Cost and Benefits Analysis of Implementing Waste Bank in Gunung Kidul Beach Area, Yogyakarta

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Abstract. Waste banks are community-based waste management programs, which group waste based on their selling value. The application of garbage banks in coastal areas needs to be done because the more beach visitors, the more garbage is also increasing. The purpose of this research is to see the potential application of garbage banks in coastal areas. The method used is Cost-Benefit Analysis (CBA) with secondary and primary data. The results show that the application of waste banks can be done based on the investment criteria applied. Net present value shows a positive value, BCR > 1, IRR > discounted interest, and Payback period < 1 year. It can be concluded that the garbage bank program will positively impact the progress of tourism in terms of economic aspects.

1. Introduction

Indonesia is a country that has great tourism potential. Many foreign tourists come to visit for a vacation. Various tours in Indonesia that can be visited by tourists locally and abroad [1]. One of the best tours that Indonesia has is the coastal region.

The coastline of Indonesia is 95,181 kilometers long, making it the world's second-longest. In addition, with 17,508 islands, Indonesia is the largest global archipelago. Indonesia is a maritime country with natural resources that may be focused on increasing tourism value [2].

Yogyakarta Special Region is ranked second after Bali in the scope of National Tourism [3]. One area that has a variety of tourism potential is Gunungkidul Regency. As the largest district in the special region of Yogyakarta Special Region Province (DIY), Gunungkidul Regency has the potential and resources that can be developed to support regional programs in the field of tourism. Its geographical location in the south of Java islands makes Gunungkidul Regency one of the most popular marine tourism destinations by tourists visiting DIY. This is a good thing for the local government to increase income, such as in Dieng Regency, which has a famous natural tourism impact on increasing people's income from 53.3% to 68.5% [4]. However, on the other hand, it also causes environmental problems, namely garbage.

High tourist interest in tourism provides excellent benefits to the regional economy. The number of benefits provided by the tourism sector to the regional and national economy must undoubtedly be accompanied by the environmental conservation of coastal areas [5]. Practice in the field shows a
contradiction between the high level of tourist visits and the quality of the environment. The higher the level of tourist visits, the more significant the potential decrease in the quality of these attractions’ environment. The most common environmental problem in tourist areas is the problem of garbage. The higher the interest of tourists towards tourist attractions, the higher the possible amount of waste generated. The potential of this waste comes from tourists and waste generated by businesses around the coastal area. For example, Padang Beach is a favorite destination for residents of the Padang Regency and its surroundings, but much garbage is scattered along the beach. At the same time, the ability of the beach to accommodate tourists in a Tourist Attraction has a tolerance limit [6]. Based on the problems outlined, there needs to be a program carried out by tourism managers to reduce the amount of waste produced by visitors and traders. The program can be a garbage bank. Garbage banks collect and sort waste and train their customers to be aware of environmental cleanliness.

This research aims to calculate the costs needed to manage waste banks that will be carried out. In addition, the calculation of the benefits felt by the existence of garbage banks is also done. After knowing the costs and benefits of garbage procurement, an analysis is carried out for environmental improvement efforts.

2. Method
Primary data is provided by the Environment Agency and the Center Department of Statistics, while secondary information is collected by the Environment Agency and the Central Bureau of Statistics. The tool for financial analysis was utilized.

For calculating the entire costs and benefits incurred throughout a project, the Cost-benefit Analysis (CBA) approach is utilized.

2.1. Net Present Value (NPV)
Conducted in order to know the differences between of present value of benefits and the cost flow. The NPV is calculated using the following equation:

\[ NPV = \sum_{t=1}^{n} \frac{B_t-C_t}{(1+i)^t} \]

Information:
- \( B_t \) : benefits earned
- \( C_t \) : costs incurred
- \( n \) : number of years
- \( i \) : interest rate (discount)

The NPV is used to determine investment viability; if the NPV is more significant greater than zero, the project is considered profitable and practicable. If the (NPV) is zero, the project is either not worth pursuing or does not generate a cost value that can be applied. If the (NPV) is zero, the project will recoup its initial investment or generate a balanced profit.

2.2. Benefit Cost Ratio (BCR)
The cost-benefits ratio is calculated by comparing discounted income and expenditure with the Social Opportunity Cost of Capital (SOCC). The formula for the benefit-cost ratio is as follows:

\[ BCR = \frac{dB}{dC} \times 100 \% \]

Information:
- \( dB \) = discounted benefits
- \( dC \) = discounted costs

If the BCR is greater than one, the project is worthwhile, if the B/C ratio is less than one, the project is unprofitable, and if the B/C ratio is less than one, the project is unprofitable.
2.3. Payback Period

Payback period is used to determine the period of return of an investment made.

\[
\text{Payback period} = \frac{I}{A_b}
\]

Information

\(I\) : The amount of investment needed

\(A_b\) : net benefit discount that can be obtained on each year

A decent payback period is less than the project's specified lifespan.

2.4 Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) determines the degree of investment in a waste bank. Both models' IRRs are derived by first determining the NPV1 and NPV2 values. The NPV1 value must have a positive score for the discount factor that has been calculated. Unlike NPV2, IRR NPV2 must be calculated by trial and error by increasing the discount factor score to achieve a negative score. If the NPV1 and NPV2 results are known, the calculation is completed using the formula below.

\[
IRR = i + \frac{NPV}{NPV - NPV'}(i' - i)
\]

IRR : Internal rate of return

NPV : net present value

I : Interest level

3. Results and discussion

Before analyzing the cost of procurement of waste banks, the first group identifies the types of garbage received from tourists, such as small plastic and large plastic. These types of garbage include small plastic bottles, large plastic bottles, plastic packaging, used cans, and others that can be sold to garbage collectors. After the garbage sorting is done must determine the purchase price of waste obtained from customers.

Garbage bank customers are merchants or managers of beach tourism. Garbage bank officers do weighing and then calculate the amount of money that will be put into the customer's bookkeeping. The waste will be sold to the garbage collector to be processed to the final result, used as margin or profit for the waste bank manager. The profit is as additional income to manage existing facilities in the coastal area.

The amount of garbage is also projected based on the number of visitors who come during 2020. Considering that in 2020 there is a pandemic covid-19, then the data in April and May does not exist. Furthermore, the calculation of CBA will start from the calculation and grouping of costs. There are three sub-components used, namely customer savings, investment costs, and operational costs.

3.1. Calculate the cost of procuring garbage banks in coastal areas

Customer savings are obtained based on the total waste obtained from the overall weight of waste is multiplied by the purchase price of waste that has been set. The number of customers is assumed to be 100 people. Furthermore, the amount of waste produced in one year averages 3.5 tons. Thus, the total savings of customers in the first month is IDR.8,665,151.00.

Investment costs are a set of expenses incurred for commercial activities in the form of commodities having a set lifespan. Vehicle rental, land rent, calculator purchase, ballpoint, savings book, garbage sacks, boots, gloves, sitting scales, garbage cans, masks, and handwashing kits are all investment charges employed in the economic calculation activities of garbage banks. The investment fee amounted to IDR. 5,825,000.00.

Operational costs are costs carried out related to artistry during the business, such as electricity and labor. In this case, operating expenses only include labor wages and vehicle fuel purchases. The amount of operating expenses is IDR 290,000.00.
The total cost needed for the creation of a garbage bank in the first month is IDR. 20,605,151.61. To details, waste bank cost component are stated in Table 1.

| Name of Cost        | Component                          | sum  | unit          | price  | total price     |
|---------------------|------------------------------------|------|---------------|--------|-----------------|
| Merchant Savings    | (junk sales)                       | 100  | person        | 70000  | 70000           |
| Rent Motor Viar     | 1 Times per month                 |      | 25000         |        | 25000           |
| Land lease          | 1 year                            |      | 0             |        | 0               |
| Calculator          | 3 Unit                            |      | 20000         | 60000  |
| balpoin             | 5 dozen                           |      | 15000         | 75000  |
| Savings book        | 100 Pcs                           |      | 5000          | 500000 |
| sack (55x75)        | 100 Pcs                           |      | 3000          | 300000 |
| AP 9303 boots       | 3 pair                            |      | 85000         | 255000 |
| latex gloves        | 3 pair                            |      | 25000         | 75000  |
| 50kg sitting scales | 1 Unit                            |      | 350000        | 350000 |
| 30-liter garbage    | sorting barrel                    | 16   | Unit          | 90000  | 1440000         |
| mask                | 2 Box                             |      | 50000         | 100000 |
| buckets of hand     | washing and soap                  | 2    | Unit          | 50000  | 100000          |
| Labor Wages         | 5 person                          |      | 250000        | 250000 |
| Vehicle fuel costs  | 4 liter/month                     |      | 10000         | 40000  |

3.2. Calculate the benefits of benefits obtained by the existence of garbage banks in coastal areas

In general, two benefits are considered in the CBA. The advantages are both direct and indirect. The benefits that are directly known in quantity due to the existence of productive activities are known as direct benefits. The gains acquired outside of production operations are referred to as indirect benefits. The benefits of obtaining waste banks for tourism management are primarily examined in terms of direct benefits.

Customer administration, the value of the remaining assets, and the value of the remaining assets are all direct benefits of the waste sales sub-component. The volume of waste multiplied by the selling price of waste to the collector equalizes the value of rupiah gained from the garbage sale. Waste is frequently sold at a higher price than the buyer paid for it. Furthermore, as additional costs for waste bank managers, the administration is included in the benefits of garbage banks. At the same time, the remaining assets' value is the value of goods that can be resold if the garbage bank is no longer operational. The remaining value of the assets is accumulated in the 12th month. The amount of benefits in the first month is IDR. 11,029,105.00. In full, direct benefits are stated in table 2.
### Table 2. Direct Benefits

| Benefit Immediatel y | Component | unit | price | amount of price |
|----------------------|-----------|------|-------|-----------------|
| Sale of garbage to collectors | 1 | 10,829,105.43 |
| Customer administration | 100 | 2000 | 200,000 |
| remaining assets (end of year) | | | 200,000 |
| **Sum** | | | **11,029,105** |

3.3. **Analyze the cost of junk bank benefits for customers in an effort to improve the environment**

The overall expenses and benefits incurred throughout an economic life are calculated using CBA. In the form of garbage banks, one year is the economic age employed in tourism management activities. It is required to calculate the increase or decrease of expenditures employed during the project's life cycle. Four criteria are utilized to invert a cost-benefit analysis. Some investment criteria include NPV, BCR, Internal Rate of Return, and Payback Period.

a. **Net Present Value (NPV) Calculation**
   In terms of financial analysis, the NPV should be greater than zero.
   
   \[ \text{NPV} = \sum (\text{Net benefit} \times \text{Discount Factor}) \]
   \[ \text{NPV} = 574,815.99 \]
   The net present value, or \( \text{NPV} > 0 \), is positive, according to the calculations. This demonstrates that garbage bank operations in coastal areas are worthwhile.

b. **Calculation of Benefit Cost Ratio (BCR)**
   The BCR is the next investment criterion, which seeks to determine the cost-benefit ratio. If the project's gross B/C ratio is less than one, it is said to be viable.
   \[ \text{BCR} = \frac{\sum \text{DB}}{\sum \text{DC}} \]
   \[ \text{BCR} = \frac{31,966,005.25}{31,391,999.26} \]
   \[ \text{BCR} = 1,018 > 1 \]
   BCR more than 1 means that garbage bank activities in coastal areas are worth running.

c. **Payback Period Calculation**
   Garbage bank calculations show that NPV has a positive value after 11 months running in the 12th month.

d. **Internal Rate of Return (IRR)**
   The IRR calculation shows 12.25%, less than the interest rate. It can be said that the activities of the garbage bank for one year with calculated costs and benefits are worth running.

### 4. Conclusion

Based on the discussion that has been presented, it can be concluded that the costs needed include selling costs to customers, investment costs, and operational costs. The benefits obtained are direct benefits that include waste sales, customer administration, and residual value. The results of cost-benefit calculations based on investment criteria, waste banks are worth using. The results of this study can be used as consideration by beach managers and local governments for waste management policymaking. This
research requires deeper laboratory tests on the characteristics of existing waste, especially the impact of plastic on the life-cycle.

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