction. Environmental cadres transfer knowledge and technology, guide and motivate the community. Knowledge transfer about HSW reduction improves the community's level of knowledge, increases awareness, and changes the awareness into action pro-environmental.

There are four strategies that can be proposed to support the community participation on HSW reduction in eastern Surabaya. The first strategy of reduction HSW at source is to intensify the HSW reduction training for community and environmental cadres. The HSW reduction training can transfer information about the HSW handling, and reduction, and it can improve their knowledge. The participants of training involve all of the community. The government, private sector, NGOs, institution, and community can contribute in training materials, funding, trainer on HSW reduction training. The second strategy is to intensify the information about the HSW handling, reduction and recycling through the mass media and campaign. The third strategy is to multiply the number of environmental cadres as motivators and guides to the community in the HSW reduction. Environmental cadres are not only from residents outside the region but also from local residents and local community leaders. The fourth strategy is to multiply the existence of waste bank and its functions. The waste bank functions are as a bank accepting recyclable waste from community as customer, and as an organization improving the community through environmental campaign and trainings.

6. Conclusion

The average of HSW generation rate in eastern Surabaya was 0.33 kg/capita/day, and the HSW composition in eastern Surabaya was dominated by food waste (64.19%), followed by plastics (10.79%), paper (9.24%) and used diapers (6.97%). The socio-

economic characteristics of respondents had less influence than supporting factors in sorting HSW, creating unique handcrafted goods from recyclable waste, and composting. In order to improve the community activity in 3R, the collaboration between the government and community, private sector, and NGOs have to be conducted. Four strategies to achieve the goal of community participation in HSW reduction are to intensify the HSW reduction training for community and environmental cadres; to increase the information through mass media and campaign about the HSW handling and reduction; to multiply the number of environmental cadres from community and the local leaders; and to increase the number of waste bank and their functions (as bank which accept the recyclable waste; and an organization for environmental campaign and trainings).

Acknowledgements

The authors gratefully acknowledge the Higher Education of Ministry of Education and Culture of Indonesia for the financial research fund, contract no. (013674.33/IT2.7/PN.08.01/2013). The authors are also grateful to Yoanita Puspita Ratih, Hendri Sutrisno, and Intan Julia Laksono for the assistances in data collection. Our gratitude is also delivered to Dr. Vita Ratnasari for her advice in finalizing this manuscript.

References

Alexander, C., Smaje, C., Timlett, R., Williams, I.D., 2009. Improving social technologies for recycling. Proc. Inst. Civil Eng. Waste Resour. Manage. 162, 15–28.
Barraza, L., Walford, R.A., 2002. Environmental education: a comparison between English and Mexican school children. Environ. Educ. Res. 8, 171–186.
Borsgstede, C., Biel, A., 2002. Pro-environmental activity: situational barriers, and concern for the good at stake. Göteborg Psychol. Rep. 32 (1), 1–10.
Chung, S.S., Poon, C.S., 2001. A comparison of waste-reduction practices and new environmental paradigm of rural and urban Chinese citizens. J. Environ. Manage. 62, 3–19.
Corraliza, J., Berenguer, J., 2000. Environmental values, beliefs and actions. A situational approach. Environ. Behav. 32 (6), 832–848.
Dhokhikah, Y., Trihadiningrum, Y., 2012. Solid waste management in Asian developing countries: challenges and opportunities. J. Appl. Environ. Biol. Sci. 2 (7), 329–335.
Grodziní ska-Jurczak, M., Tarabul, M., Read, A.R., 2003. Increasing participation in rational municipal waste management–a case study analysis in Jaslo City (Poland). Resour. Conserv. Recycl. 38, 67–88.
Hage, O., Söderholm, P., Berglund, C., 2009. Norms and economic motivation in household recycling: empirical evidence from Sweden. Resour. Conserv. Recycl. 53, 155–165.
Hoornweg, D., Thomas, L., Otten, L., 1999. Composting and its Applicability in Developing Countries. Urban Waste Management. Working Paper Series. The World Bank, Washington, USA.
Hosmer, D.W., Lemeshow, S., 2000. Applied Logistic Regression, 2nd ed. John Wiley & Sons, Inc., Toronto, Canada.
Hotta, Y., Aoki-Suzuki, C., 2014. Waste reduction and recycling initiatives in Japanese cities: lessons from Yokohama and Kamakura. Waste Manage. Res. 32 (9), 857–866.
INS (Indonesia National Standard) 19-2454-2002. 2002. The procedure for the operational techniques of urban waste management. National Standardization Board. (in Bahasa Indonesia).
INS (Indonesia National Standard) 3242-2008. 2008. Waste management in the settlement in Indonesia. National Standardization Board. (in Bahasa Indonesia).
Keramitsoglou, K.M., Tsagarakis, K.P., 2013. Public participation in designing a recycling scheme towards maximum public acceptance. Resour. Conserv. Recycl. 70, 55–67.
Körner, I., Saborit-Sánchez, I., Aguilera-Corales, Y., 2008. Proposal for the integration of decentralised composting of the organic fraction of municipal solid waste into the system of Cuba. Waste Manage. 28, 64–72.
Martin, M., Williams, I.D., Clark, M., 2006. Social, cultural and structural influences on household waste recycling: a case study. Resour. Conserv. Recycl. 48, 357–395.
Mbuligwe, S.E., Kassenga, G.R., Kaseva, M.E., Chaggu, E.J., 2002. Potential and constraints of composting domestic solid waste in developing countries: findings from a pilot study in Dar es Salaam, Tanzania. Resour. Conserv. Recycl. 36, 45–59.
Ministry of Environmental Indonesia solid waste bank profile. 2012. National Workshop of Solid Waste Bank. Malang 2–4 November 2012. (in Bahasa Indonesia).
Mongkolnchaiarunya, J., 2005. Promoting a community-based solid waste management initiative in local government: Yala municipality, Thailand. Habitat Int. 29, 27–40.
Perry, G.D.R., Williams, I.D., 2007. The participation of ethnic minorities in kerbside recycling: a case study. Resour. Conserv. Recycl. 49, 308–323.
Public Work Department Waste generation standard specifications for small and medium cities in Indonesia. 1993. LPMB. Bandung. (in Bahasa Indonesia).
Purbasari, N., 2014. Community empowerment through recycling plastic waste (Case study on waste bank community housing poklili in Perumahan Griya Lembah Depok, Sukmajaya Subdistricts, Depok city). Thesis. Social Science Education Department. Faculty of Tarbiyah and Education. Syarif Hidayatullah State Islamic University. Jakarta. (in Bahasa Indonesia).
Ramayah, T., Lee, J.W.C., Lim, S., 2012. Sustaining the environment through recycling: an empirical study. J. Environ. Manage. 102, 141–147.
Robinson, G.M., Read, A.D., 2005. Recycling behaviour in a London Borough: results from large-scale household surveys. Resour. Conserv. Recycl. 45, 70–83.
Salequzzaman, M., Stocker, L., 2001. The context and prospects for environmental education and environmental career in Bangladesh. Int. J. Sustain. High. Educ. 2 (2), 104–126.
Sanitation Working Group Surabaya, 2010. Draft of Sanitation Surabaya White Book. Settlement Sanitation Development Acceleration Program (PPSP) (in Bahasa Indonesia).
Setiawan, N., 2007. Sample size determination using Slovin's formula and Krejcie–Morgan's table: the study of the concept and its application. Scientific discussion of Socio-Economic Department, Faculty of Animal Husbandry, Universitas Padjadjaran (in Bahasa Indonesia).
Shaw, P.J., Lyas, J.K., Maynard, S.J., van Vugt, M., 2007. On the relationship between set-out rates and participation ratios as a tool for enhancement of kerbside household waste recycling. J. Environ Manag. 83, 34–43.
Singhirunnusorn, W., Donlakorn, K., Kaewhanin, W., 2012. Contextual factors influencing household recycling behaviours: a case of waste bank project in Mahasarakham municipality. Procedia–Soc. Behav. Sci. 36, 688–697.
Standard Test Method for determination of the composition of unprocessed municipal solid waste D 5231-92. 1994. Annual Book of ASTM Standards. Section 11th Water and Environmental Technology Vol. 11.04.
Sukhor, F.S.A., Mohammed, A.H., Sani, S.I.A., Awang, M., 2011. A review on the success factors for community participation in solid waste management. International Conference on Management (ICM) Proceeding.
Surabaya City Government Awards received by the City of Surabaya. www.surabaya.go.id (accessed 25.11.14.) (in Bahasa Indonesia).
Timlett, R.E., Williams, I.D., 2008. Public participation and recycling performance in England: a comparison of tools for activity change. Resour. Conserv. Recycl. 52, 622–634.
Trihadiningrum, Y., 2006. Reducing potential of domestic solid waste in Surabaya City, Indonesia. In: Proceedings of the 4th International Symposium on Sustainable Sanitation, Bandung, 4–6 September.
Triwardani, R., Sarmini, 2013. Acculturation of character caring environment through waste banks in Duwet Village, Subdistrict Bendo, Districts Magetan. Kajian Moral Kewarganegaraan 1 (3), 470–484 (in Bahasa Indonesia).
Troschinetz, M., Mihelcic, J.R., 2009. Sustainable recycling of municipal solid waste in developing countries. Waste Manage. 29, 915–923.
Utami, B.D., Indrasti, N.S., Dharmawan, A.H., 2008. Household waste management of community-based: the example of the two communities in Sleman and South Jakarta. Sodality. J. Transdisiplin Sosiol. Komun. Ekol. Manusia 2 (1), 49–68 (in Bahasa Indonesia).
Valaencia-Vazquez, R., Perez-Lopez, M.E., Vicencio-de-la-Rosa, M.G., Martinez-Prado, M.A., Rubio-Hernandez, R., 2014. Knowledge and technology transfer to improve the municipal solid waste management system of Durango City, Mexico. Waste Manage. Res. 32 (9), 848–856.
Wardi, I.N., 2011. Waste management based social culture: efforts to overcome the environment in Bali. J. Bumi Lestari 11 (1), 167–177 (in Bahasa Indonesia).
Yencken, D., Fien, J., Sykes, H. (Eds.), 2000. Routledge, London.
Zhang, W., Che, Y., Yang, K., Ren, X., Tai, J., 2012. Public opinion about the source separation of municipal solid waste in Shanghai, China. Waste Manage. Res. 30 (12), 1261–1271.
Zurbrugg, C. 2002. Urban solid waste management in low-income countries of Asia: how to cope with the garbage crisis. Scientific Committee on Problems of the Environment (SCOPE). Durban, South Africa, November.
Zurbrugg, C., Drescher, S., Patel, A., Sharatchandra, H.C., 2004. Decentralised composting of urban waste–an overview of community and private initiatives in Indian cities. Waste Manage. 24, 655–662.