

# Implementation of environmental policy on solid waste management in Bondowoso Regency - Indonesia

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**Abstract.** Solid waste is an important issue in the urban area that is in line with the increasing of resident's number and the population activities. This study aims to analyze the problem and aspect related to waste management including operational-technical aspects, institutional aspect, legal and regulatory aspects, and community participation aspect in Bondowoso Regency. This study was descriptive research using a qualitative approach. The Data collected by literature study then analyzed qualitatively. There are laws correlated to solid waste management in Bondowoso, consist of: 1) Law No. 18 of 2008 on Solid Waste Management, 2) Law No. 32 of 2009 on the Protection and Environmental Management, 3) Government Regulations No. 81 of 2012 on Management of Domestic Solid Waste and Domestic-Like Solid Waste, 4) Local Regulations No. 3 of 2011 on Solid Waste Management In Bondowoso, and 5) Regent Regulation No. 82 of 2018 on Strategy and Policy Management of Domestic Solid Waste and Domestic Like Solid Waste. In addition, the Government of Bondowoso Regency has done many aspects of solid waste management, namely legal aspects, operational technical aspects, institutional aspects, and public participation.

## 1. Introduction

Environmental problems in the modern and global era are increasingly complex and have a negative impact on the lives of living things, especially humans. Managing the environment properly is a human obligation in accordance with the mandate of God Almighty. The 1945 Constitution of the Republic of Indonesia Article 28 H mandates that everyone has the right to live in physical and spiritual prosperity, to have a home and to enjoy a good and healthy environment. Solid waste is an important issue in the urban area that is in line with the increasing number of residents and also the improvement of population's activities. In their domestic life, every human produces a number of solid waste, both organic and inorganic waste. Solid waste consisting of 65% - 80% of organics fraction (biodegradable) [1,2]. The amount of solid waste production can increase exponentially with the population. However, this condition has not been accompanied by an increase in local government revenues that are commensurate with municipal solid waste management. Therefore, good waste management is a necessity of all urban communities. To make it happen, the government encourages the Regent/Mayor to apply the principles of good governance in environmental management. According to the World Health Organization (WHO), waste defines to something that is unusable, not liked or something that is derived to human activities (manmade), and waste does not create naturally.

The problems in solid waste management can be caused by four things [3]: (a) Institutions that are less optimal in carrying out their duties and functions in the field of solid waste management; (b) Operational techniques that are not optimal because they are not supported by sufficient resources,



including the small portion of the budget for waste management programs, lack of capacity and capability of human resources, lack of waste infrastructure both in quantity and quality; (c) Enforcement of environmental law, especially related to solid waste is still not optimal; and (d) Lack of community participation. These aspects are related to each others, and they cannot be separated in order to overcome solid waste issue among community. However, one of the concerns in waste management is related to the role of the community that continues to be improved with various programs and activities.

Bondowoso Regency also has problems in managing waste. The population continues to increase (population growth of 0.68% per year), the tendency of increasingly consumerist society led to increased volume, type and characteristics of the waste generated. The community in managing waste still uses the end-of-pipe paradigm, where waste is collected, transported and disposed of to the final waste processing site (Landfill). This process still causes various problems, especially on the behavior of people who litter. Besides, the major problem related to solid waste management occurs in the landfill, in which the area of landfill is limited but the waste continues to pile. This condition may pollute the soil, water, and air around the landfill area, where it could affect toward public health. Current conditions, The Bondowoso landfill is experiencing over. Even medical waste was also found scattered in the Bondowoso landfill. Pharmaceutical wastes and medical plastics werw disposed in uncontrolled landfill [4]. The above conditions indicate that solid waste management is still not optimal. Community participation in the solid waste management was found to be weak [5]. The impact of solid waste management policies on changes of the environmental quality and public health are clean, beautiful and comfortable. The government should keep the implementation of solid waste management regulations and increasing environmental education to community [6]. This study aims to analyze the problems and aspects of waste management covering operational technical aspects, institutional aspects, legal and regulatory aspects, and community participation aspects in Bondowoso Regency.

## 2. Research Methods

This study was descriptive research that is conducted in Bondowoso Regency, Indonesia. According to its form, this study was classified to diagnostic research, in which this study aimed to obtain information about the causes of a symptom or several symptoms of phenomena [7]. The type of data used in this study was secondary data, in which literature studies sourced from research reports, books, and scientific articles was used. Those secondary data was retrieved from scientific journals, programs or activity report documents, and also online media, where the literatures in accordance to the topic of study will be analyzed. The laws and regulations also reviewed in this study, consisting of Laws, Government Regulations, Regional Regulations, Regent Decrees, and Decisions of Head of Waste Management Agency. In addition, the data obtained were processed qualitatively.

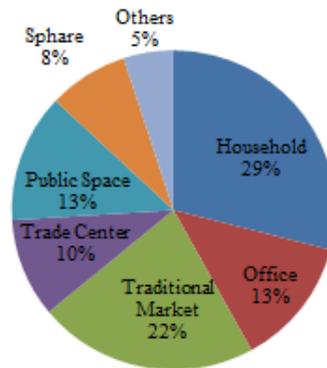
## 3. Result and Discussion

### 3.1 Overview of Waste Generation In Bondowoso Regency

Bondowoso Regency is geographically located in the eastern part of East Java Province with a distance of about 200 km from the Surabaya city, the capital of East Java Province. Bondowoso Regency is located at 7050'10" to 7056'41" South Latitude, and 113048'10" to 113048' 26" East Longitude. Bondowoso Regency has an area of 1.560,10 km<sup>2</sup> which is divided into 23 sub-district, 209 villages and 10 urban villages [8].

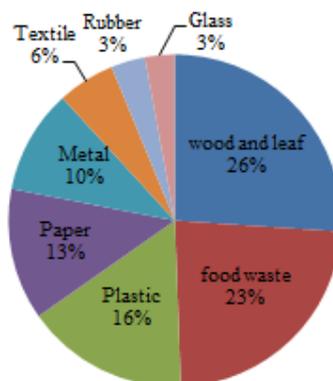
The Bondowoso Regency government in carrying out its duties in the field of solid waste management focuses its service coverage in urban areas. The area of solid waste management reaches 174,82 km<sup>2</sup> with a percentage of service area coverage of 96,74%. The total waste generation per day reaches 277,24 tons and in the regency, the capital area reaches 110,36 tons. Waste generation is strongly influenced by the population. Bondowoso Regency is included in the category of small cities with solid waste generation of 2,4-2,75 liters/person/day or equivalent to 0,625-0,7 kg/person/day. On average, solid waste generation in developing countries about 109,5-525,6 kg per person per year (0,3-

1,44 kg per person per day) [9]. The amount of waste generation based on the source in Bondowoso Regency can be seen in Figure 1.



**Figure 1.** The Amount of Daily Solid Waste Generation

Figure 1 shows that the largest waste generation comes from households (30%). This condition indicates that the solid waste management must involve community participation. The solid waste composition can be seen in Figure 2.



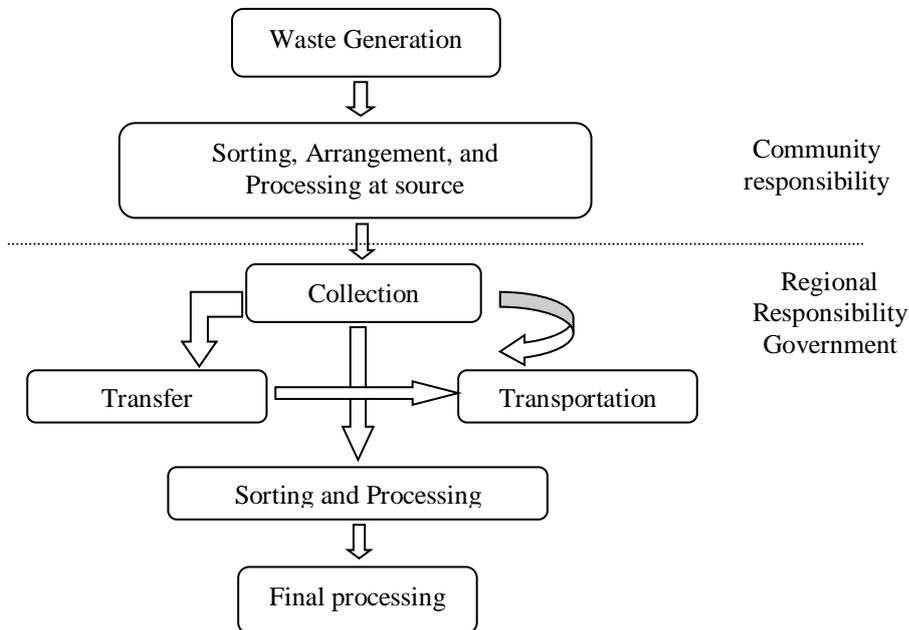
**Figure 2.** The Composition of Solid Waste Generation

The figure above shows that the composition of waste in Bondowoso Regency is a mostly organic waste. Most of the waste produced in Indonesia was dominated by organic waste (biodegradable) [10].

Inorganic waste is non-biodegradable, which is waste that cannot be biologically (aerobically and anaerobically) decomposed perfectly. Some examples including inorganic waste are plastic, glass, metal, textiles, and styrofoam, while organic waste is biodegradable waste which can be biologically (aerobically and anaerobically) decomposed. Some examples which include organic waste are food scraps, animal waste, leaf waste, and agricultural or plantation waste.

### 3.2 Aspects of Operational Engineering

The operational techniques of solid waste management carried out in Bondowoso Regency starting from the waste generation and then sorting until the provision of storage is the responsibility of the community as the waste producers. The collection stage until the transfer, transportation, provision of Temporary Trash Shelter (TPS), processing, and final processing stage at the Landfill is the responsibility of the regency government, in this case, the Department of Environment and Transportation of Bondowoso Regency. The operational mechanism for solid waste management in Bondowoso Regency can be seen in Figure 3.



**Figure 3.** The Operational Mechanism For Solid Waste Management In Bondowoso Regency

To support the operational techniques of solid waste management, Bondowoso Regency provides waste infrastructure and facilities as follows (Table 1).

**Table 1.** Solid Waste Management Infrastructure, Department of Environment and Transportation, Bondowoso Regency

Types of Infrastructure	Total		Capacity
<b>Arrangement Facility</b>			
Small trash bin	900	Unit	60 L
Public area trash cans	160	Unit	180 L
<b>Transfer facility</b>			
Garbage cart	100	Unit	1,5 m <sup>3</sup>
3 Wheel Motorized Cart	10	Unit	1,5 m <sup>3</sup>
Trash Pick Up	1	Unit	3 m <sup>3</sup>
<b>Collection facility</b>			
Temporary Trash Shelter (TPS)	1	Unit	4 m <sup>3</sup>
Transfer Depo	23	Unit	18 m <sup>3</sup>
Container Arm Roll	36	Unit	9 m <sup>3</sup>
<b>Transporter to landfill</b>			
Mini truck	1	Unit	3 m <sup>3</sup>
Truck	1	Unit	6 m <sup>3</sup>
Dump Truck	2	Unit	6 m <sup>3</sup>
Arm roll	5	Unit	6 m <sup>3</sup>
<b>Excavator</b>			
Waste sorting place in the landfill	1	Unit	10 m <sup>3</sup> /day
Dump site (Controlled landfill)	1	Unit	1,6 Ha

Source: Department of Environment and Transportation of Bondowoso Regency, 2018

The aspect of Operational techniques is one of the effort to control the growth of waste, but its implementation must still be adjusted with health, economy, engineering, conservation, aesthetics and environmental considerations [11].

Landfill in Bondowoso Regency is still not ideal, with an area of 1,6 Ha is not enough to accommodate the waste. The Landfill operational method is still using control landfills with limited equipment. Based on observations, Bondowoso landfill is not feasible called control landfill but is more suitable with open dumping. Because it does not comply with control landfill standards. The landfill is provided as a means of managing waste. The availability of landfills that meet the standards is proof of the government's responsibility to provide public services in accordance with Law No. 8 of 2018, articles 22 and 44 [12]. Nevertheless, the remaining problem is that not all waste can be transported. The potential negative impacts of the landfill on the surrounding area are pollution of water, land, air, and public health. Both the volume and hazardous substance of urban waste are high, where it could potentially pollute the environment around the landfill [6].

In order to increase the coverage and services quality in solid waste management, the Regent of Bondowoso issued a Regent Regulation No. 82 of 2018 concerning Regional Policies and Strategies for Domestic Solid Waste and Domestic Like Solid Waste. The essence of this Regent Regulation was a) policies and strategies in reducing generation and handling of waste, and b) instruction to continue an action related to improving its infrastructure, especially in the landfill, namely : (1) building for waste sorting and composting sites; (2) building for a methane gas installations; (3) leachate WWTP development plan. In addition, in the 2017 budget year, it was budgeted for land acquisition for landfill expansion, in which the Landfill will be operated using the sanitary landfill method and strives to innovate to carry out solid waste management with new technologies and promotions to reduce waste generation in the future [13].

### 3.3 Solid Waste Law and Regulation

The Law of the Republic of Indonesia Number 18 of 2008 concerning Solid Waste Management has just been promulgated in May 2008. This Law gives hope for a better waste management system, in the sense that the system is easy to apply and environmentally friendly. This Law also regulates in detail about how solid waste must be managed and what are the duties, obligations, and authorities of the government, regional government, private sector, and the community. To support the implementation of good governance in the environmental field, regulations need to be established from the central to regional level as a legal basis for its implementation. Solid waste management should be done by government centric and community centric [14].

Given the importance of solid waste regulations, the Bondowoso Regency Government-issued Regional Regulation No. 3 of 2011 concerning Solid Waste Management in Bondowoso Regency.

In the Republic of Indonesia Law Number 18 of 2008, the duties of the Government and Regional Governments (Article 6) are described as follows: (1) to develop and increase public awareness in solid waste management; (2) to conduct research, develop reduction technology, and handle solid waste; (3) to facilitate, develop, and carry out efforts to reduce, handle and utilize solid waste; (4) to carry out solid waste management and facilitate the provision of infrastructure and facilities for solid waste management; (5) to encourage and facilitate the development of benefits resulting from solid waste management; (6) to facilitate the application of specific local technologies that develop in the local community to reduce and handle solid waste; and (7) to coordinate between government agencies, communities, and the business world so that there is an integration in solid waste management.

Whereas the authority of the Regency/City Government (Article 9) are :

a. In carrying out solid waste management, the Regency/City Government has authority to:

1) Establish solid waste management policies and strategies based on national and provincial policies;

- 2) Carry out regency/city scale solid waste management in accordance with the norms, standards, procedures, and criteria set by the Government;
- 3) Foster and monitor the performance of solid waste management carried out by other parties;
- 4) Determine the location of temporary trash shelters, integrated solid waste treatment facilities, and/or final waste processing sites;
- 5) Carry out periodic monitoring and evaluation every 6 (six) months for 20 (twenty) years towards solid waste final processing sites with open disposal systems that have been closed; and
- 6) Compile and implement an emergency solid waste management system in accordance with its authority.

Of the various laws and regulations, those laws and regulations have managed solid waste management properly. But there are still many institutions and individuals who violate them. The sanctions contained in regulations, especially those concerning solid waste management, did not provide a deterrent effect for people who do not carry out solid waste management with environmental considerations so that it needs to be studied regarding the effectiveness of sanctions in law enforcement in solid waste management. The role of local government is very important in issuing policies on solid waste management. Law enforcement can be implemented by punishments (penalties) and incentive methods [7].

### *3.4 Solid Waste Law and Regulation*

The Government of Bondowoso Regency has duties and responsibilities that must be carried out in order to provide the best service to the community. According to the Law, one of its duties is to deal with solid waste issues. For this reason, it is necessary to establish an institution that handles solid waste. According to Saraswati (2007), the capacity of solid waste management institutions is smaller than the amount of solid waste that must be managed [15]. In Bondowoso Regency, Department of Environment and Transportation is responsible for managing solid waste, particularly in the cleanliness aspect. This refers to the Bondowoso Regency Regulation No. 7 of 2016 concerning the Organization and Work Procedure of Regional Technical Institutions. As a part of the Government of Bondowoso Regency, the vision of the Department of Environment and Transportation is to realize Bondowoso Regency as a quality environmentally based district in an effort to protect and to manage both the environment and natural resources in a sustainable manner towards a prosperous and dignified society. The organizational structure of Department of Environment and Transportation is accompanied by their respective functions and duties, so they are able to carry out solid waste management services properly. The establishment of the institution that is responsible for managing solid waste indicates that the Bondowoso Regency Government had implemented the policy.

The establishment of the Department of Environment and Transportation of Bondowoso Regency means that the Government of Bondowoso Regency is organizing the institution that is concerning to solid waste management. Solid Waste management institutions carry out multi-disciplinary tasks involving technical, management, economic, and socio-cultural activities based on the characteristics of the people served [15]. Community should be aware and make sure these regulations protect public health and the environment [16]. The form of solid waste management institution should be the Regional Office and the Regional Public Service Agency (BLUD), in which BLUDs can receive income from levies, grant funds, private investment, other business results from solid waste management, and regional expenditure budget (APBD) [15].

Solid waste management institutions will work properly if it supported by adequate resources, especially human resources. According to WHO, human resources are more important than technology [17]. The sufficient number of workers can support the performance of solid waste management agencies [18]. In addition, the ability of workers takes important role within solid waste management, in which education, experience, and good work behavior are factors related to the ability of workers.

### *3.5 Community participation in solid waste management*

Community participation in managing solid waste is a very important thing. This is also contained in legislation related to the obligations of the community in solid waste management. Community participation is focused on individual and household levels. Article 12 of the Republic of Indonesia Law Number 18 of 2008 regulates the obligations of the Regional Government and the community relating to the domestic solid waste management, as follows: Every person in the domestic solid waste and domestic like solid waste management is obliged to reduce and handle solid waste in an environmentally sound manner. The community can participate in solid waste management organized by the Government and/or Local Government (Article 28). Participation, as intended, can be done through: (1) Giving Proposal, consideration, and advice to the Government; (2) formulation of solid waste management policies, (3) giving advice and opinions in resolving solid waste disputes.

While further provisions concerning the form and procedure of the community participation as referred to are regulated by Government Regulation and/or Regional Regulation. Bondowoso Regency Regulation Number 3 of 2011 explicitly regulates the community participation in solid waste management, namely in article 19 which contains the community participation in solid waste management through (a) doing reduce, reuse, recycle (3R); (b) giving proposal, consideration and advice to the regional government; (c) formulation of solid waste management policies; and (d) giving advice and opinions in resolving solid waste disputes. The regulation was strengthened by the Regent Regulation and in line with the Minister of Environment Regulation No. 13 of 2012 concerning the 3R guidelines through the Solid Waste Bank. The 3R program can be integrated with the waste to energy program [19]. Some bases for community participation are : (1) provide information to the government; (2) increase people's willingness to accept decisions; (3) help legal protection; (4) democratize decision making [20]. Policies to improve the domestic solid waste management system can be done by enforcing the law and completing existing government regulations, then doing the following things : (a) Law enforcement and the imposition of sanctions on the solid waste management violators as an effort to foster community, apparatus and stakeholders; (b) Completing and improving legal products needed for the implementation of solid waste management; (c) The weak law enforcement against violators of garbage dumping is a challenge for law enforcers to implement local regulations to be implemented seriously and fairly [21-22]. The need for socialization to improve public knowledge about sanitation, especially solid waste management [23]. Socialization can be done in the form of promotional media, such as booklets [24].

The follow-up of Bondowoso Regency Regulation No. 03 of 2011, especially to increase community participation is by establishing community-based solid waste management programs, namely by encouraging the establishment of solid waste banks. Solid Waste banks involve any stakeholders : local government, communities, private sectors, NGO and mass media [25]. The establishment of various solid waste banks was determined by a Decree of the Head of Department of Environment and Transportation of Bondowoso Regency. Solid Waste banks are an alternative model in solid waste management, especially in reducing the amount of solid waste and can improve the local economy [26].

## **4. Conclusion**

1. The Bondowoso Regency Government has attempted to carry out solid waste management in accordance with applicable laws and regulations starting from the central level to the regional level. These regulations include Law Number 18 of 2008 concerning Solid Waste Management, Law Number 32 of 2009 concerning Environmental Protection and Management, Government Regulation Number 81 of 2012 concerning Domestic Solid Waste Management and Domestic Like Solid Waste, Regional Regulation Number 3 of 2011 concerning Solid Waste Management in Bondowoso Regency. In these regulations, good solid waste management is regulated, including community participation.

2. Various aspects of solid waste management have been carried out by the Bondowoso Regency Government, including legal aspects, operational technical aspects, institutional aspects, and community participation aspects.

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