

## Analysis on the Appropriate Model of a Community-Based Waste Management (Case of Rural Area in Karang Joang Village, Balikpapan, Indonesia)

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### Abstract

The habit of some communities in Indonesia, including in the village of Karang Joang, Balikpapan, in handling their domestic waste is to burn the garbage without implementing the 3R concept. It happens because such habit is passing down from generation to generation. In order to be success in changing the habit, the research was conducted to obtain the appropriate waste management model for the community. In the first step, identification of public environmental awareness was conducted by means of distributing questionnaire to 500 residents, and interviewing 5 housewives, 1 grocery store owner. The questionnaire consists of material flow analysis (MFA), asking on the resident environmental awareness for their current behavior and their future potential behavior towards the waste handling. The survey results showed that 76% of the respondents did not treat the kitchen waste into compost. The community has a quite low level on their waste management awareness. Almost all of the respondents (70%) burn their kitchen waste, 10% of them discharge the waste directly into the river without any prior treatment or composting. About 65% of the respondents usually bury their glass and bottle-type wastes in the backyard ground. Although the awareness shows in quite low level, the majority of the respondent (65%) claimed that they are willing to be more environmental friendly, especially to handle their domestic waste. Total amount of garbage generated by the community Karang Joang is 250-300 grams/day/family, with a composition of 60% of organic and 40% non-organic. Those wastes have potency to be reused and recycled. Conditions and data acquired by survey were then being used as basic information on SWOT analysis in order to determine the appropriate model of waste management in Karang Joang. Several models which can be applied are: 1) Operating a village-scale waste bank, 2) Composting the organic waste using the *Takakura* method and *Biopori* method to produce compost, 3) Recycling plastic waste into plastic pellets using shredder. Those activities need to be attractive by formulate them into the business opportunity.

**Keywords:** Solid waste management; Community-based; Recycling; Compositing

### Introduction

Rising global population, urbanization, and rapid industrialization cause increasing demand for raw materials [1], this in return will also increase the volume of the waste generated. Inappropriate management of the waste will lead to unhealthy environment and other problems affecting the social and economic issue. Nowadays, Indonesia has about 500 landfills which almost all of them are open dumping. Emerging middle class due to relatively high economic growth drives increasing consumption level which causes significant increase in volume of waste from year to year [1].

Indonesian Government actually have already published UU No 18/2008 as a basic law regarding on the management of solid waste to change the disposal to the 3R (reduce, reuse and recycle) method. This law was published to overcome the solid waste-derived problems which are frequently occurred in almost every city in Indonesia. However, the old paradigm on the waste disposal method was still used by almost all the citizens. "The Old Paradigm of Solid Waste" so-called Collect-Transport-Dispose, is used [2], while the 3R method has reduction, separation, reuse, and recycling activities.

Karang Joang is one of an attractive village in the Balikpapan City, East Kalimantan. The village has some leisure areas for domestic tourists. Manggar Dam, which is located in the village, also attracts people with its natural environment. The dam was constructed by the Indonesian Government Public Works in 2004 to store raw water for drinking water of Balikpapan City citizens. Nowadays, many

communities visit the place to have leisure activities, such as fishing, off-road cycling, camping, etc. [3]. As a tourist destination, the Karang Joang village needs to preserve the environment, including in managing the generated solid waste.

Until today, the Karang Joang's community behavior of handling the solid waste is still using the old paradigm. To make it worse, the habit of burning the garbage is still conducted by the community. It was stimulate by the pilling up waste which was uncollected and not transported to the final disposal. The solid waste handling is understood as an inconvenience burden for the people. Therefore it is needed to formulate an attractive program of solid waste handling for the community. This study was conducted to obtain the most appropriate model of a community-based waste management of Karang Joang Village. Community-based participatory research (CBPR) engages the

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multiple stakeholders, including the public and community providers, who affect and are affected by a problem of concern [4].

Several methods have been applied in other cities in Indonesia to overcome the domestic solid waste problem. One of popular method is *biopori* holes. In addressing the problem of household organic waste, *biopori* holes can be one solution processing of organic waste that is effective and efficient and provide a better return for the hosts, and the environment [5]. Other methods that have been applied in domestic solid waste management are *Takakura* and Waste Bank Methods.

This study is aimed to find out the most appropriate model in order to solve problem concerning the domestic solid waste management in the Karang Joang Village considering the community power and effort.

## Methodology

### Reseach location

The Karang Joang Village is located in the east part of Kalimantan Island. (Figure 1) shows a map of Indonesia and the arrow is pointing the location of Karang Joang Village. The village is situated close to Balikpapan City. (Figure 2) shows the map of the surrounding of Balikpapan City, whereas the shaded area shows the Karang Joang Village administration border [6].

### Methods

This research was conducted by several activities i.e.,:

**Questionnaire distribution:** This activity was carried out to find out the people lifestyle living near the dam. Questionnaires were distributed to 500 respondents living in 12 sub-villages near the river. The questionnaire consists of material flow analysis (MFA), asking on

the resident environmental awareness for their current behavior and their future potential behavior towards the waste handling. The specific waste for this research was solid waste generated by kitchen activities.

**Direct interview:** This activity was performed to 5 housewives to have description of the usual daily shopping items of the community. Besides, the interview was conducted to explore the garbage generated daily from the households. Direct interview was also performed to an owner of a small grocery store who sells his products for the community.

**Workshop:** A workshop was carried out to respond the results of the questionnaire. This workshop provide knowledge to the community concerning waste handling and recycling, including the government policies on the waste management. The community was introduced by several potential method of waste processing such as composting methods (*Takakura* and *Biopori*), waste bank, etc.

**SWOT analysis:** The results of questionnaire, interview and workshop activities were then being analyzed using SWOT method. This type of analysis attempts to figure out all possibilities that exist in that village involving the strength, the weakness, the opportunity and the threat. All those factors will be summarized and analyzed in order to find out the solution for this case.

**Model formulation:** Formulation of the most potential and suitable waste management was then being performed based on the SWOT analysis results.

## Result

### Questionnaire results

From the distributed questionnaires, it was found that almost 50% people of Karang Joang have income between IDR 1,000,000 to IDR



Figure 1: Map of Indonesia (<http://www.mapsofworld.com>).



Figure 2: Map of the Karang Joang village.

2,000,000. According to the Balikpapan Government, the minimum wage is approximately IDR 2,100,000. The average of family income can be categorized as middle to lower income. The questionnaire also shows that 90% of respondent were housewives with the average education level is elementary school.

Total amount of garbage generated by the community of Karang Joang was 250-300 gram/day/family, with a composition of 60% of organic and 40% non-organic. Figure 3 shows the result of questionnaire on the behavior of the community in handling the kitchen waste. It indicates that approximately 48% of the Karang Joang people do the waste separation processes to sort organic and non-organic domestic waste.

The proper treatment of the kitchen waste was not conducted by the Karang Joang Village community. The 3R concept application was quite low where only 48% of the communities do the separation waste.

Figure 4 shows the further handling of the kitchen waste by the community. It indicates that most of the people of Karang Joang burn the waste. This method was their habit that passing down from generation to generation.

Composting treatment of the kitchen waste was performed by only 24% of the community. The community did not have habit on composting their organic waste (Figure 5).

### Workshop result

Several findings from workshop activity are:

- The community has the will to separate the waste into organic waste and inorganic, which will be further managed. The organic waste will be treated into compost and the inorganic waste will be traded in a Waste Bank. The waste bank is mainly addressed to motivate the community to separate the waste, give the reward for efforts in separating, and collecting waste in form of monetary instrument [7].
- There is a plastic waste treatment process by one of the Karang Joang Village community being operated since 2011. The process includes collection and pressing. The pressed plastics were then being transported and traded to the next treatment agency. This

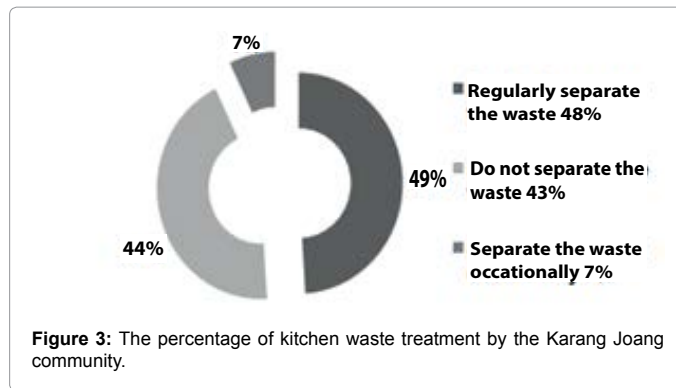


Figure 3: The percentage of kitchen waste treatment by the Karang Joang community.

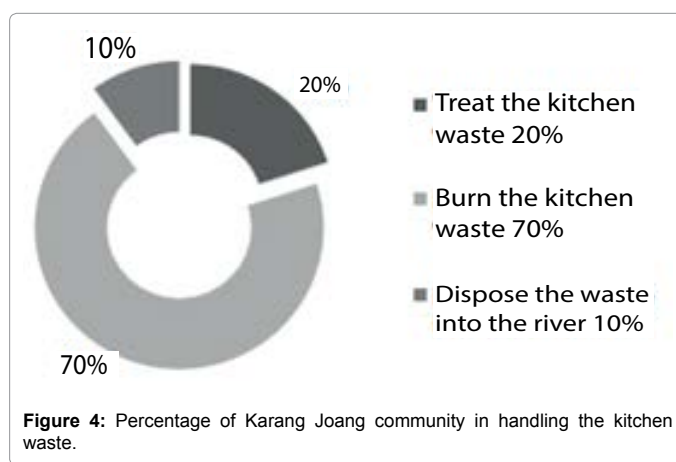


Figure 4: Percentage of Karang Joang community in handling the kitchen waste.

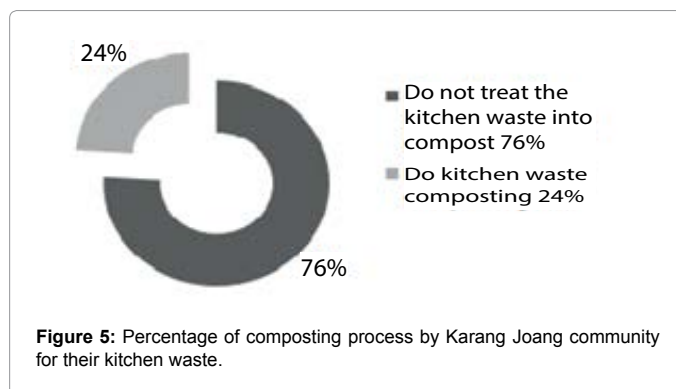


Figure 5: Percentage of composting process by Karang Joang community for their kitchen waste.

plastic waste business was relatively undeveloped due to lack of management and raw material.

- Government support for the community was apparently quite low.

### SWOT analysis

SWOT analysis has its origins in the 1960 which is a simple yet useful planning tool to understand the 'Strengths', 'Weaknesses', 'Opportunities', and 'Threats' as part of a strategic planning process [8] (Table 1). When applied to ecosystem services and its associated research fields, Strengths can be considered to be those features of the ecosystem services concept that underpin the ability of the concept and the field to achieve the implicit goals of [9]:

Increasing awareness of the extent to which human societies

Components	Strategy
S-O	Improvement of the tourism area quality Enrich the business type to support tourism activity Starting the profit oriented waste management activities (waste bank, compost production, plant and nursery business)
W-O	Workshops to upgrade business and technical skill ( <i>biopori</i> method, <i>Takakura</i> method, etc.) Business matching to open product market
S-T	Involvement of key persons in environmental events and programs Assistanship by the experts or volunteers
W-T	Continuous environmental education Periodic events of environmental program

Table 1: Strategic plan of S-O, W-O, S-T, and W-T.

interact with and are dependent upon the environment;

- a) Better integrating the natural and social sciences and engaging and acknowledging stakeholder knowledge;
- b) Greater understanding of the impacts of environmental change and environmental policy on human wellbeing;
- c) Contributing towards achievement of sustainable relationships between human society and ecosystems.

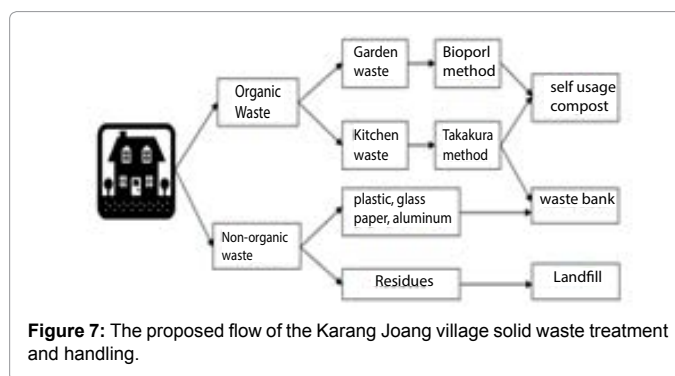
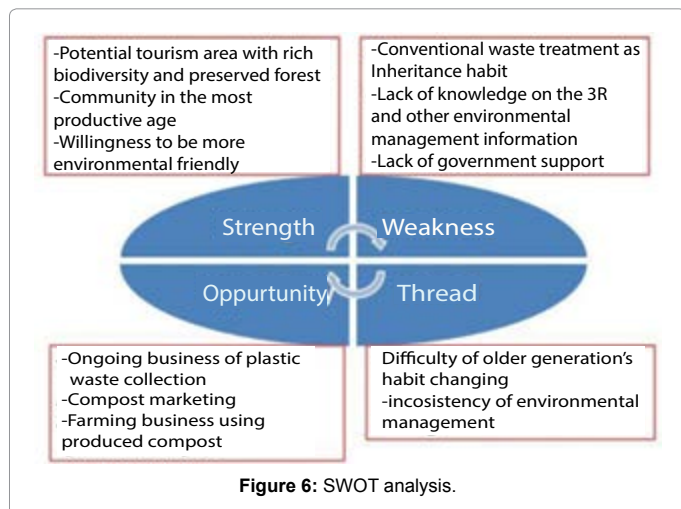
Figure 6 shows each component of the SWOT diagram concerning the domestic waste management in Karang Joang Village. This diagram will be used to formulate strategies connected between Strength and Opportunity (S-O), Weakness and Opportunity (W-O), Strength and Thread (S-T), Weakness and Thread (W-T).

### Model formulation

Based on the previous stages of the research, it can be formulate that some potential methods may be applied in the Karang Joang Village as the domestic solid waste management (Figure 7).

By analysing all aspects, the most appropriate activities to be applied in the Karang Joang Village are as follow:

1. Operating a village-scale waste bank
2. Treating the organic waste using the Takakura and Biopori methods to produce compost
3. Recycling plastic waste into plastic pellets using shredder



### Conclusion

The Karang Joang Village community is still applying conventional method in handling the domestic waste. As low as 48% separate the waste into organic and non-organic waste and most of them burn the waste or dispose into the river without any prior treatment. Questionnaire result shows that although the 3R practice was quite low, the will of the community to be more environmental friendly was increasing. Total amount of waste generated by each household was as much as 250-300 gram/day which indicate a good opportunity and potency to have further treatment. The most appropriate model is 3R concept with composting process for the organic waste and professional waste bank operation for the non-organic waste, all conducted and organized by the community of Karang Joang Village.

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