

The Role of a Compost House in Producing Externalities, Based on an Islamic Perspective

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The city of Surabaya received Adipura trophies from the Indonesian Government in 2019 because of its very good performance in environmental management, especially waste. The Mayor made a program, part of which was the construction of a compost house in Bratang. Waste management in the Bratang Compost House has a positive externality, that is proven by odour and by the sound produced not exceeding the specified standards. In addition, the existence of compost houses can help preserve the environment of Surabaya and become a source of waste electricity generation (PLTSa: Waste Power Plant). The data in this study were obtained from interviews, observations, and literature studies. It was then analyzed using explanatory descriptive techniques. The analysis shows that the Bratang compost house produces more benefits than harm. This is in accordance with Islamic values and therefore worthy as an operation. It is expected that the results of this study can be a reference for governments in other regions managing waste, as something beneficial for the community, environment, and local government. This paper is also expected to be an additional literature for government, academics, and those who care about the impact of waste management from an Islamic perspective.

Key words: *Bratang compost house, cost benefit analysis, externalities.*

Introduction

Environmental pollution may occur because of the development efforts actually aimed at improving living welfare. Some development efforts do not take into account the surrounding environment (Titienberg and Lewis, 2012), whereas the principle of sustainable development is very important and therefore must be a guideline, because it adheres to the concept of development that considers environmental considerations or “eco development” (Abdurrahman, 2003).

There is, in the concept of sustainable development, a principle that efforts to manage and maintain the environment must become the responsibility of all humans, especially Muslims, to balance the carried-out activities and their environment (Ghafar, 2018). Moreover, Allah says in *Surah Al Baqarah* (Abd and Rizk, 1997: 26, 30) and *al-Qashash* (Rahardjo, 2010: 77) that humans were created as vice-regents on earth and, therefore, must always remember not to damage the earth. As a vice-regent, humans have two attributes, namely formal positions and functions of Muslim personalities. First, the formal office means the obligation to carry out the mandate of God by realizing the law of God fairly, correctly, and protecting the entire community and the region he leads. Second, the function of Muslim personality states that all Muslims must obey Allah's law, and not be fooled to preserve and develop prosperity on earth (Yusuf, 2016).

Regarding the management and preservation of the environment, it turns out that the city of Surabaya was the only city to receive the Adipura Kencana Trophy award in 2019. The award was given because the government and the people of the city of Surabaya have performed excellently in managing a sustainable environment, in strategic garbage management and good environment governance.

Garbage is becoming a serious problem in urban areas because population growth is quite large (Ogbonna, 2007). Surabaya has been categorized as a city that produces a large volume of garbage. In addition, garbage will have negative impacts such as environmental degradation (Ogbonna, 2007), increasing the concentration of sulfuric acid in the atmosphere in the lake region (Nature Publishing Group, 1958), and resulting in the death of organisms in the water (Nature Publishing Group, 1958). However, proper garbage management would greatly benefit the community, institutions, and environmental preservation. Such management includes, among other things: composting organic garbage for soil fertility (Rajagopal and Bansal, 2015; Abd and Rizk, 1997), saving annual expenditure of more than one percent in multi-process food and beverage companies (Bates and Phillips, 1999), as well as generating income and improving living welfare (Mansyur dan Ulum).

With regard to garbage management, Surabaya has several strategies. One is the establishment of the Bratang Compost House. It was the first compost house in the city of Surabaya, and became a reference in developing a compost house and a garbage power plant. Many researches – which are accessible - have been done on the Bratang Compost House. They include the study of “The generation and reduction of compost house garbage and the calculation of greenhouse gas emissions in East Surabaya” (Addiansyah dan Herumurti, 2017); “Physical and chemical quality in the indoor Bratang Compost House, Surabaya” (Ariesa, 2012); “Exploration of the Surabaya Compost House in biology learning to shape the character of students who care about the environment” (Mudo, 2016); “Phylogenetic analysis and anti-microbial activity of streptomycetes from compost soil in Surabaya” (Kurnijasanti, 2017) and “Aspects that affect the success and failure of the Bratang Compost House” (Diviana). However, there is still no research that examines the externality of compost houses based on Islamic perspectives, whilst the research is important to find out whether the value of the benefits generated from garbage management exceeds the costs incurred, or vice versa. The use of net present value (NPV) and benefit-cost ratio (BCR) calculations aims to state whether implementation of the project is feasible (Suparmoko, 2008).

This paper aims to find out the externalities produced by Bratang compost house activities, to investigate the feasibility and sustainability of the existence of Bratang compost house. And last, to explain the differences between Islamic and conventional perspectives on externalities.

This research will benefit the government in Indonesian cities and districts. It will be a consideration when making policies for managing garbage into something more useful that does not impact the community and surrounding environment negatively. It will explain for the community if there are results of the Bratang compost house which can be used free of charge.

Literature Review

Compost House

Based on KITA data in Maeda (2011), Surabaya has a very large composition of organic waste. It is 55% of the total waste, 13% of road waste, 10% of wood/bamboo, 8% of plastic, 8% of paper, and 8% of other waste. This fact has encouraged the Surabaya City Government to be more intensive in handling organic waste, namely by establishing compost houses. Currently there are 26 active compost houses in Surabaya (DKRTH, 2018). The management of organic waste in compost houses can reduce waste in the Benowo Final Disposal Site (TPA), and positively impact the surrounding environment both directly and indirectly.

The compost house is a fairly large place and is used to manage organic waste into compost. Compost is an organic material (food waste and yard waste) that can help in fertilizing plants (United States Environmental Protection Agency, 2017). Composting is quite easy and inexpensive, because it is a process of decomposition of leaves, grass, and other materials to be used as fertilizing substances (Michigan Department of Environmental Quality, 2009). The advantages of the compost house are: (Al-Qur'an) Better household environment (Abd and Rizk, 1997), greener and cleaner streets (Abdurrahman, 2003), environmental education (Addiansyah dan Herumurti, 2017), employment (Adisasmito, 2009), production of vegetables using compost (Ariesa, 2012), waste segregation and promotion of recycling (Bates and Phillips, 1999), and income from selling compost (Maeda, 2011).

Principles of Environmental Management in Islamic Perspectives

Several principles in Islam are used in environmental management (Sarhar (1985), in Fachruddin (2005) and Nasrullah et al. (2015)), namely:

a) *Khilafah* (leadership)

The principle of *khilafah* can be used as the principle for developing environmental policies. Its application is expected to make every individual accountable and not produce waste, when utilizing and exploiting natural resources.

b) *Istishlah*

Public benefit (*al-istishlah*) means prioritizing the benefit of the people. This is one of the absolute conditions in considering the preservation of the environment. Allah (*subhānahu wa-ta'ālā*¹ (SWT) ("May He be praised and exalted") has forbidden humans to commit acts that are environmentally destructive (Qur'an, sura ar-Rum (Sugiyono, 2013) verse 41). The main purpose of preservation and management of natural resources and ecosystems is to realize the benefit and welfare (*istishlah*) of all beings on earth.

c) *Amanah* (Principle of Trust)

This principle requires that humans accept nature as a trust (*amanah*) from God and as a place of moral struggle.

d) Ecological Balance/*I'tidal* (Principle of Ecological Balance)

Al-Qur'an (sura 54 [al-Qamar] verse 49 etc.) teaches humans that Allah (SWT) has created the universe in good proportion and size, both in a quantitative and qualitative manner. Thus, humans will not experience scarcity as long as they keep the safekeeping of God on this earth as well as possible.

e) Inter-generational Equity/Sustainable Use (Principles of Sustainability)

This principle emphasizes the human obligation to use resources wisely and always consider the surrounding environment, not be greedy and excessive, and always think for the future.

Externalities

Adisasmito (2009) suggested that waste management efforts would mean producing environmentally friendly and safe waste for the surrounding community. Garbage usually causes a bad smell and disrupts environmental sustainability. In addition, garbage will also pollute the soil, and can cause disease. Karjadi (2012) argues that externalities occur when the welfare of economic actors is influenced by their activities and the activities of other economic actors. Based on their impacts, externalities are divided in two:

- a. Positive externalities or external economy, namely the actions of someone who benefits others, and is not allocated in the market (Prasetyia, 2013). In other words, other parties will get benefits that are not reflected in prices (Mukhlis, 2009).
- b. Negative externalities or external dis-economy, namely the activities of either consumption or production that create costs for other economic actors due to the behaviour of other parties who are not responsible or not careful. Much environmental pollution is a dominant example of this negative externality (Prasetyia, 2013).

It should be noted that views differ on externalities, as between Islamic economic and conventional economic perspectives. If the conventional economy considers that negative and positive externalities are just as bad, Islam states that only negative externalities are bad and therefore must be minimized or even eliminated. This is implied in the Qur'an 2: 279 which states: "You are not detrimental and not harmed."

Cost-Benefit Analysis

Suparmoko (2008) states that a cost and benefit analysis (CBA) is a method of systematic assessment of all benefits or costs that will arise from government actions in implementing pollution prevention. Calculation of this benefit and cost analysis can be done by calculating NPV and BCR, with the following formulas:

$$NPV = Bd + Be - Cd - Cp - Ce$$

where

NPV = Net Present Value

Bd = direct benefit

Be = external benefit

Cd = indirect cost of the project

Cp = cost of environmental preservation

C_e = environmental cost

$$BCR = \frac{B_d + B_e}{C_d + C_p + C_e}$$

where

BCR = benefit-cost ratio

$(B_d + B_e)$ = total benefit

$(C_d + C_p + C_e)$ = total cost

The results of the project procurement calculation state that if the $NPV > 0$ and B/C ratio > 1 , then the benefit value is greater than the value of the costs incurred; hence the project is feasible. Conversely, if the NPV value is < 0 or B/C ratio < 1 , the benefit value is smaller than the value of the costs incurred, and the project is not feasible because it will later harm various parties whether directly involved or not.

Research methodology

The theoretical foundation is a guide so that the focus of research accords with facts in the field (Kuncoro, 2001). This research was conducted through participant observation research methods and case studies. Primary and secondary data are used.

Primary data are obtained directly from the informant (Muhammad, 2008), through interviews and natural observations (Hasanah, 2016) at the Surabaya Bratang Compost House and the Green Cleaning and Open Space Service (DKRTH), Surabaya Municipality. Secondary data are obtained from company profiles, information from companies related to research, and other supporting data (Sugiyono, 2013). Data collection is done through:

a. Documentation

Each process of proof is based on any type of source, both written, oral and imaged (Nilamsari, 2014);

b. Literature study

Relevant theoretical references are obtained from trusted books, journals, articles, research reports and websites (Neyman, 2012);

c. Data on waste utilization, gasification in Bratang Compost House, and goods procurement costs. The data are managed by the author so that the amount of income or benefits and expenditure for organic waste management are known, to analyze NPV and BCR (Adisasmito, 2009).

The analysis technique used is descriptive explanatory. The validation of the study was carried out using source triangulation techniques. A multi-method approach is used by researchers in collecting and analyzing data (Rahardjo, 2010).

The number and type of informants are determined by considering the informant's requirements for source triangulation, i.e:

- a. Variation. The informants chosen must vary, ie not be uniform. "Variation" means that the informants must vary in, for example, their type of work, role, expertise, and so on.
- b. Competence. All informants who are going to be chosen must be competent people. If one wants to examine the state of an office, for example, then the office secretary would be the right informant. Another example is, if you want to examine the financial management of an organization, the treasurer or head of finance will be a suitable person.
- c. Right on target. In interviewing informants, researchers must constantly focus on the purpose of the research. Sometimes informants answer the questions of the researcher with numerous stories, so that they deviate from the answer to the question itself. In matters like this, the researcher must be able to turn the direction of the conversation without having to hurt the informant.

Given these three conditions, the informants chosen in this study are (Kuncoro, 2001):

- a. Leader of the Compost House.
- b. Compost House staff.
- c. People who live around the Compost House.
- d. Users of the product produced.

Results and Discussion

The Bratang Compost House is one of the compost houses in the city of Surabaya which serves as a composting place for Surabaya city parks (owned by both individuals and offices) and reduces the volume of waste to TPA Benowo (DKRTH, 2018). In addition, the supervisor of the Bratang Compost House explained that twig waste can be used as gasification material in PLTSa Bratang, and large wood is used as material to burn road asphalt.

Bratang Compost House was built in 1995 and began operating in 1996. Its location is on Jl. Raya Manyar. The building area is 391.9 m². The capacity of organic waste that can be processed is 12 m³/day. The average compost production is 8 m³/day. Processing was carried

out by eight workers with a supervisor. The supervisor will be responsible to the coordinator of the Surabaya Compost House.

In addition to producing compost, the Bratang Compost House can also produce electricity. In 2016, the Surabaya City government built a Waste Power Plant (PLTSa) at the same location as the Bratang Compost House. This is because the tree branches used as raw materials for PLTSa come, and are externalities from, composting in the Compost House. The boundaries of the Bratang Compost House are: North: Flora Park; East: Flora Park; South: Manyar Road and the Gubeng Sub-district Police Station; West: Bratang Temporary landfill and Center for Street vendors, Nginden.

Compost Bratang House workers were interviewed. The majority of them have received direct training from pre-existing workers, regarding managing waste into compost. In addition, supervisors also provide their own tricks and directions. The impact of waste management on workers is the smell and dust, and noise, but this is not a problem for them because they are used to it. They also argued for the positive impact generated from waste management in the Bratang Compost House, namely that the indigenous people of Surabaya get free compost, as do parks in Surabaya. In addition, it reduces the amount of waste to TPA Benowo, to help regenerate the environment by the surrounding community.

It can be observed that they are competent people in their duties. Not only that, they are aware of the disturbances that their work might cause, so they know what they have to do to minimize the disruption.

That disturbance can be in the form of foul doors, noise, or dust. To find out the intensity of this disorder and the response to it, the researchers asked questions to those who incurred the greatest possible impact. They are employees and workers, as well as visitors to the Flora Park.

The compost house is near the police station and flora garden. Next to the compost house is a parking lot for pedi-cabs and “angguna”. The author got information from several individuals near the compost house that the sound produced from the management of waste was tolerable; they did not feel disturbed. Some visitors to the flora garden mostly did not feel the impact. This is different from the police who have felt the impact, as well as people who park near the compost house. They feel the impact, but they do not complain because they do not interfere with their activities.

Interviews show that stakeholders were not disturbed by the Bratang Compost House activities. Stakeholders are defined as employees or workers, surrounding residents, and visitors to the Flora Park. Some even stated that there was no interference at all.

Next, the research questions were submitted to the subjects responsible for carrying out the House activities. The questions were around the work process and its accountability. In addition, as part of their responsibilities, the officials must also pay attention to the protests of the local residents.

From the results of interviews with House supervisors and coordinators in Surabaya, activity took place normally, in terms of how it should be for an official government agency. The Standard Operating Procedure (SOP) is also clear. Each party knows who is responsible to whom. In addition, their caution in carrying out their duties has resulted in praise from the surrounding community, from whom there has been no protest so far.

As noted, the main activity of the House is to process waste into compost and gas. From these activities it is expected that benefits can be obtained in the form of electricity, fertilizer and efficiency.

Waste can generate electricity, and is used as four-point lighting in the Compost House and three points in Flora Park. In addition, waste management in the House can save government expenses of Rp. 41,666,453.3 (2016), Rp. 38,208,851.9 (2017), and Rp71,823,166.7 (2018). Of course the amount is quite large and can be allocated to other needs. Calculations can be seen at Appendix A.

The Compost House is able to manage waste which is 2,029,000 kg, into compost amounting to 315,000 kg or equivalent to Rp. 719,998,650.00 in 2017. In 2018, 1,761,500 kg of waste was successfully turned into 324,000 kg of compost, equivalent to Rp. 740,570,040.00. It was utilized for community plants, the city government, and special installations in the Surabaya area for free. This means that the Surabaya city government saves money, because of the use of waste for goods in the environment. The data on waste management into compost in Surabaya from 2016 to 2018 can be seen in Appendix B.

Following are analyses of waste management costs and benefits generated. The author had problems in getting data before 2017, because of changes in officials and employees in the DKRTH, Surabaya City. Based on the results of interviews with the Head of Waste Utilization Section, DKRTH, Surabaya, Ms. Khoirun Nisa', changes must be made to passwords and systems to see previous budgeting. As a result, the author only uses data for 2017 and 2018 in calculating NPV (Net Present Value) and BCR (Benefit – Cost Ratio). The results of these calculations are shown in Table 6 below.

Table 1: NPV and BCR Calculation Results

Year	NPV	BCR
2017	636.794.451,9	6,244
2018	688.673.197,7	6,566

Source: Appendix C

Table 1 shows that $NPV > 0$ and $BCR > 1$. That means it is feasible to run and continue the waste management project in Bratang Compost House. It is very likely that the location of the House will be converted into a shop, restaurant or other location that can generate profits or income, due to inappropriate locations. Thus, the location has been appropriately used as a compost and PLTSa house.

A review of the activities and results of the Bratang Compost House from an Islamic economic perspective is also presented:

1. *Khilafah*: The attitude to managing waste is carried out every day and in accordance with the guidelines. This attitude has a positive impact on the environment and the streets in Surabaya because it is clean, the compost produced is able to meet the needs of city parks, and the people of Surabaya City receive it for free and in almost unlimited quantities.
2. *Istishlah*: Arranging risk management in the event of protests from the community, namely managing waste outside hours of rest, procurement of soundproofing equipment, negotiations, procurement of dynamo machines. Workers have been given equipment and instructions to avoid injury. Until now, there have been no protests from the surrounding community because the smells and sounds that arise do not interfere with their activities. Also, workers do not experience injury and are familiar with the effects of waste management.
3. *Amanah*: Managing waste is done as well as possible and adhering to a pre-determined schedule. It can have a positive impact on society, the environment, and the government.
4. Ecological balance: Management is carried out according to standards so that ecological balance is guaranteed. In this case, waste is utilized properly so that the ecological balance is not disturbed.
5. Sustainability: Caring for and maintaining the sustainability of the compost house, so that it can provide benefits continuously, both for life today and for future generations. The fertilizers produced will be beneficial for the preservation of nature, and a good natural life will be obtained. The gasification produced will also reduce the use of diesel fuel which is a non-renewable natural resource.

The Bratang Compost House has more positive externalities than negative externalities. Thus it can be said that the existence of the House is in accordance with Islamic values. Externalities as viewed from an Islamic perspective are different from externalities in the

view of mainstream, conventional economics. In the mainstream, both positive and negative externalities are considered as bad. In the Islamic view, only negative externalities from production activities are declared bad and, therefore, must be minimized or even eliminated. If there is an externality in the economy, Islam requires only positive externalities because it produces benefits. This is implied in the Qur'an, chapter Al-Baqarah verse 279 which says: "You are not detrimental and not harmed".

Conclusions

1. Waste management in the Bratang Compost House has a positive impact on the externalities of the general public, the environment, and institutions if viewed from the economic side of natural resources and the environment in an Islamic perspective. This can be seen in the management principles of *khilafah*, *istishlah*, *amanah*, ecology, and sustainability. Even though there is an odour and sound effect caused in the management of the waste, it does not produce a bad impact, and even becomes commonplace in the environment around the compost house.
2. The results of calculating the cost and benefit analysis of waste management in Bratang Compost House in 2017 and 2018 obtained $NPV > 0$ and $BCR > 1$. This means that the project carried out is feasible.
3. The mainstream view states that positive and negative externalities are equally bad. But, in the Islamic view, only negative externalities from production activities are declared bad and, therefore, must be minimized or even eliminated.

Suggestions

1. For waste managers in the Bratang Compost House, it is hoped that they will continue to strive to improve waste management, so that the negative impacts of management generated, such as bad odours and sounds, can be minimized. Socialization of the surrounding community can be done so that they can use compost in the compost house for their plants and their own conditions as needed.
2. For the community, if the impact from the House is disturbing their activities, it should be immediately communicated well to the parties in the House.

Appendix A: Data on Waste Utilization in the Bratang Compost House for Gasification 2016 - 2018

Year	Raw Materials		For Power Usage (watts)	Cost / Expenditures saved (per year) (Rp)		Total (Rp)
	Branch (kg)	Plastic (kg)				
				Electricity	Solar Purchases	
2016	5.877	4.099	722.752	986.455, 295	40.680.000	41.666.455,3
2017	11.450	4.560	769.350	1.128.851,87	37.080.000	38.208.851,9
2018	11.905	3.935	860.890	1.263.166,68	70.560.000	71.823.166,7

Source: Data on DKRTH in the utilization of waste in 2019 (processed)

Appendix B: Waste Utilization Data in the Bratang Compost House for Compost 2016-2018

Year	Types of Materials (m ³)					Amount of waste treated (m ³)*	Total expenditure on compost (Kg)	Cost efficiency by the government for garden compost in Surabaya**
	Branch	Market garbage	Park garbage	Household garbage	Road-sweeper garbage			
2016	2,474	361	338	344	5	1.311.000	258.500	590.856.035
2017	3,292	455	1,125	637	0	2.029.000	315.000	719.998.650
2018	3,042	456	644	596	0	1.761.500	324.000	740.570.040

Source: Data on DKRTH in the utilization of waste in 2019 (processed)

Notes: *Provisions for conversion from m³ to kg from DKRTH are 1 m³ multiplied by 500 kgs.

** Market price of 1 kg (Rp 16.000,00 ÷ 7 kg) = Rp 2,285.71.

Appendix C

1. Benefit

- Total benefit 2017 = 719.998.650 + 38.208.851,9 = Rp 758.207.501,9
- Total benefit 2018 = 740.570.040 + 71.823.166,7 = Rp 812.393.206,7

2. Cost

- Total cost 2017 = Rp 121.413.050



- b. Total cost 2018 = Rp 123.720.009
- 3. Net Present Value
 - a. NPV 2017: $758.207.501,9 - 121.413.050 = 636.794.451,9$
 - b. NPV 2018: $812.393.206,7 - 123.720.009 = 688.673.197,7$
- 4. Benefit/Cost Ratio
 - a. BCR 2017: $758.207.501,9 \div 121.413.050 = 6,244\%$
 - b. BCR 2018: $812.393.206,7 \div 23.720.009 = 6,566\%$

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