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STUDY OF MUNICIPAL SOLID WASTE IN WEST JAVA PROVINCE, INDONESIA

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ABSTRACT

In recent centuries, the environmental issue is becoming a serious topic, especially about waste. Waste is becoming a trending issue around the globe due to the continuous increase of urbanization and industrialization activities. Indonesia as the second largest country which contributes waste in the world needs to take some action regarding solid waste management. West Java as one of a populated province in Indonesia facing waste management problem. Household and non-household waste production in the West Java region continues to increase from year to year. The pattern of handling waste in West Java has not undergone systemic and paradigmatic changes ranging from the central government to local governments. Even though Law No. 18 of 2008 concerning waste management mandates a system change and paradigm in waste management both the prevention and handling aspects of waste from upstream to downstream. This research was conducted from November 2018-January 2019. The object of this research is the existing condition regarding waste in West Java Province. Using the secondary data, we tried to analyze Solid Waste Management in West Java Province. The results show that the four largest waste contributors are Ciamis Regency, Sukabumi Regency, Bandung City, and West Bandung. West Java also lacks in research regarding waste management.

INTRODUCTION

The management of solid waste is becoming a main environmental issue in urban areas. Rapid urbanization, increase of population growth rate and economic activities such as industrialization in the developing countries combined with the lack of knowledge and training in waste management practices confuse the improvement of solid waste management. As a consequence, the management of solid waste system needs to update due to appropriate conditions (Manaf et al. 2009). Solid Waste Management (SMW) usually relates to both formal and informal sectors. In Indonesia, the formal sector involves municipal agencies and formal businesses, whereas the informal sector consists of individuals, groups and small businesses which not formally regulated (Aprilia 2012).

In most developing countries, including Indonesia, there is typically a lack of human resources either the national or local levels with technical expertise essential for solid waste management. Research and development activities are often a low priority. A lack of design sustainable waste management is also problematic. As a result, a solid waste technology is often selected without due consideration to its appropriateness in the overall solid management system in most developing country (Ogawa 2000).

West Java province with the population in 2016 was estimated at 47.38 million is divided into 9 municipality and 18 regencies. Garbage in the West Java province continues to increase along with the increase in population. Like in other developing countries, West Java province has so far been least studied environmental issues. Recently, some efforts have been made by the government with various parties to overcome the waste problem. However, the problem is still not resolved. To explore the about this problem, we need to analyze the solid waste to describe the existing condition regarding waste in West Java Province.

METHODOLOGY

The study was conducted from November 2018-January 2019 which included data collection, data analysis and writing of the final report. This study used quantitative and qualitative research. Quantitative data is the volume of waste data in West Java obtained from the database of the Indonesian Ministry of Environment and the West Java local government. This data describe in bar charts, pie charts, and table with simple statistic (percentage)

The qualitative data in this study is waste management in West Java where it is intended to understand and describe the existing conditions for carrying out solid waste management conducted by district and city governments in the West Java province. Descriptive study is used to analyze the data.

RESULT AND DISCUSSION

Based on National law No. 18/2008 concerning Solid Waste Management (SWM), the responsibility of SWM in Indonesia is undertaken by local government (municipality or regency). There is also the possibility to cooperate among local governments, provincial government and private sector in solid waste management.

Table 1. Basic Information of Waste Volume and Some Demographic Data in West Java

Region	Waste Volume/Month (Tons)	Total Population (people)	Area (Km2)	Minimum Wage (Rupiah)
Purwakarta Regency	744	916.912	971,72	3.445.616
Banjar City	30	203.317	113,79	1.562.730
Garut Regency	120	2.526.186	2692,00	1.672.947
Bekasi City	565	2.447.930	210,49	3.915.353
Indramayu Regency	152	1.718.495	2001,00	1.873.701
Sukabumi Regency	3129	1.068.201	4161,00	2.583.556
West Bandung Regency	818	1.636.316	1305,00	2.683.277
Kuningan Regency	178	1.068.201	1196,71	1.606.030
Ciamis Regency	3327	1.401.423	1434,00	1.604.334

Region	Waste Volume/Month (Tons)	Total Population (people)	Area (Km2)	Minimum Wage (Rupiah)
Bogor City	475	1.064.687	118,50	3.557.146
Bandung City	1120	2.490.622	167,29	2.678.028
Bekasi Regency	560	3.371.691	1273,88	3.837.939
Depok City	600	2.179.813	200,29	3.584.700
Karawang Regency	740	431.649	103,58	3.919.291
Tasikmalaya City	163	6.577.477	183,58	1.931.435
Sukabumi City	102	335.848	48,00	2.583.556
Tasikmalaya Regency	33	1.735.998	2712,52	1.920.937
Subang Regency	208	1.546.000	2051,76	2.529.759
Bandung Regency	320	3.525.149	1762,40	2.678.029

Regency or City with the four largest waste volume

Table 1 listed the total waste in West Java (12 regencies and 7 cities). The highlighted column is the area with thelargest waste volume. The area with the most waste contribution is Ciamis regency with a total volume of 3327 tons/day. The other three areas with the most significant waste production are Sukabumi regency, Bandung City, and West Bandung City with total volume respectively 3129 tons/day, 1120 tons/day and 818 tons /day.

Ciamis is one of the regencies in West Java Province which has a fairly large waste production of 100 tons / day. most significant waste production is from household waste. In its management, only 20% can be managed,and the remaining 80% is disposed to TPA (Final Disposal Sites). Meanwhile, capacity and garbage officers are inadequate and limited.

This also happened in other areas where the biggest waste is household waste. Based on the type, the major contribution is caused by food and leftover. In figure 1 it shows the detail of percentage of the type of waste in West Java.

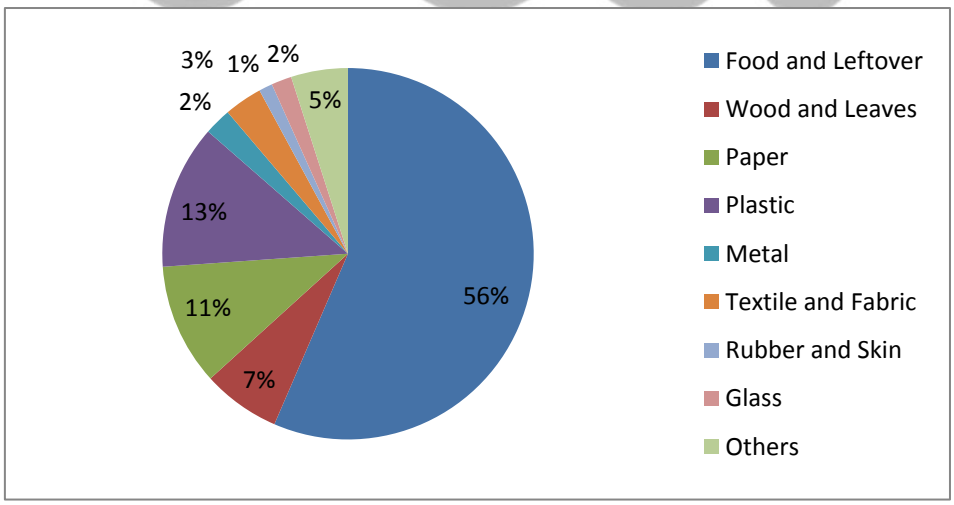

Figure 1. Percentage of Type of Waste

Food and Leftover is the most abundant type of waste with a percentage of 56%. Plastic is the second largest and paper is the third largest with percentage respectively 13% and 11%. Waste composition in Indonesia is dominated by organic waste come from the food-based activity. Then it is still treated together with other municipal solid waste which correlates to landfill (Brigita and Rahardyan 2013).

According to Tsabitah et al. (2016) in a study about the waste system in fast food restaurants, it was suggested that in general the composition of garbage every day is dominated by organic waste. For the 8th day's research, for example, the composition of the largest waste came from organic waste (57%) followed by paper/duplex

(19%), mixture (13%), plastic (9%), and residue (2%). It indicates that food and leftover waste is not only a problem in West Java Province.

The problem of food waste globally is a special concern to overcome both in reducing hunger and in increasing environmental sustainability by reducing carbon emissions and using landfills (Finn, 2011). In addition to environmental impacts, food waste also imposes economic costs on consumers and retailers. If calculated correctly, this can provide incentives that can simultaneously reduce emissions and save money by reducing waste (Venkat 2012).

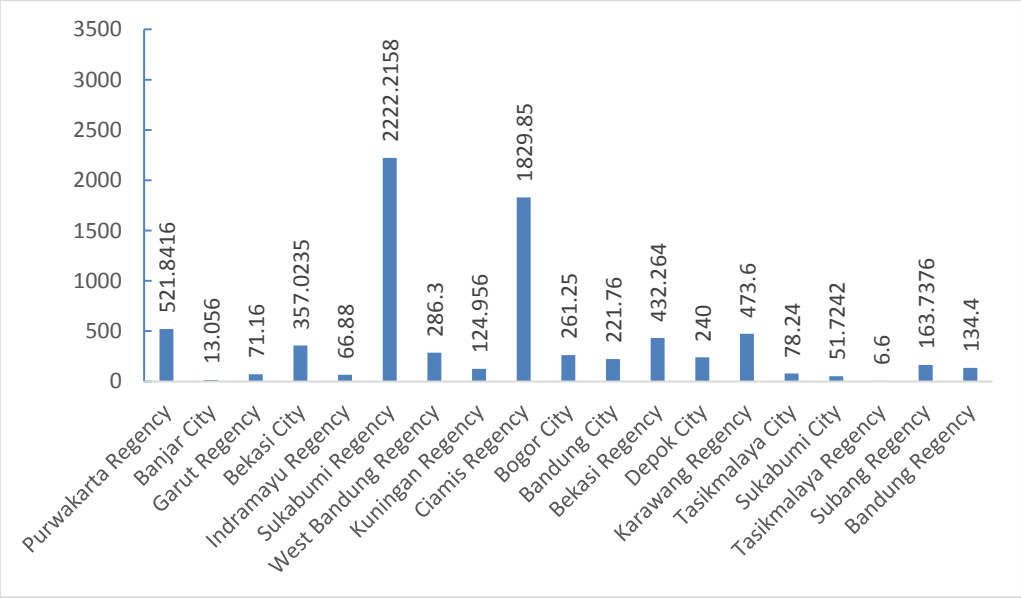

Figure 2. Volume of Food and Leftover Waste in West Java/day
Source: Ministry of Environmental

According to Figure 2, Sukabumi Regency contributing most of Food and Leftover waste in West Java. It was followed by Ciamis Regency and Purwakarta Regency. Meanwhile, Tasikmalaya Regency and Banjar City added less than 10 tons of waste respectively. The total volume of food and leftover litter in West Java approximately 13357,5 ton.

Based on Sukabumi District Environmental Service 60% of waste from the garbage transported by officers at 5.00-21.00 is organic waste and mostly contributed from food and leftover waste. Based on Hebrok and Brok (2015) food waste is a contemporary environmental, social and ethical issue, which is a historical context is a result of moving from scarcity to abundance in Western society. In the EU households stand for about 53% of the food wasted within the value chain (Stenmarck et al. 2016).

Food waste occurs within many different but interconnected practices of everyday life such as shopping routines, storing, cooking, and eating. Consumers are not aware of all drivers behind the food they waste because they are deeply entangled in the routines of everyday life (e.g., Quested et al., 2011). Decisions and actions made long before food is wasted may actually be the root of the cause, such as choosing what and how much to buy, how food has been treated before the consumer takes it home, how it is stored when it arrives in the household, and how meals are planned (Hebrok and Brok, 2015).

There is not many consumer behavior research in West Java as well as in Indonesia as prevention of household waste. The research about consumer behavior toward food waste is needed because values influence awareness and attitudes in order to manage everyday life.

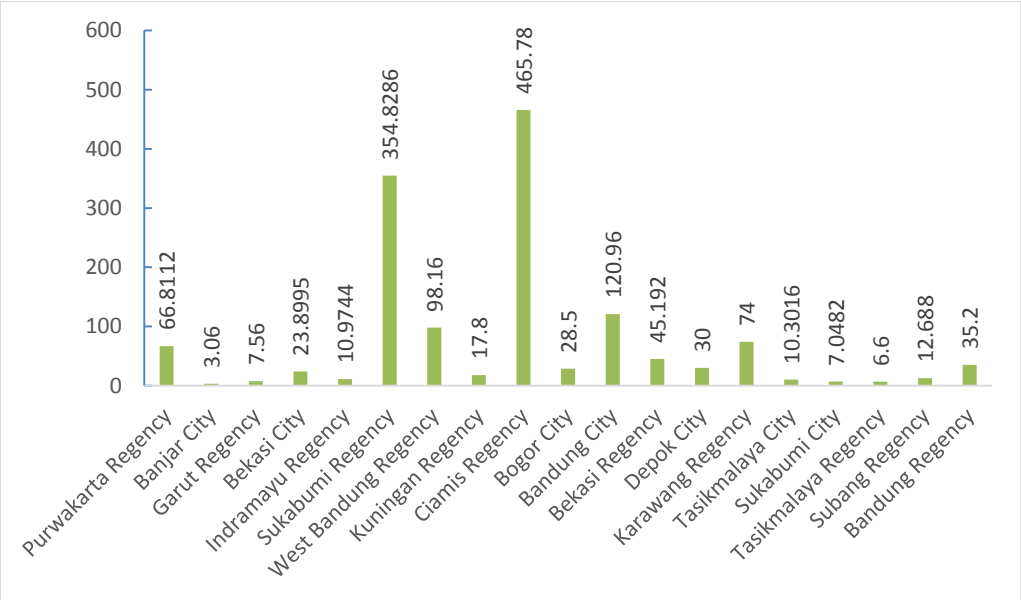

Figure 3. Volume of Paper Waste in West Java/day
Source: Ministry of Environmental

Paper also another problem regarding waste in West Java. The total volume of paper litter in West Java itself is around 906.53 ton. According to Figure 3, Ciamis Regency and Sukabumi Regency taken first and second place with a totalvolume of approximately 465,78 and 356,82 ton consecutively. Meanwhile, Banjar City contributes only 0,35 ton of paper waste.

Paper waste in West Java is usually caused by office and packaging activities. Paper waste is usually taken by scavengers,and they sell it to recycling business places. Paper waste is dominated by cardboard and cartons, the price of this kind of waste is Rp. 1200,-/kg. Newspapers are sold with the price of Rp. 800, - / kg. Wrapping paper food also dominates the paper waste, but this type of paper waste is not in demand because usually the condition of this type of paper waste has been damaged. They sometimes dry up collected paper waste to reduce water content so that the selling price will rise.

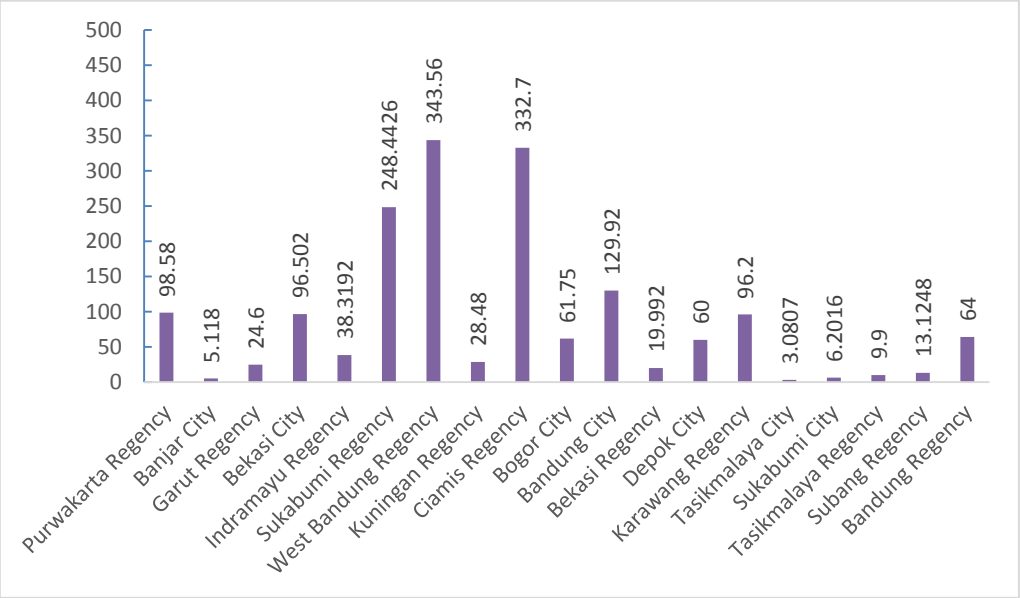

Figure 4. Volume of Plastic Waste in West Java/day
Source: Ministry of Environmental

According to figure 4, West Bandung Regency. Sukabumi Regency and Ciamis Regency given more plastic waste than other regions. The total of plastic waste from three regions approximately 924.7 ton, which represent 65% towards overall plastic litter in West Java.

Low density, strong, user-friendly design, durable, light, and cheap become a factor behind the increasing number of plastic use (Siddique, 2008). Most of plastic waste in West Java contribute by plastic bag with a percentage by 43.67%, followed by sheet type plastic which is 36.19%. This is due to the lifestyle of people who always use plastic bags and plastic sheet types as plastic wrappers. Plastic bags are also often used as a wrapper for other waste, such as organic waste from households.

Indonesia ranks as the second most significant contributor of plastic waste dumped into the sea yearly worldwide after China. The current Indonesian plastic recycling sector is unable to cope with the ever-increasing use of plastic packaging. Lack of human resources and technology are the main reason why this problem remains unsolved.

This also happens in West Java; people are very dependent ona plastic bag. Recently, some supermarket already usesan eco-friendly plastic bag which more biodegradable, but due to the high prices, traditional traders still use a plastic bag that is not environmentally friendly.

WASTE MANAGEMENT IN WEST JAVA PROVINCE

Removal and destruction of waste or other solid waste into the ground is a method that is always used because other processing alternatives have not been able to solve the existing problems. This method has many risks, primarily due to the possibility of groundwater pollution. The method of removing waste into the land, known as landfilling, is a method that is currently the most widely used because the cost is relatively cheap, the operation is easy and flexible in receiving waste.

Waste thrown into the environment will cause problems for life and environmental health, especially human life. These problems are now a hot issue and are highlighted because they require serious handling.

Regarding the regulations, there are some policies on waste in West Java. On a national scale, Law No. 18 of 2008 concerning Waste Management in Article 4 states that waste management in general aims to improve public health and environmental quality and make waste as a resource.

Regarding waste management, Article 5 states that the government and regional government have the duty to ensure the implementation of good and environmentally sound waste management in accordance with the objectives referred to in Law No. 18 of 2008. Here the task of the central government and local government is:

a. Develop and increase public awareness of waste management;
b. Conduct research and development of technology for reducing and handling waste;
c. Facilitating, developing and implementing efforts to reduce, handle and utilize waste;
d. Carry out waste management and facilitate the provision of infrastructure and facilities for waste management;
e. Encourage and facilitate the development of benefits resulting from waste management;
f. Facilitate the application of specific local technologies that develop in local communities to reduce and handle waste; and
g. Coordinate between government agencies, communities and the business world so that there is integration in waste management.

In Sukabumi, as the most substantial contribution to waste in West Java province, the daily waste production reaches 100 tons and goes to the Cikundul Final Disposal Site, 60 tons is managed by Sukabumi (Sammi) and TPS3R Waste Banks in 7 sub-districts. The Cikundul landfill is almost overloaded if garbage is not appropriately managed. The West Java Provincial Government plans to provide assistance for the provision of a new landfill for Sukabumi.

Addition of landfills is not the right solution. Sukabumi government started the clean and smart life movement in sorting out the garbage. The government stated that the community must be aware of sorting out the garbage from the start.

In Indonesia, the problem often faced is the mixing of different types of waste. This makes it difficult for waste to be managed. In management, the government must spend additional funds to sort waste. The most appropriate step that must be done is to change the pattern of society towards waste management.

Lifestyle is the most influential thing. Lifestyle is mainly defined by everyday practices that influence important

food waste related practices such as planning of purchases, handling of leftovers and management offlood risk. In order to reduce food waste levels cultural and social norms and values residing within people, as well as material and structural conditions out there in the experienced world, need to be addressed simultaneously. The figure below shows an illustration of interrelated major food waste drivers.

Another program conducted by the Sukabumi government is to convert organic waste into compost, fuel, and so on. Other wastes such as plastic, glass, or non-organic are made into handicrafts to improve the quality of the regional economy.

In Ciamis Regency waste management is one of the most urgent and environmental issues that must be addressed. Ciamis Regency has a 2020 vision towards Zero Waste Ciamis. One of the steps is through waste management by utilizing the Black Soldier Fly (BSF) or Maggot initiated by the Department of Public Housing, Settlement Area and Environment Ciamis Regency since June 2017.

The use of larvae (maggot) from these insects as decomposers of organic waste is becoming a trend. The garbage decomposed by this maggot has economic value. Previously, waste management was only transported to landfill by garbage workers and did not produce any added value. After this innovation, the entire area that manages waste into magot actually produces 200-300 kg of magot per day which is used as animal feed. This indicates that production growth has increased along with the increasing location of BSF management in 20 zero waste areas. Insect or maggot larvae are used to feed catfish, sheep, goats,and others.

In addition to environmental impacts, from that method, it can be seen how collaborative efforts built by the government, in this case, the Public Housing Agency, Settlement Area and Environment of Ciamis Regency involve community groups.
Based on the government of West Java Province, Some problem of Solid Waste Management (SWM) in the Municipalities and Regencies are:

- Limited budget for SWM
- Technology still open dumping or landfilling
- Lack of proper technology
- Lack of private participation
- Limited land availability especially for the metropolitan area

In the other side, there is a study about waste handling fraction. Bandung area as a capital of West Java, relies on landfills as an effort of waste management. The study that conducted by Zulfinar and Sembiring (2015) stated that around 88,81% of housholds chose to dispose their garbage to the landfill, while 3,38% dispose them to the empty lands. This also approving that most districts and cities rely on landfills as a waste management mechanism.

Budget is actually the main problem not only for West Java Province but also for all developing countries. Environmental problem usually set not as a main priority. Possible cooperation among local governments, provincial government and private sector in solid waste managementare needed to solve this problem.

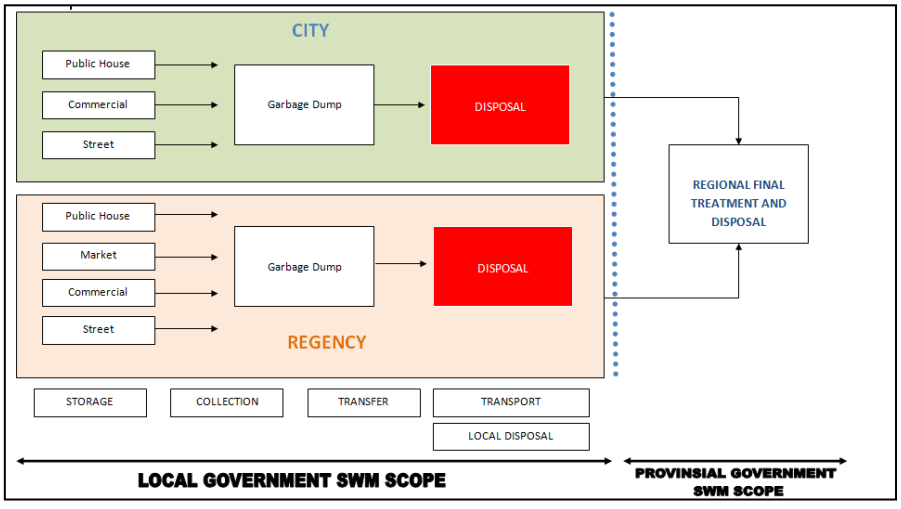

Figure 5. Scope Framework SWM in West Java Province

Provincial government use regionalization of landfill as part of solution. The government believes that it could Improve availability of budgeting by cooperation among local(s), provincial and central government, SWM technology (thermal and/or non-thermal), public and private partnership and implementing Reduce, Reuse, and Recycle (3R) concept.

In the waste management of West Java **(Figure 5)**, municipality or regency has authority to manage solid waste management from the source to the final treatment and disposal site. Meanwhile, Provincial government's authority is to manage regional solid waste management at the final treatment and disposal site. In this case, provincial government acts as cross-boundary cooperation.

So far, West Java lacks in research about waste management. There is no record regarding cooperation between government and education institutions to combat waste problem in West Java. Even though some actions were already made, but there is no evidence about the evaluation of the data.

CONCLUSIONS

Based on the Indonesia Ministry of Environmental Central Bureau of statistics data, there are four regions that contribute more waste, such as Ciamis regency, Sukabumi Regency, Bandung city,and West Bandung city consecutively. Mostly, about 56% type of waste is food and leftovers. The problem of municipal solid waste in West Java requires a complex solution. Some regions have their own policy in this case. Furthermore, all stakeholders must take responsibility through the process of reducing waste in West Java.

Acknowledgment

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