

Mapping of Waste Management Planning Based on Society and Geographic Conditions

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Abstract: Household solid waste is a major environmental issue, not only in big cities but also in suburban areas. Setia Asih Village location is in Kecamatan Tarumajaya, Kabupaten Bekasi. Bekasi is closed with Jakarta, and it has unique characteristics, such as the dual market economy, administration system, and the local people's social culture. Setia Asih Village has tremendous unmanaged household solid waste. It covers the land and the river. This research paper used a qualitative approach due to the limited statistical data on the village level in Indonesia. The preliminary observation showed that local people do not know about managing their household solid waste. Their local government does not have any responsibility to manage the household solid waste on the village level. It becomes the local people's responsibility. There is a lack of coordination among stakeholders in household solid waste management at Setia Asih Village. I conducted the solid waste management training for 300 people and Focus Group Discussion (FGD) with each Dusun (lower level than a village) representative. I found that local people have solutions to solve their household solid waste problem. The local government builds a new waste bank as Corporate Social Responsibility (CSR) from state-owned enterprises.

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1. INTRODUCTION

Recent studies related to waste management in the regional scope have become the focus of research in this decade (Giovanis, 2015; Ko et al., 2020; Prajapati & Patel, 2018; Ramandey, 2016). Several discussions highlighted the involvement of stakeholders in independent waste management in each region (Indrianti, 2016; Lederer et al., 2015; Suthar et al., 2016). The trend in parts of the world is household solid waste (Babaei et al., 2015; Dai et al., 2015; Dhokhikah et al., 2015). Household solid waste is still the biggest issue in most developing countries in Asia, one of which is Indonesia.

Indonesia had more than 260 million people in 2019. They concentrate in big cities, such as Jakarta, Surabaya, and Medan. As a capital city, Jakarta has more than 10 million people live there (a.k.a. megacity). Jakarta has supporting areas, such as Bogor, Depok, Tangerang, and Bekasi (JABODETABEK). Bekasi has the biggest number of housing sales last year compared to the other supporting areas. Bekasi also has the biggest number of population growth rate than the other supporting areas. They do not have household solid waste composition data for inorganic and organic waste. The phenomena show us that the Bekasi area can transform into a fast-growing city based on its population and its easy access to Jakarta. The peri-urban area of Jakarta Metropolitan Area is still growing faster than the core area, DKI Jakarta. The population growth in the peri-urban has converted land uses from mostly agriculture to urban (Winarso et al., 2015).

The increasing number of populations relate to the increasing number of household needs, such as the demand for housing, clothes, and food. People cannot live without their basic needs. Since the Industrial Revolution, there is a huge development in the transportation, health service, manufacturing, and communication sectors. In the 19th and 20th centuries, all of those sectors' development is faster and bigger with information and technology (IT). We called it the globalization era, where people can connect without border, space, or time limitations. Technological advancements, which have risen above simply being a development, affect generation procedures and day by day life of consumers by changing their habits and behaviors (Alim, 2019). Since the industrial revolution, the use of plastic has increased manifold without improving its adequate management as a waste. Most of the plastic waste produced in the world is mainly from packaging industry followed by building and construction (Hameed et al., 2019).

People engaged in more daily routines and need more practical food serving (a.k.a. packaging for food products). In ancient times, we know only natural packaging from leaves or dried animal's skin. For example, if we go to a different place or travel and we need to carry our food, we wrap it with a big leaf or use dried goatskin. All-natural packaging materials changed into plastic, which has specific characteristics that can beat other packaging materials. Plastic packaging materials are easy to fold, low price, waterproof, and light to carry out.

People would do more consumption activities if the advertisements on non-food and food products were intense on the television (Widyaningsih, 2015). Besides that, people in big cities live close to each other due to the scarcity of land for housing. So, it makes people easy to communicate with each other during their free time, and it becomes unpaid advertisement media among people. After we do the consumption activities, we create waste and pollution to the environment. Most people do not know any knowledge and information to manage their household solid waste from their house before they throw it into the temporary waste area. They let the local government and the scavengers are managing their household solid waste. In developing countries, we can easily find scavengers as an informal, hidden market economy. In the Jakarta area, the percentage of inorganic waste is higher than organic waste. Jakarta has a high regional minimum wage compares to other areas. This income level makes people in Jakarta can shift the consumption pattern. Their consumption is also higher on non-food products than on food products.

Bekasi has almost the same conditions as in Jakarta, such as population number is big, high mobility of the people, and close distance between Jakarta - Bekasi. The only difference is that the local government does not manage their local household solid waste on the village level. From my preliminary observation at Setia Asih Village last January 2018, I could see plastic waste covers almost the soil or land and river. Local people do not pay much attention to land pollution everywhere around the Bekasi area. They do not bother with their solid waste around their house area. They do not have any penalty from the local government if they ignore their household solid waste. Most local people throw their household solid waste into unmanaged areas or the closest vacant/empty area.

Some previous research only focused on how to manage waste, but did not pay attention to regional aspects that could help facilitate waste management (Eriksson et al., 2005; Johnson, 2017; Khandelwal et al., 2019; Liikanen et al., 2018). Seeing the existing gaps, this paper aims to map the area in determining service zones in waste management. This research paper used a mix-methods approach to gather more information from the field because there is no data or updated data statistically from the local government, especially household solid waste at Setia Asih Village. I combined the secondary data and the primary data to support the analysis and results. In the end, the research paper will be used for the local government and local people to set up a new mechanism for their household solid waste management based on their local characteristics (social and geography conditions) through a waste bank system.

2. DATA AND METHODS

The research started at the end of the last year, 2017, where I helped on Corporate Social Responsibility (CSR) program from one of the state-owned enterprises in Jakarta to build a waste bank in one region of Jakarta's supporting areas. The main idea is not on the physical new waste bank building but especially on the household solid waste management system based on the local absolute advantage. For example, if a local region has a household solid waste problem and does not get any non/institution funding, the state-owned enterprise is willing to help society. My first observation is that Setia Asih Village has a good financial track record with the state-owned enterprise. The local people do not have any household solid waste management system yet.

Based on the secondary data for their administration level, we found that Setia Asih Village location is in Kecamatan Tarumajaya (kecamatan is higher level than village) and the location is in Kabupaten Bekasi (kabupaten is higher level than kecamatan). There are eight villages in Kecamatan Tarumajaya, such as: (a) Pusaka Rakyat Village; (b) Setia Asih Village; (c) Pahlawan Setia Village; (d) Setia Mulya Village; (e) Segara Makmur Village; (f) Pantai Makmur Village; (g) Segarajaya Village; and (g) Samudra Jaya Village. Setia Asih Village has the biggest number of Rukun Tetangga or RT (around 90-100 households in one RT). This village has 110 RT, 32 Rukun Warga or RW (RW is higher level than RT) and seven Dusun (dusun is higher level than RW).

Setia Asih Village has the biggest population, which is 41,548 people (20,879 males and 20,669 females) in 2016. Their household number is 10,065, which is still the biggest number compared to the other villages and has an average of 4-5 persons per household. The number is higher than on my previous research in Kecamatan Duren Sawit, East Jakarta, which has 3-4 persons per household. It means the demand for food and non-food products for basic needs will be higher at Setia Asih Village than in Kecamatan Duren Sawit, East Jakarta. If the demand increases, so do the household consumption. It means more waste on the environment.

Setia Asih Village has heterogenic people with an open-minded society that can accept the socio-culture changes dynamically. They have a dual market economy, where I found the traditional market in front of the Local Government Office (Kantor Kepala Desa) and minimarkets, such as Alfamart or Indomaret. These markets have different characteristics, but both give plastic shopping bags to the customers. In Indonesia, we called the plastic shopping bag plastic kresek. I interviewed with semi-structured questionnaires to gather the primary data. I randomly used samples or respondents (in school, traditional market, minimarket, local bank, local business area, or government officers).

People live unevenly distributed among the sub-region of Setia Asih Village area. We will see the used area spreading on the local map later. Almost 50% of the area is for regular housing areas, markets, and schools. The rest of the areas are for housing complex projects, and they are still vacant/empty land. They do not have the Setia Asih Village map administratively. So, I used the online Google map to spot the areas and the new waste bank potential location at Setia Asih Village.

The local people work in the agriculture sector, such as farming (chicken, duck, and catfish) and independent farming for their household needs (vegetable and fruit). I found that each household could develop their own small farm/pond in their own backyard. They do not need a big area. For example, they do farming in a portable big pond for the catfish. It is space efficiency farming with a bigger number on their harvesting than traditional farming.

To build a household solid waste management system at Setia Asih Village, I divided this research framework into three sections, such as:

- a. Mapping of Social condition from their population number, housing types, and work fields.
- b. Mapping of Environment condition from the local map – housing area or vacant/empty area.
- c. Mapping of Economic condition from their number of savings book accounts through the state-owned enterprise.

I used a qualitative approach by conducting: firstly, the general training on household solid waste on April 21, 2018, that divided into two sections – in the morning from 9 am-12 pm and in the afternoon from

1 pm-4 pm. More than 300 people attended the event. The event collaborated with the state-owned enterprise for its CSR program (Figure 1). Secondly, I gathered the information deeply about the household solid waste issues and their local solutions based on their capability and capacity. The FGD was conducted on April 25, 2018, from 1 pm-4 pm with each Dusun representative (two people). The total number who attended the second event were eight Dusun multiples by two people is the same as 16 people. Still, only 10 people attended the FGD because of the bad rain weather in Setia Asih Village (Figure 2). We had a one-person representative from Tabungan Desa (Village Savings Bank), the representative for the CSR program from the state-owned enterprise, and the representative from the local government officials who became the household collector leader.



Figure 1. Training on Household Solid Waste



Figure 2. Focus Group Discussion on the Household Solid Waste Management

3. RESULTS AND DISCUSSION

Setia Asih Village location is a very attractive area because it closes with the capital city with easy access (transportation); the local people have some home-industries that have the export quality of products (food products and batik linen to improve their economic condition); and many potential areas for a housing complex in the future (environment aspect). The important thing is they are willing to learn how to manage their household solid waste. The solid waste comes from the household. I find it floating on the river and almost in every corner of the road, especially for the vacant/empty area. It around 55% of the household solid waste is organic waste, and the rest is an inorganic waste.

From the first event training on the introduction about household solid waste, the representative from all levels of community associations attended the morning session. They are representative from each RT (two people) and community leaders, such as housewife group, a home industry group, youth group, non-government organization, religious group, local school, and local market community). They were very interested in listening to the training and the explanation about household solid waste. Here are some semi-structured interview responses during that event:

“Basically, we do not know how to manage our household solid waste. So far, we just throw it to the closest vacant/empty area. We used the vacant/empty area behind one of the housing complex walls. Now, after listening to the information about household solid waste and solid waste management, we know that our household solid waste can have economic value and can be recycled products.” (Alias Mrs. Yuni)

“Our villagers can support the new waste bank, but not all of us live close with the waste collector positions. So far, we collected our plastic bottles from house to house into a big empty house/room, and sometimes there are waste collectors who helped to sell it.” (Alias Mr. Anto)

“We thought that inorganic and organic waste would be degradable by nature together whenever we put it. We do not know that we can use organic waste into liquid organic fertilizer and inorganic waste into the recycled product.” (Alias Mr. Udin)

First, there is no statistical data regarding the household solid waste composition (plastic, paper, glass, and metal) at Setia Asih Village. I used an approximate number (after discussing with the local government officials, the state-owned enterprise, and the community leader). Each person creates around 0.5 – 1 kilogram (kg) of household solid waste every day. The average number of people per household at Setia Asih Village is 4 – 5 people. The total population is 41,548 people multiple by 0.7 kg (the average value) for each person from the demography data. The total number of unmanaged household solid waste every day is 29,084 kg per day without any support from the local government at the village level to manage it properly.

Second, I searched for information at Setia Asih Village for the waste collectors who buy the household solid waste, such as plastic, paper, glass, and metal. The informal, hidden market economy system for the scavengers on the solid waste is not open access data than any other job fields. It made the research for the solid waste price was difficult. My observation along the river showed that almost all of the soil blended with plastic waste for years. It is a tremendous solid waste. There are used plastic wrap, dirty bottles or paper, and used styrofoam packaging. So, when the building construction officers built the new waste bank building (March 2018), it was hard to dig the soil blended with plastic waste (Figure 5). It took a long time to finish the job. Besides that, from statistical data, Setia Asih Village has the biggest store (397) in 2016 compared to other villages at Kecamatan Tarumajaya. The second biggest store is Pusaka Rakyat Village (250) and Pantai Makmur Village (146). Of course, these stores will add easier access for the local people to buy more stuff (food and non-food products) whether they do the consumption with rational thinking (buy the products only if they need them) or they buy the products to satisfy their other thought (buy the products because they want to have it or for their prestige only).

Third, the housing distance at Setia Asih Village is distributed unevenly. No administrative local map, and I used the online search engine (Google) to plot the area, including the new waste bank position. In the future, the new waste bank position is in the corner of the river at Setia Asih Village. They will build a playground for the kids and a public park also. Below are the local maps for Kabupaten Bekasi (Figure 3)

and Setia Asih Village (Figure 4). In Figure 4, I divided the region into four quadrants to make it easier to analyze the region:

- a. Quadrant 1 has a vacant/empty area, and there will be a new housing complex in the future.
- b. Quadrant 2 has two housing complex areas (Green Ara and Cluster Somerset), and part of the area is vacant/empty area.
- c. Quadrant 3 has two housing complex areas (Perumahan Wahana Harapan and Perum Pesona Bumi Insani), and there are local schools, minimarkets, and mosques.
- d. Quadrant 4 has two housing complex areas (De Residence and Perum Puri Harapan), local banks, and public utilities. This quadrant is close with Harapan Indah Bekasi for business.

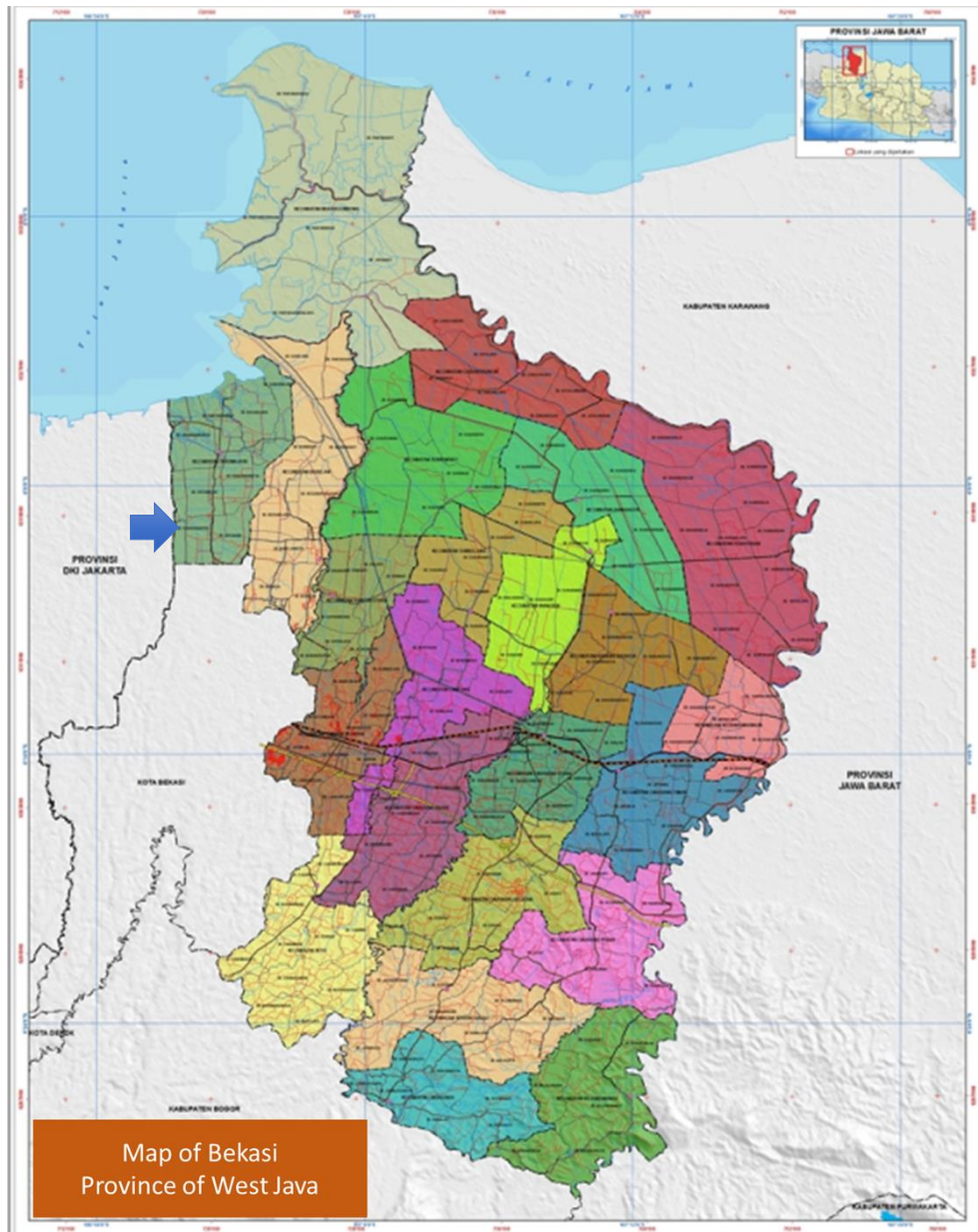


Figure 3. Map of Bekasi, West Java

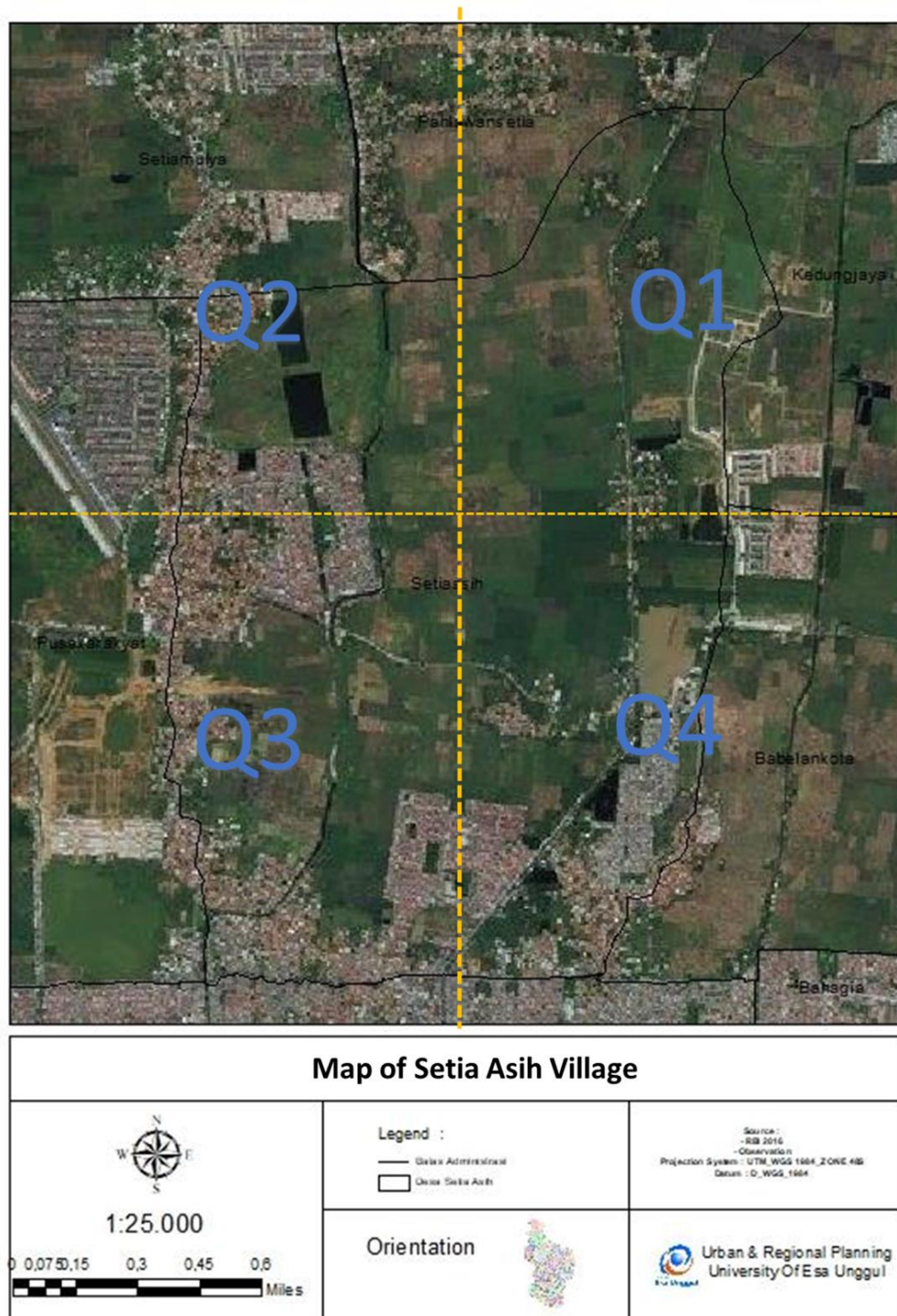


Figure 4. Map of Quadrant Analysis for Setia Asih Waste Management

After the household solid waste training, the local government chose the people involved in the household solid waste management and people to manage the new waste bank at Setia Asih Village. From each Dusun, they have one person to be their preventatives or as a waste collector who brings the household solid waste to the new waste bank. I explained how to manage the household solid waste from their house before throwing it into the temporary waste area and the new waste bank mechanism for the household solid waste based on the conditions.



Figure 5. The New Waste Bank Location at Setia Asih Village

The local government, the local people (through their representatives), the state-owned enterprise (under the CSR program manager), and I agreed that we are going to implement the household solid waste to clean up the region from the household solid waste (Figure 6):

- a. The waste collector officer will collect the household solid waste (twice a week) from each household, and s/he will bring it to the new waste bank for people who live far from the new waste bank location.
- b. People who live close to the new waste bank will directly bring their household solid waste to the new waste bank location. The new waste bank will open every day with regular office hours.
- c. All the household solid waste must be separated into plastic, paper, glass, and metal because we considered the solid waste market.
- d. The household solid waste must be cleaned to be measure at the new waste bank. If it is clean, the price is higher on the solid waste market.
- e. Each household must have a savings book account to record all the prices of the household solid waste.

The informant informed me that around 2,500 – 3,000 people already have a savings book account (individually or each household) at Setia Asih Village. Before introducing the new waste bank mechanism, the scavenger around Setia Asih Village sells the household solid waste (without being recycled) for a very low price. Now, the local people can have extra money from their household solid waste.

Table 1. Setia Asih Village Waste Bank (Price per Kg)

	Type of Solid Waste	Price per Kilogram
Plastic	Aqua plastic bottles	7,000 IDR
	Aqua plastic cups	5,000 IDR
Paper	Newspaper	1,600 IDR
	White paper	1,500 IDR
Glass	Syrup bottles	3,000 IDR for each bottle
	Regular glass	5,000 IDR
Metal	Aluminum	7,500 IDR
Misc.	Wooden stuff	Unidentified

Actually, qualitative research can gather more information if we can deeply listen to local people's opinions. I can describe it as extra knowledge based on local capability and capacity from the unstructured interview. The local people and the local farmers said they could transform the organic household solid waste into organic liquid fertilizer. The farmers bought that to use in their farming. Here is one of the inputs from the community leader:

"We could transform the organic household solid waste using the composter tools, and the organic liquid fertilizer price is only Rp. 10,000 each bottle. The farmers used it, and the vegetable/fruit is of good quality. We just need funding to buy composter tools." (Alias Mr. Toni)



Figure 6. The New Waste Bank Mechanism

Finally, Setia Asih Village is one example of how local condition (socio-cultural and their geography condition) can solve their household solid waste by their own capacity and capability. They need to build a bridge to do the household solid waste management system comprehensively from local government, non-government institutions, community groups, academic, and all stakeholders (including the waste picker and the small home-industry for the recycled products) who involve strengthening the waste management system through a waste bank.

4. CONCLUSION

This research shows that the regional aspect and the role of stakeholders are very important in the management of household waste. This research also produces a new mechanism for household waste management based on local characteristics. This can be a reference for the government and local communities to implement a waste bank system so that waste management can be carried out effectively and efficiently.

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