

## ANALYSIS OF ELECTION OF INFRASTRUCTURE FINANCING SCHEMES IN THE DEVELOPMENT OF REGIONAL WASTE MANAGEMENT IN THE DISTRICT AND CITY OF PROBOLINGGO

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### ABSTRACT

Regional waste management is a crucial aspect in ensuring environmental sustainability and public health in the Probolinggo Regency and City. One of the main challenges in the development of regional waste management is the financing of the necessary infrastructure to achieve these goals. This research aims to analyze the selection of infrastructure financing schemes in the development of regional waste management in the Probolinggo Regency and City. The research methodology involves field surveys, interviews with relevant stakeholders, and economic and financial data analysis. The investment analysis method used includes calculations of Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit Cost Ratio (BCR), considering Availability Payment financing. Additionally, this study will also analyze Life Cycle Cost (LCC) while considering various financing schemes, including government financing schemes (APBN/APBD) and non-government financing schemes such as Public-Private Partnership (PPP) schemes like Build-Operate-Transfer (BOT) and Regional Loans. The results of the analysis show that all financing schemes, both government and non-government, yield viable results. These three schemes are then validated through Focus Group Discussions (FGD) using financial and non-financial criteria. The selected financing scheme is the regional loan, with the second alternative being APBN & APBD. Meanwhile, the BOT Public-Private Partnership scheme is considered as the last alternative financing scheme.

**Keywords:** Infrastructure Financing, Financing Schemes, Regional Waste

### INTRODUCTION

Waste management is a critical aspect in modern and sustainable city development. Increasing urban life accompanied by population growth causes the volume of waste produced to also increase significantly (Sodiq et al., 2019). This is not only faced by all countries in the world but also in Indonesia. As a developing country with rapid economic growth and an ever-increasing population, Indonesia is faced with serious challenges in managing waste

effectively and sustainably. The Sustainable Development Goals (SDGs) target until 2030 is to ensure the availability and sustainable management of clean water and sanitation, including waste. (Weststrate et al., 2019) The problem of waste management in Indonesia can be seen from several indicators, namely the high amount of waste produced, the low level of waste management, the limited number of final waste disposal sites, waste management institutions and financing. Waste handling that is not managed properly

will cause environmental pollution and health impacts. Currently, the construction of a TPA (Final Processing Place) for waste is still the main choice for waste management in Indonesia (Weststrate et al., 2019).

The development of Regional Waste Disposal Sites is a positive step in reducing the negative impact of waste on the environment (Akib et al., 2022). By combining waste from several areas into one place, we can optimize the management process and minimize the risk of pollution. Regional TPA development must be viewed in a long-term context (Pang & Lu, 2004). Changing consumption patterns and population growth must be considered in infrastructure planning to ensure that the Regional Landfill can meet future demands. To fulfill these basic infrastructure needs, the government should ideally carry out development using funding sourced from the APBN/APBD (Kurniati & Suryanto, 2018). However, the need for development funding originating from within the country continues to increase while the available funding sources are very limited, so the government requires the involvement of the private sector in developing existing infrastructure.(Artiningsih et al., 2019)

The Indonesian government has committed to continuing to improve and innovate in growing investment attractiveness and ensuring that the involvement of the private sector or business entities is not hampered(Patu & Akhmadi, 2021). Investment is the key word in the process of accelerating infrastructure development, which in detail can be realized in the form of a cooperation agreement. Through this mechanism the government can facilitate its interests and the interests of investors simultaneously, this is the best mechanism to attract investors so that they can use the technology and innovation they have for the benefit of the country(Dutz & Sharma, 2012).

Furthermore, to assist in the financing and funding dimension, the Central Government, through the Ministry of

Finance, is paying special attention to the waste management sector by providing Project Development Funds (PDF) for waste management projects that use the Government Collaboration Scheme with Business Entities or what is known as PPP. This is also confirmed in the 2022 Financial Note which states that waste management has become one of the priority sectors that will be encouraged by the Government Cooperation with Business Entity (KPBU) scheme. The PPP scheme in waste management is one of the infrastructure financing schemes in order to provide solutions not only related to financing aspects but also to ensure the creation of adequate services in waste management in Indonesia.

According to PUPR Ministerial Decree Number 21/PRT/M/2018, waste infrastructure is one of the sectors that can also be financed using the PPP scheme(Karsayuda et al., 2023). Based on Presidential Decree no. 38 of 2015 PPP scheme, business entities build or finance construction implementation as well as operations and maintenance during the cooperation period (concession). The return on investment comes from income from beneficiaries (user fees) and payments by the Government (availability payments). The benefit of PPP for the government is that it accelerates the provision of basic infrastructure for the community(Trebilcock & Rosenstock, 2015).

The implementation of this PPP scheme of course still takes into account the legal umbrella in the waste management sector in Indonesia, namely Law Number 18 of 2008 concerning Waste Management and its derivative regulations(Thi, 2019). It is hoped that projects in the waste management sector that use the PPP scheme will be able to attract financing sources from the market, in this case investors and financing institutions. Financing from this market is one way of strengthening the financial dimension that will accelerate the achievement of waste management

infrastructure development. Apart from that, through a cooperation structure that emphasizes the provision of waste management services, this PPP scheme will provide greater certainty of achieving adequate services in waste management as a targeted result (outcome) and not only focus on the physical construction of the project or its output (output).

Waste management in East Java Province itself up to 2020 was 54.91% of the target of 100% in 2025 as set by the Central Government in the National Policy and Strategy (Jakstranas) for Management of Household Waste and Similar Types of Household Waste. Based on waste data, East Java Province shows that waste reduction in 2020 was 14.81% with a target in 2025 of 30%. In the aspect of waste handling in 2020, it was 40.09% with a 2025 target of 70%. Meanwhile, unmanaged waste is 45.10%, which is quite a high percentage and is still far from the target achieved in 2025.

Probolinggo Regency is a district located on the north coast of East Java Province (Suyarso et al., 2023). It has an area of  $\pm 1,696.16$  km<sup>2</sup> with a population of  $\pm 1,165,298$  people. The Probolinggo Regency TPA is in Seboro Village, Krejengan District, and was inaugurated in 2011, with an area of approximately 5.1 hectares which can accommodate waste from 75 TPS and serves 20 sub-districts and 4 sub-districts that are still unserved. The final disposal system implemented at the Seboro TPS is a sanitary landfill system. This sanitary landfill system has been operational since 2012 which is divided into two parts, namely, cell 1 is the old effective land which has been closed (finished operating) with an area of 1.5 Ha (Open dumping) and cell 2 is the new effective land which is currently operating with an area of 2.3 Ha (Sanitary landfill system). The waste reduction target based on Regional Policy and Strategy in 2019 is 20%, while waste handling is 80%. Waste generation in 2020 from January to August was 57,747.98 m<sup>3</sup> with a weight of 9,720,910 kg. At the moment

Similar to the Regency, Probolinggo City is one of the cities in the northern region of East Java Province which has an area of around 5,667 Ha with a population of  $\pm 235,211$  people. The Final Processing Place (TPA) for Probolinggo City, namely TPA Bestari, is located in Sukabumi Village, Mayangan District, Probolinggo City, and has a land area of 4 Ha. Currently the Bestari TPA has three cells where the first cell is overloaded, the second cell has almost reached full capacity and the third cell was just built in 2019. The target for handling waste based on Regional Policy and Strategy (Jakstrada) in 2019 is the target for handling household waste and waste similar to household waste by 80% and a reduction target of 20%, with the achievement of Probolinggo City in 2019 reducing 13.98% and 36.34% for handling. In 2020 (January-June 2020) the reduction was 9.22% and treatment was 41.04% (Source: Environmental Service, Probolinggo City, 2020). In accordance with East Java Province Regional Regulation Number 5 of 2012 concerning Provincial Spatial Planning for 2011-2031 in article 48 paragraph (6), an Environmental Management Infrastructure System Plan has been established, namely the Probolinggo Regional TPA Development Plan which serves Probolinggo City and Probolinggo Regency. In order for the Probolinggo Regional TPA Development plan to be successful, a well-structured plan is needed that outlines the specific infrastructure and the needs to provide its benefits.

Waste, which is a problem in Probolinggo Regency and City, must be handled appropriately and quickly so that the impact on the environment can be minimized (Pribadi et al., 2021). One strategic step that can be taken is through synergistic waste management with a regional approach, so that the potential that exists in one Probolinggo Regency/City can be utilized well. The aim of building the Probolinggo Regional Waste Landfill is to provide environmental sanitation services

with service areas across districts/cities in the Probolinggo region.

In general, to answer the need for public infrastructure procurement, the Government can use various financing scheme options, including the public budget (APBN/APBD), BUMN capital budget, private sector participation (Public Private Partnership) or what is more familiarly called PPP (Government Cooperation) (Falashifah, 2019). Business Entities) as well as foreign loans/debts (van Diemen & Domnitcheva, 2020). In this case, the right methodology must be used to choose which financing scheme is most suitable for financing an infrastructure project. This is crucial, not only because of budget limitations, but also because effectiveness and efficiency in infrastructure development is very dependent on the selection of financing schemes. The success of achieving infrastructure development goals is influenced by the scheme chosen. Thus, it is hoped that the policies taken will be of high quality and have positive implications for the implementation of the development and operationalization of the Probolinggo Regional Waste Landfill infrastructure project, so that it can achieve its goal of serving the community's sanitation needs with the maximum benefit.

The sustainability of the development of an infrastructure project is very important to consider. This research focuses on providing several alternative financing schemes that can be implemented for the Probolinggo Regional Waste Landfill development project, both sourced from the government budget (APBN/APBD) and non-government by involving the private sector as well as loans/debts. By comparing several infrastructure financing schemes, it is hoped that the best and most suitable financing scheme can be obtained for the construction of the Probolinggo Regional Waste Landfill.

This research aims to determine the best financing scheme for the Probolinggo Regional Waste Landfill construction project with a focus on selecting an appropriate

scheme, financial analysis, and determining the optimal scheme based on financial and non-financial criteria. The objectives include identifying appropriate financing schemes, financial analysis, and determining optimal schemes (May, 2015). The benefits involve contributions to the East Java Provincial Government and Probolinggo Regency/City Government in planning the Regional Waste Landfill infrastructure financing scheme. Theoretically, this research tests financing schemes from government and non-government budgets in the context of waste infrastructure. Problem limitations include restrictions on financing schemes from government and non-government budgets, without covering waste generation calculations and technical or technological aspects of waste processing. The selection of alternative financing schemes is limited to three options with equal weighting for each criterion.

## **RESEARCH METHODS**

This research method includes research design, research subjects, research location and time, as well as data collection procedures. This research design uses a systematic and interconnected approach. The research subject involves parties related to the Probolinggo TPASR project (Juni & MZ, 2014). The research location is in Purut Village, Lumbang District, Tuban Regency, and the research period was carried out from September to December 2023.

The data collection procedure involves interview techniques for primary data from expert sources and secondary data from regulations, journals and related agencies (Rassel et al., 2020). This research uses a comparative approach with quantitative methods, focusing on comparing the Probolinggo TPASR project financing schemes. Identification of alternative financing schemes was carried out through literature studies and assessments by three expert sources.

Criteria for selecting a financing scheme include legal certainty, regional government capacity, implementation risks, historical implementation of similar projects, financial benefits, and development leverage. Criteria weights are determined by expert sources, and the top three schemes are selected for cash flow analysis. Identification of investment costs and annual cash flow involves secondary data from relevant agencies, with investment cost components including land acquisition, engineering work and equipment.

Projections of waste generation until 2045 and identification of operational and maintenance costs were carried out to calculate the life cycle cost analysis for the construction of the Probolinggo TPASR. Income from tipping fees and processed waste is obtained from the projection of waste entering the landfill, with a basic tipping fee rate of IDR 260,000 per ton of waste.

Calculation of processed waste income and tipping fees until 2045 produces total income. This analysis provides a comprehensive overview of the financing scheme and financial aspects of the Probolinggo TPASR project.

### Identification of Alternative Financing Schemes by Expert Sources

Based on the expert judgment questionnaire analyzed by 3 (three) resource persons from each SKPD related to the construction of the Probolinggo TPASR project, the results showed that 3 (three) schemes were selected from a total of 8 (eight) Probolinggo TPASR financing schemes both sourced from government and non-government budgets. . Determining the selection of these three schemes is an alternative obtained from references provided by expert sources, namely by comparing the three financing schemes in the construction of the Probolinggo TPASR project with the highest total weight. These five financing scheme selection criteria have the same weight of importance for selection. These five criteria are legal certainty, regional government capacity, implementation risks, historical implementation of similar projects and development leverage. Researchers also provide some supporting secondary data on each criterion in each scheme to be taken into consideration by expert sources in providing assessment weight results. The results of the weighting carried out by the sources in this research can be seen in table 1 below.

## RESULTS AND DISCUSSION

**Table 1. Weighting Results of the TPASR Financing Scheme Selection Questionnaire**

No	Financing Scheme	Criteria					Total Weight Value	Average Weight
		Legal certainty	Local Government Capabilities	Implementation Risk	Historical implementation of similar projects	Development Leverage		
1	Conventional (APBN or APBD)	3	2	3	3	2	36	12.0
		3	3	3	3	3		
		3	1	1	1	2		
2		3	1	1	1	2	27	9.0
		3	2	1	2	3		

No	Financing Scheme	Criteria					Total Weight Value	Average Weight
		Legal certainty	Local Government Capabilities	Implementation Risk	Historical implementation of similar projects	Development Leverage		
	PPP (Availability Payment) AP	1	1	2	1	3		

**Table 2. Weighting Results of the TPASR Financing Scheme Selection Questionnaire (Continued)**

No	Financing Scheme	Criteria					Total Weight Value	Average Weight
		Legal certainty	Local Government Capabilities	Implementation Risk	Historical implementation of similar projects	Development Leverage		
3	PPP (Viability Fund) VGF Gap	3	1	1	1	2	29	9.7
		3	2	1	3	3		
		3	1	2	1	2		
4	PPP BOT (Build, Operate, Transfer) only	3	3	2	1	2	33	11.0
		3	2	1	2	3		
		3	1	3	1	3		
5	Join Venture	3	2	1	1	2	28	9.3
		3	1	1	1	3		
		3	1	3	1	2		
6	PINA (Government Non-Budget Investment Financing)	3	2	1	1	2	28	9.3
		3	1	1	1	3		
		3	1	3	1	2		
7	Regional Loans (Loans)	3	2	2	2	2	30	10.0
		3	2	2	1	3		
		1	1	1	2	3		
8	Bond	3	2	1	1	2	26	8.7
		3	2	1	1	2		
		3	1	1	1	2		

The three schemes were selected based on the scheme with the highest score. Based

on the weight given by the three expert sources, it was found that the three schemes

selected were the Government financing scheme (APBN&APBD), the PPP BOT financing scheme and Regional Loans (Loan). The highest weight score was obtained by conventional financing schemes (APBN & APBD) with a score of 36. Second place was KPBU BOT with a score of 33 and regional loans with a score of 30. The selection of these 3 (three) schemes was in accordance with the highest total weight obtained by each scheme based on 5 (five) criteria set by the author.

### Life Cycle Cost of the Probolinggo Regional Waste Landfill Project

Identification of Life Cycle Costs in the Probolinggo Regional Waste Landfill construction project consists of development investment costs (capital expenditure) which are divided into construction and land acquisition stages. Meanwhile, the operational and maintenance costs for the Probolinggo Regional Waste Landfill each year are assumed to be in accordance with the percentages identified in chapter 3. Projected income originating from tipping fees is calculated based on the projected volume of waste entering the TPA every day. All of this cost identification data was obtained from the results of the TPASR Probolinggo feasibility study conducted in 2020 and supported by other data, both from interviews with related SKPD and other studies. The following sub-chapters each explain the identification of costs for the

construction of the Probolinggo Regional Waste Landfill.

### Cash Flow Analysis of Selected Financing Schemes

Based on the results of the weighted questionnaire by expert sources which was carried out in sub-chapter 4.3, 3 alternative financing schemes were obtained for building TPASR Probolinggo. These three schemes are financing schemes sourced from the government (APBN/APBD), private financing schemes with KPBU BOT (Build Operate Transfer) and State Loans (Loan). The following describes the cash flow analysis of each Probolinggo TPASR development financing scheme as assessed from the perspective of the Provincial Government as the PJKP for the Probolinggo TPASR project.

### Decision Making on Selecting the Best Financing Scheme for the Probolinggo TPASR Project

The decision to select the best financing scheme for the Probolinggo TPASR project was carried out by weighing financial and non-financial criteria, the results were then validated through an FGD (Focus Group Discussion) process involving 3 (three) expert speakers. The results of the best decision making analysis are explained in table 3 below.

**Table 3. Decision Making Scheme**

No	Decision Making Criteria	Scheme I (APBN & APBD)	Scheme II (BOT PPP)	Scheme III (Loan)
1.	Financial Feasibility (NPV)	√ 431,148,007,790	75,729,812,986	110.115.495.905
2.	Capital Expenditure (Provincial Government)	174,340,513,522	161.724.287.309	√ 68.655.457.143

3.	Availability of Funds	Minimal availability	Medium availability	√ Greater availability
4.	Technical Implementation	Medium technical process (depending on preparation of RKA)	Long Process	√ The process tends to be shorter

Source: author's analysis with FGD validation from expert sources, 2023

Based on the results of weighting the table 3 financial and non-financial criteria for the financing scheme above, the result was that financing TPASR Probolinggo with a regional loan financing scheme (loan) was the best scheme to choose and apply in the development of TPASR Probolinggo. After that, the second alternative financing scheme is APBN & APBD financing and finally the PPP BOT (Build Operate Transfer) scheme.

### CONCLUSION

The conclusion of this research shows that of the 8 alternative infrastructure financing schemes identified, there are 3 selected schemes, namely the government budget financing scheme (APBN APBD), the PPP BOT (Build Operate Transfer) financing scheme, and Regional Loans. Financial analysis of the Probolinggo Regional Waste Landfill development project shows that all

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schemes, whether sourced from government or non-government budgets, are feasible. The government budget financing scheme has the highest NPV value of IDR. 431,148,007,790,- with IRR 40.55% and Payback Period in the 3rd year.

Meanwhile, the non-government financing scheme (KPBUBOT) has an NPV of IDR. 75,729,812,986,- with IRR 10.14% and Payback Period in the 8th year. Another non-government financing scheme, namely Regional Loans, has an NPV of Rp. 110,115,495,905,- with IRR 9.03% and Payback Period in the 9th year. From financial and non-financial criteria, the best financing scheme for the construction of the Probolinggo Regional Waste Landfill is Alternative I, namely a non-Governmental Financing scheme with Regional Loans, followed by Alternative II, namely the Government Financing scheme APBN and APBD, and Alternative III, namely the non-government financing scheme (KPBUBOT).

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