

A Study Of The Economic Supporting Capacity Of New Landfill In The Western Region Of Bojonegoro Regency

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ABSTRACT

There are always problems caused by waste at various regional levels, starting from the village, sub-district, district/city levels even at the national and state levels. The rate of population growth is increasing rapidly which has an impact on increasing the amount of waste. The Landfill for waste in Bojonegoro Regency had been overloaded since 2019, which in 2020 will operate a new Landfill in the western region. Improper planning will be able to cause financial losses but on the contrary if done with proper planning it will create opportunities to advance the economy for the surrounding community. The supporting capacity of the Landfill is an important thing that had to be considered in planning the development and operation of the Landfill, in order to be able to support the activities of using the landfill in a sustainable manner. The purpose of this research was to find out whether the new Landfill was feasible to operate by considering the estimated costs incurred and the income earned. The calculation of the economic supporting capacity was carried out using the Landfill economic valuation method. The results of the calculation of the economic carrying capacity of the new landfill had a benefit cost ratio (BCR) of 1.16, with an IRR value of 35.48% so that the New landfill activity was feasible to carry out.

INTRODUCTION

Everyone inhabiting this earth produces waste, since it is produced from their activities and cannot be separated from the waste that comes from the activities of organisms. As time goes by, the number of people inhabiting the earth is increasing. This result is an increase in the

amount of waste produced, as well as rapid technological growth which results in various types of waste. This is faced by a regional leader, starting from the hamlet, village, sub-district, district/city or even in a country level.

The population in Bojonegoro is always increasing. This is shown in the last 8 year period from 2010 from the results of the population census as many as 1,210,375 people and in 2018 as many as 1,311,042 people, in which it experienced an increase of 100,667 people or 8.3% (BPS Bojonegoro, 2019). Based on data obtained from the Bojonegoro Regency Environmental Service, the waste generated by the Bojonegoro Landfill in 2018 was 263.81 m³/day or 92.34 tons/day, where the waste service area at the Bojonegoro Landfill only serves 9 sub-districts in Bojonegoro Regency.

The increase in waste amount will have an impact on the amount of waste that can be managed by the Landfill. The current state of the Bojonegoro Landfill is overloaded, so a new one is needed. This Landfill was built in 1990 with a total area of 4.9 ha. The new Landfill is planned to be built in the western area of Bojonegoro which will begin to be prepared in 2019 and will start operating in 2020. This waste management certainly has a risk of impact, positive impact and negative impact. So that each stage of waste management activities that have the potential to change environmental conditions needs to be studied regarding its economic carrying capacity. The economic carrying capacity of the landfill is an important thing that must be considered in planning the development and operation of the landfill, in order to be able to support the activities of using the landfill in a sustainable manner. (Maria et al., 2018). The results of the supporting capacity analysis can be used as a tool or method for planners to help determine policies to be applied to an area. The policies that will be set will be very closely related to the various implications inherent in them. Bojonegoro Regency has not

possessed yet a study on the economic supporting capacity of the new western Landfill, so it is necessary to conduct an analysis to find out whether this Landfill is feasible to operate or not.

LITERATURE REVIEW

Economic Support of Landfill

Based on the definition of environmental supporting capacity in UU 32 of 2009, environmental supporting capacity is the ability of the environment to support human life, other living things, and the balance between the two. In another sense, the supporting capacity of the environment is the upper limit of the growth of a population when the total population can no longer be supported by existing facilities, resources and the environment (Suryani et al., 1987). If it is analogous to the supporting capacity of the Landfill, it will have an understanding of the surrounding environmental conditions in supporting the sustainability of the Landfill. The supporting capacity of the Landfill in terms of the economic aspect shows the value of the Landfill's ability to maintain its sustainability from the economic aspect. In the study, an economic feasibility analysis was carried out using the economic valuation method by comparing the economic valuation of the positive and negative impacts of the existence of Landfill.

According to (PSSAL, 2005) economic valuation is the science of making choices. In making choices from alternatives faced with choices about the environment, it is more complex, compared to making choices in the context of purely private goods. Therefore, the basic principle in economic valuation is an estimate of the price based on the community's ability to pay (WTP) provided for environmental

services or willingness to receive compensation for a disturbance /degradation of environmental quality (WTA). In the context of the environment, what must be compared is one item with a price (priced good, private good), and one item without a price (unpriced good, public good).

The main objective of the economic valuation of environmental goods and services is to be able to place the environment so that it is known as an integral part/component of any economic system. Thus environmental valuation should be an integral part of sectoral priorities, in determining the balance between conservation and development, and in selecting environmental standards. (Defra, 2004)

The supporting capacity of the landfill from the economic aspect is studied to obtain the economic feasibility value of the landfill using the economic valuation method, where economic valuation is a method used to provide quantitative values for goods and services produced by natural resources and the environment regardless of market value or non-market value. (Salma & Susilowati, 2004)

The economic value of the Landfill takes into account the benefits that can be measured by the value of money (Tangible) in the form of direct benefits, indirect benefits and benefits that cannot be measured by the value of money (Intangible). Where the direct benefits are

in the form of income from recyclable materials, the use of compost as fertilizer and/or a substitute for land cover for the landfill, the use of bio gas as an energy source and income from the use of ex-landfill land for the purposes of green open space. Meanwhile, the indirect benefits include an increase in the value of land and building prices and a reduction in the cost of treating raw water for drinking water. As for the benefits that cannot be measured in monetary terms, such as reducing the level of pollution, maintaining the preservation of water resources and reducing the degree of conflict caused by waste pollution.

The economic assessment is carried out by comparing the benefits received by the community with the costs incurred, both in the form of operating costs, maintenance costs and the cost of returning capital. From the results of the economic feasibility study, Landfill is declared economically feasible, if the economic benefits are greater than the costs incurred, either in the form of operating costs, maintenance costs and capital recovery costs.

RESEARCH METHODOLOGY

Variables and Indicators

This research examined several aspects and variables that affected the supporting capacity of the New Landfill in Western Region of Bojonegoro Regency. The variables and indicators were described in the following table:

Table 1: Variable and indicator of economic benefits of landfill

Aspect	Variable	Indicator
Economic Benefits of Landfill	Benefit Valuation of Landfill	Labor Absorption Value
		Projected levy value
	Cost Valuation of Landfill	Result Projection value of Landfill
		Projection value of waste sorting
	Investment value	
		Operational value

Economic Valuation Data Analysis

In analyzing data for economic valuation of landfill activities, the stages were:

1. Identification of the process and parties involved in the management of the New Landfill for the Western Region of Bojonegoro.
2. Identification of costs incurred as a result of activities in the New Landfill of Bojonegoro Western Region.
3. Estimating the potential benefit value of the activities at the New Landfill of Bojonegoro Western Region.

Total Economic Value of Landfill

The data obtained were analyzed qualitatively and quantitatively. Data processing was carried out using tables by comparing the results of the assessment of the benefits and disadvantages of landfill activities. Then, it analyzed the benefits and impacts of Landfill activities with calculations within the next 5 years with a discount rate of 7.49% based on the Bank Indonesia deposit interest rate in January 2020.

RESULTS AND DISCUSSION

In calculating the supporting capacity of the Landfill from the economic aspect, it was carried out by calculating the value of benefits compared to costs (B/C Ratio). Where the value of benefits referred is the value of direct benefits such as absorption of labor, and retribution for incoming waste as well as indirect benefits such as the potential for sorting inorganic waste that can be sold directly by scavengers and selling organic compost. While the costs in this research were investment costs and operational costs which would be

calculated for the next 5 years, impact evaluation was not included because the new landfill had not been technically operational, so the measurement was used to compare it with investment and operational costs.

Investment Cost of Landfill

The new Landfill for the western region of Bojonegoro was only built in 2019 and operated at the end of 2020. The initial investment was in the form of purchasing land covering an area of 3.9 Ha, where if converted at the current price of Rp. 200,000/m², the investment value for the purchase of land is 7.8 billion rupiah. As for other investments, such as infrastructure development, purchase of heavy equipment and vehicles, as well as operation of landfill activities in the amount of Rp. 11,174,025,000

Operation of Landfill

In the operations of Landfill, fixed and variable costs were costs that must be spent every year to finance landfill operations. As for the operational costs of the Bojonegoro New Landfill, it would be the same as the operational costs of the Bojonegoro Old Landfill because the technology and management capacity was the same as the old one.

From the calculation results and based on Landfill budgeting documents, it was found that the total fixed costs for Landfill for 1 year were Rp. 3,092,659,250 as in table 2, with details, including: 1) For Landfill workers with a total of 19 people with a regional base salary of Rp. 2,016,000 per month, so that in 1 year the need for labor costs was Rp. 459,648,000. 2) Building operation and maintenance costed Rp. 125,000,000 per year, 3) Landfill area maintenance costs were Rp. 89,000,000 per

year, 4) Office utility costs were Rp. 27,000,000 per year, 5) Installation maintenance was Rp. 75.84 million per year, where the cost was calculated from 3% of the value of movable assets, vehicles and heavy equipment, and 6) Depreciation costs of Rp 558,701,250 per year with 5% depreciation calculation of the asset value.

For variable costs, there were only 2 costs, they were the cost of producing compost and the cost of landfilling. The first was that variable costs were obtained from compost production, with a production cost of Rp. 300 per kg of waste

that was processed into compost. The potential for organic waste to be used as compost in the Bojonegoro new Landfill was 3,010 tons/year. So that the annual cost of compost production was Rp. 903,294,000.00. in addition to the cost of compost production, landfilling costs become variable costs later, in 1 year with a prediction of incoming waste amounting to 213,544 m³/year with a landfilling cost of Rp. 4000 per m³ of waste, so that the total need for landfilling in the landfill for 1 year was Rp. 854,176,000.

Table 2: Annual Operational Costs of New Landfill in Western Region of Bojonegoro

No	Type of Fee	Volume	Unit	Price	Amount (Rp)
Fixed Cost					
1	Salaries and wages of employees / year	19	Person	24.192.000	459.648.000
2	Building operation and maintenance costs	1	ls	125.000.000	125.000.000
3	Landfill area maintenance and maintenance costs	1	ls	89.000.000	89.000.000
4	Office utility costs	1	ls	27.000.000	27.000.000
5	Maintenance of installations, vehicles and heavy equipment	3%		2.528.000.000	75.840.000
6	Cost of depreciation	5%		11.174.025.000	558.701.250
Variable Cost					
1	Compost production 2.79 tons/month	3.010.980	kg	300	903.294.000
2	landfilling activities per year	213.544	m ³	4.000	854.176.000
Total of Operational Cost					3.092.659.250

Benefit Value of Landfil

In the valuation of benefits, there were 2 benefits that were assessed, including direct and indirect benefits. Direct benefits were benefits that were directly felt on the operation of the Landfill, such as the income of workers and retribution income from the waste that went to the Landfill. While the indirect benefits were in the form of potential income for the community who became

scavengers through the calculation of the potential value of recycling and resale of waste, besides the sale of processed waste products including indirect benefits from the existence of a Landfill. From the results of the calculation of benefits value as in table 3, the total benefit of the new Landfill in the western region of Bojonegoro was Rp. 9,395,492,000 per year. The new Landfill in the western region of

Bojonegoro required 19 workers with a 2020 regional base salary of 2,016,000/month.

The direct benefits felt by the working community and the results of the waste retribution were as follows:

Table 3: Table of Total Income of Workers and Scavengers

Types	Income/month	Income/year
Workers	Rp 38.304.000	Rp 459.648.000
Scavengers	Rp 597.550.042	Rp 7.170.600.500
Amount	Rp 635.854.042	Rp 7.630.248.500

According the table, the direct benefits felt by people who become workers are Rp459.648.000 / year.

From the table, the direct benefits felt by people who become workers were 459,648,000 / year. While the indirect benefits are assessed from the potential of waste that can be taken advantage of for resale by scavengers. The potential for this

waste was calculated from the composition of the waste that went to the Landfill, including: 10.18% paper, 7.86% plastic, 2.04% metal (BPPT, 1994) of the total volume of potential waste going to the Landfill which was estimated at 320 m³ per day, then after being converted into units of kg and the selling price was explained in the following table:

Table 4: Potential salable waste generated by scavengers

Type of waste	Waste m ³ /day	Composit ion Coef	Amount of Waste m ³ /day	Waste to Sell (10%)	Weight (kg/m ³)	Weight of Waste (kg/hr)	Price (Rp/kg)	Total (Rp/Hr)	Total (Rp/Th)
Paper	320	10,18%	32,576	3,26	1800	5,864	1000	5.863.000	1,876,377,000
Plastic	320	7,86%	25,152	2,52	517,5	1,302	1500	1.952.00	624,775,000
Metal	320	2,04%	6,528	0,65	7850	5,124	2500	12.811.000	4,099,584,000
Amount								20.627.000	6.600.737.000

Table 4 showed the potential sales of inorganic waste by scavengers of IDR 6,600,737,000 per year. This value is obtained from the potential for daily waste that goes to the Landfill which could be recycled and was suitable for resale multiplied by the specific gravity. Then this value was multiplied by the price of waste (trash selling). So that the total potential income of scavengers was obtained for one year.

In addition, the next indirect benefit was the sale of compost, where the

price of bulk compost was Rp. 500. The New Landfill in the western region of Bojonegoro was capable of producing 2.1 tons of compost per year. The amount of 2.1 tons of compost that comes from the amount of organic waste that was processed would produce 70% compost of the total organic waste that was processed every year. So the benefit from selling compost was Rp1,053,843,000 per year, as described in table 5.

Table 5: Benefit Valuation of Landfill

No	Type of Fee	Volume	Unit	Price	Amount(Rp)
Direct Benefit					
1	Job Opportunity (Rp/year)	19	org	24.192.000	459.648.000
2	Waste Retribution	213.544	m3	6.000	1.281.264.000
Direct Benefit					1.740.912.000
Indirect Benefit					
1	Potential sales of anorganic canoes by scavengers	4.301.500	kg	1.535	6.600.737.000
2	Sales of compost per year	2.107.686	kg	500	1.053.843.000
Indirect Benefit					7.654.580.000
Total Benefit					9.395.492.000

Total Economic Value of Landfill

From the calculation obtained cash flow for 5 years with an interest rate/discount of 7.49%. The total economic value of landfill management in 2020 -2024 was calculated from the costs incurred and the benefits obtained. The result of the calculation of the cost was Rp. 94,023,977,742.83,- while the result of calculating the value of the benefit was Rp. 109,342,087,280,-, thus the total economic

value of the existence of the new Landfill in the western region of Bojonegoro was Rp. 15,318,109,537,43,-, This meant that waste management activities in the informal sector had so far the benefits were greater than the environmental costs borne by the community and the surrounding environment. Details of the calculation could be seen in Table 6.

Table 6: The total economic value of the new Landfill in the western region of Bojonegoro

Tahun	Diskonto	Biaya Investasi	Biaya Operasional	Manfaat Langsung	Manfaat tidak Langsung	Net cash flow
2019	7.49%	11,174,025,000				(11,174,025,000)
2020			14,266,684,250	11,174,025,000	7,654,580,000	4,561,920,750
2021			15,335,258,900	12,010,959,473	8,227,908,042	4,903,608,614
2022			16,483,869,792	12,910,580,337	8,844,178,354	5,270,888,899
2023			17,718,511,639	13,877,582,804	9,506,607,313	5,665,678,478
2024			19,045,628,161	14,917,013,756	10,218,652,201	6,090,037,796
Jumlah		-	82,849,952,743	64,890,161,370	44,451,925,910	

The impact and potential of the existence of Landfill that had not been fully utilized from these calculations included the use of methane gas as an energy source, health benefits, land value increases, and economic growth in the vicinity.

Meanwhile, the impact that would occur had not been fully utilized from calculations such as the impact of air pollution, water, decreased value of agricultural production and others.

The value of the Benefit cost ratio (BCR) of the new Landfill in the western region of Bojonegoro was 1.16, the figure was based on the calculation:

$$\begin{aligned} \text{BCR} &= \text{PV of benefits} / \text{PV of costs} \\ &= \frac{94.023.977.743}{109.342.087.280} \\ &= 1,162917055 \end{aligned}$$

From the calculation, it was found that the BCR was more than 1 (BCR>1) which meant that the value of the benefits of the project was greater than the value of the project cost. So this project was feasible to be implemented.

POLICY IMPLICATIONS AND RECOMMENDATIONS

The Landfill that would be built could be a business opportunity for the surrounding community, so that they were able to increase their income and advance their economy. For this reason, the government should make regulations that support this.

CONCLUSION

For the supporting capacity of the New Landfill for the Western Region of Bojonegoro, from the economic aspect, it was judged by the value of the benefits obtained by the existence of the New Landfill on the investment and operational costs was 1.16, with an IRR of 35.48% at the interest rate set at 7.49%, and the payback period (PP) for the new Landfill in the western region of Bojonegoro for 2.76 years. This showed that based on a BCR of more than 1 (1.16>1), the value of the benefits of the project was greater than the value of the costs of the project, so that the New Landfill activity was feasible to carry out. Meanwhile, the IRR value showed a

number greater than the bank interest rate (35.48% > 7.49%), which meant that the New Landfill activity could be accepted.

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