

Study on the Provision of Drinking Water Infrastructure through the Public-Private Partnership Scheme

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ABSTRACT

To realize the mandate of the Presidential Regulation of the Republic of Indonesia number 38 of 2015 concerning Public Private Partnership and Infrastructure Provision, in the context of providing drinking water services to the community, the Lembata Regency government has initiatively provided drinking water infrastructure in that regency through Public Private Partnership (PPP) scheme. The PPP was conducted in SPAM activities in Lembata Regency due to technical and economic needs. Technical needs were related to service coverage, topographic conditions, low water discharge and pressure, lack of interest from prospective customers in using Municipal Waterworks and its services. Meanwhile, the economic need means Lembata Regency has a limited budget in the development of drinking water infrastructure to areas that have not been served clean water. The limitation of the problems in this study was the calculation to determine the feasibility of investment in providing drinking water in Lembata Regency using the PPP scheme. This study employed a quantitative descriptive approach, where an investment feasibility analysis was carried out by calculating where investment feasibility was obtained from the calculations of cost, tariff assumptions and SPAM development project needs. Based on the calculation of the Net Present Value with a Discount Factor of 12% per year, the result was negative (Rp. 66,789,000, -) meaning the project was unfeasible. Based on the calculation, the result of Internal Rate of Return was 3%, while the value of the discount factor was lower, namely 12%. Therefore, the project was concluded unfit to run. Furthermore, the calculation result of the benefit/cost ratio was 2.05 and the return on investment in this project was ten years.

Keywords : PPP, regional finance, clean water, infrastructure, investment feasibility

1. INTRODUCTION

The determination of Lembata as a Regency requires the Lembata Regency Government to utilize the potential existing in that region for progress and improvement of community welfare. However, in the spirit of development, Lembata Regency Government needs adequate infrastructure and facilities. In line with this, budget constraint is one of the factors influencing the provision of infrastructure in the Lembata Regency.

To realize the mandate of the Presidential Regulation of the Republic of Indonesia number 38 of 2015 concerning Public-Private Partnership and Infrastructure Provision, in the context of providing drinking water services to the community, the Lembata Regency government has initiatively provided drinking water infrastructure in that regency through Public-Private Partnership (PPP) scheme.

Access to water and sanitation services is a major and challenging issue in social, economic, and environmental aspects because this sector is a significant component in community development (Tortajada, 2014). Besides, the provision of clean water is generally not well organized and many of the daily needs of clean water users are hampered due to low service standards (Vedachalam et al., 2016). In Lembata Regency, the PPP is conducted in the Waiplatin and Waiwalang Water Resources SPAM activities due to technical and economic needs, including:

(a) Technical Needs:

1. The Municipal Waterworks services in Lembata Regency were low due to the minimal amount of water supply so that it requires rotation. The percentages of Municipal Waterworks services based on Core Planning of Drinking Water Provision of 2014-2029 in Nebatukan, Lebatukan, Ile Ape, East Ile Ape, Atadei, Wulandoni, Nagawutun, Omesuri District, and Buyasuri Districts are 38.33%, 44.60%, 4.92%, 10.42%, 50.51%, 55.98%, 53.44%, 14.16%, and 1.96%, respectively.
2. Lembata Regency has various topographies and physiographies. The Lembata Regency area is dominated by hilly to mountainous areas with steep and very steep topography (the slopes are more than 25% of the areas) with a small number of plains in the form of flat topography (0-2% and 2-8%), and gentle slopes (8-15%) over 18.01% of the areas. Altitude from sea level reaches 1,319 meters. Most of the villages in Lembata Regency are coastal with 86 villages/urban villages, and 65 villages are located in the highlands. This geographical diversity causes limitations in the installation of new units due to geographical conditions difficult to access.
3. The low water pressure from the springs that have been used so far caused the impossibility to install new units in hard-to-reach areas. The large capacity of water sources is unaccompanied by pipe and production capacities so that the community's water needs remain unfulfilled.
4. The Municipal Waterworks still provides low service quality proven by the lack of communication with customers as well as the registration and payment system centralized in one place, at the head office, and thus the customers were unsatisfied, especially those staying far from the head office of the Municipal Waterworks.
5. Based on information stated in Core Planning of Drinking Water Provision of 2014-2029, the potential customers have less interest in installing Municipal Waterworks. Some of the causes include the absence of a piping network, the dysfunction existing piping network, small water discharge, inadequate piping network, and others.

(b) Economical Needs:

The Lembata government has a limited budget in the development of drinking water infrastructure for the areas that have not been served clean water. Hence, due to these problems, the feasibility of investing in the construction of drinking water infrastructure in Lembata Regency needs to be identified.

In Lembata Regency, there is a continuing demand and insufficient drinking water services. This phenomenon happens in terms of quantity and quality. Therefore, the government needs a strong basis to start a PPP. The PPP implementation is a type of strategy based on the period of the contract between the government and the private sector, where the private sector generally designs, calculates, builds, and operates the infrastructure or services (Yescombe, 2007). Also, PPP is carried out on a large and complex scale in terms of project competition and negotiations to develop efficiency, supervision, as well as risk allocation between government and private cooperation (Yu et al., 2018). Apart from the reasons for the needs existing in Lembata Regency, the potential existing in the Waiplatin and Waiwalang water sources, as well as socio-economic conditions and natural resources, need to be identified. The socio-economic potential and natural resources are as follows:

a) Socio-economic Potential and Development of the Region:

In 2017, Lembata Regency had a population of 137,714 people (73,133 females and 64,581 males). The sex ratio between females and males was 88 per 100 people. The population density of Lembata Regency in 2017 was 109 people per square kilometer. The population structure of Lembata Regency was dominated by young people with the most population from the age group 0-4 years (15,800 people) and the least population from the age group 70-74 years (2,833 people).

The livelihoods of the majority of the Lembata residents are farming and fishing. The rest people work as civil servants, businessmen, traders, laborers, craftsmen, policemen, and religious scholars or monks. The regional minimum wage based on data from the Central Bureau of Statistics for East Nusa Tenggara Province in 2017 was Rp. 1.010,000,-.

b) Potential of Natural Resources

Natural resources related to water resources in the need for clean water in Lembata Regency include rivers, forest areas, watershed areas, and springs.

Lembata Regency has seven rivers functioning as water reservoirs and surface water sources that can help to provide clean water in Lembata Regency.

From the hydrological aspect of water availability, both surface water and groundwater in Lembata Regency are generally very limited due to low rainfall and rainy days affecting groundwater and river water discharge. In the Lembata Regency area, most of the surface water comes from rivers with medium and small scales. The watershed expected to hold water during the rainy season cannot retain water because the land cover is getting thinner and open due to the clearing of agricultural land on the sloped areas by people living in the forest areas, especially in the areas around springs. Therefore, the security of the area around the springs should be regulated, including the establishment of a protected zone based on the watershed area. According to data from the Benanain – Noelmina Kupang Watershed Management Center, there are 113 watersheds in Lembata Regency.

Three springs used by the Municipal Waterworks in Lembata Regency to serve residents of the capital city of Lembata Regency, Lewoleba City are Wai Platin, Wai Golo, and Wai Onggolak springs.

Waiplatin spring uses an inter-gallery system with installed pipes for a direct transmission system to the Lusikawak reservoir with diameters of 100 mm, 75 mm, and 50 mm. The water source extraction system employs broncapturing with dimensions of 1.5 meters length and 2 meters width. The capacity of this Waiplatin source is 61.04 L/sec. The installed capacity for this source is 29.53 L/sec and the production capacity is 10.40 L/sec. The gravity system is utilized to distribute water to the service area six kilometers from the source, namely Namaweka Village.

Waigolo spring is located at an altitude of $\pm 1,300$ meters from Lite Ulumado Village, Nubatukan District. The diameters of the pipes distributing this water source are 100 mm, 75 mm, and 50 mm. The retrieval system uses broncapturing with dimensions of 3 meters length and 1.5 meters width. The capacity of this source is 9.4 L/sec. Meanwhile, the installed capacity is 6.38 L/sec, and the production capacity is 3.47 L/sec. The gravity system is utilized to distribute water to the service area kilometers from the source, namely Lite Ulumado Village. The reservoir for this source has a capacity of 200 m³ with a pipe diameter of 100 mm. Apart from Waiplatin and Waigolo Springs, there are also several springs spread out several sub-districts in Lembata Regency.

The need for provision and the potential related to the provision of drinking water in the Lembata Regency are the reasons for the urgency of the infrastructure development in the Lembata Regency. The PPP mechanism is expected to provide a solution for developing drinking water infrastructure in Lembata Regency with limited funds. The limitation of the problems in this study is the calculation of the investment feasibility in the provision of drinking water in the Lembata Regency using the PPP scheme.

2. LITERATURE REVIEW

The PPP scheme has been implemented in various infrastructure projects in many countries. The PPP scheme in India has been applied since the mid-2000s and since then, the infrastructure investment by the private sector has been increasing. Meanwhile, in Australia, private

infrastructure financing is high through the pension funds distributed through externally managed infrastructure funds. The United Kingdom (UK) had over 85% of privately financed investment in 2012. However, the UK government is continuing to play a significant role in infrastructure provision through planning, price regulation, and involvement in financing mechanisms designed to encourage private infrastructure investment (Chong and Pole, 2013). The implementation of PPP in European countries is The Sofia Water and the Wastewater Concession Project as the first project between the Bulgarian government and International Water as the private sector. The PPP contract agreement was carried out for 15 years starting in 2000. Meanwhile, the Greek Government conducted the PPP program in 2000 by building the Spata Airport and Athens Ringroad projects. France started the PPP program in 2000 on The Tunnel Prado-Carrenage, Millai Viaduct, A19, and A28 projects. Finland has started earlier, namely in 1997 with the project of The Helsinki Lahti Motorwaypada (Grimsey and Lewis, 2004). China implements the PPP mechanism on urban rail development projects (Tong-yin et al., 2011). Based on the literature from several countries, infrastructure development can be carried out through infrastructure schemes.

The development of PPP was executed to impress that the infrastructure developed has advantages over other infrastructure and is supported by service quality (Cruz and Marques, 2013). Mechanisms, innovation, flexibility, results orientation, and approaches from all sectors cause the infrastructure options provided through the PPP scheme to have more value than other infrastructure (Verweij and Meerkerk, 2021). The more visible the difference in efficiency, the value of incentives and infrastructure provided by the private sector will increase as well. Such an advantage significantly attracts the private sector's attention (Khmel and Zhao, 2016). Based on this literature, some factors are essentials for the private sector to support infrastructure development.

In general, PPP contracts in any state have political influences, and ultimately determine the type of PPP to be applied (McDonald, 2019a). Ideology, opportunist politics, and other interests generally lead to unequal agreements from the private sector (Cumbers and Becker, 2018). In one case, when the contract has expired, the renewal of the contract will be controlled by other factors, such as concessions or a large risk. However, in general, the public influence is greater than those factors (World Bank, 2017). Developing countries generally fail to restore financial balance due to the increasing tariffs or payments used to improve the services (McDonald's, 2019b). In developing countries, the problems generally arising are the need for benefits from operators who do not accommodate low-income people on contracts, and there is no negotiation or flexibility from the private sector (Voorn et al., 2020). Thus, there are risks derived from the investment feasibility through the PPP mechanism, where if the cooperation is possibly carried out, there will be weaknesses that must be anticipated by the cooperating parties, especially in terms of financial (profits) and service factors.

3. METHODS

This study employed a quantitative descriptive approach, where an investment feasibility analysis was carried out by calculating the costs, tariff assumptions, and SPAM development project needs. Financial Feasibility Analysis was conducted by compiling cash flows of the expenses and operating revenues, in actual reports and future projections. The financial feasibility criteria used were Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR), and Payback Period (PP). These analyses were executed using the following formula:

1. NPV (Net Present Value)

Calculating the NPV needed data on the estimated cost of investment, working capital, and maintenance as well as the estimated benefits of the planned project. Therefore, the calculation of

NPV relied on a discounted cash flow technique. The investment evaluation method discounted the future cash flows with a certain discounted factor reflecting the capital opportunity cost. NPV was obtained by subtracting all initial investment expenditures from the present value of future net cash flows.

$$NPV = -A_0 + \frac{\sum A_t}{(1+r)^n}$$

Notes:

- A0 = The expenses for investment in the year 0
- At = Net cash flow in the year t
- r = The profit rate required by capital owners
- n = The total period of years (economical period) of the business

If the NPV was positive, the business was feasible to be financed or continued. If the NPV was negative, the business was unfeasible to be financed.

2. Benefit-Cost Ratio (BCR)

B/C Ratio analysis is an analytical approach used to find the ratio resulting from the comparison between the values of benefits and costs in the present value (PV) condition. The basis of the BCR calculation is the interest rate generally used. The assessment of the B/C Ratio value affected the feasibility of the project with the following references:

1. If the BCR was > 1, the project was feasible to carry out.
2. On the contrary, if the BCR was < 1, the project was unfeasible to carry out.

$$NETB / C = \frac{\sum_{t=1}^n \frac{B_t - C_t}{(1+i)^t}}{\sum_{t=1}^n \frac{C_t - B_t}{(1+i)^t}}$$

- Bt = The benefit in the year of t
- Ct = The cost in the year of t
- i = Discount Factor
- t = The project period

3. IRR (Internal Rate of Return)

The IRR value was used to compare the IRR value of the project with the general interest rate or the rate of return on investment. To compare the feasibility of an investment, a general interest rate of a bank is usually used.

$$IRR = i_1 + \frac{NPV_1}{NPV_1 + NPV_2} (i_2 - i_1)$$

where:

- IRR = Internal rate of return i
- i_1 = Discount rate yielding NPV1
- i_2 = Discount rate yielding NPV2

IRR was obtained by seeing the NPV = 0. If the IRR value was higher than the general interest rate of the bank or investment in general, then the investment was worth continuing.

4. Payback Period

The payback period means the calculation of the payback period of the investment made through the profits obtained from a project that has been planned. The time required to replace all investment expenditures used proceeding or net cash flows. An investment has a level of risk due to uncertainty in the future. The risk will be higher if the payback period of return on investment is longer. If the payback period of investment is longer, the risk to the bank will increase because the interest will escalate as well. On the investor side, if the credit period is too short, the installment burden will be higher and disrupt cash flow. In determining the payback period, the interests of both parties are also taken into account.

$$PBP = T_{p-1} + \frac{\sum_{i=1}^n I_i - \sum_{i=1}^n B_{icp-1}}{B_p}$$

- PBP = Pay Back Period
- T_{p-1} = The year before PBP
- I_i = The amount of discounted investment
- B_{icp-1} = The amount of discounted benefit before PBP
- B_p = The amount of benefit in PBP

Through this calculation, the investment feasibility analysis could determine whether the PPP was feasible to be considered in drinking water supply activities in Lembata Regency. After the investment or economic feasibility had been identified, then the financing risk was investigated from the investment feasibility calculation process, where the risk indicated the changes in costs that may occur in the calculation due to influencing external factors.

4. RESULT AND DISCUSSION

4.1 Technical Planning of DWPS Establishment in Lembata Regency

Based on the DWPS network development plan in Lembata Regency, the network plan was developed from the Waiplatin spring to serve customers in the Lewoleba urban area, Ile Ape Sub-District, and East Ile Ape Sub-District. Meanwhile, the Waiwalang Spring is channeled to serve the Omesuri and Buyasuri Sub-Districts.

The investment is needed to procure DWPS infrastructure and facilities following the DWPS development plan managed by the Municipal Waterworks. The development plan using the PPP scheme is explained as follows:

Table 1. Need of Investment of DWPS in Lembata Regency

Description of Project	Needs	Total Amount
Building Wai Platin Spring gallery intake		125,720,000
Building Wai Walang Spring gallery intake		101,670,000
Installing reservoir	300 m ³	587,970,000
Providing and installing 150 ml transmission pipes	6212 m	5,874,980,000
Providing and installing 150 ml transmission pipes	10800 m	9,941,850,000
Providing and installing 150 ml transmission pipes	5418 m	5,259,240,000
Providing and installing 150 ml transmission pipes	5262 m	4,872,390,000
Total		26,763,820,000

Source: The Municipal Waterwork of Lembata Regency, 2019

The needs of investment are divided into several activities, namely the construction of intakes at Waiplatin and Waiwalang Springs, the installation of reservoirs and pawnsops, as well as the installation of transmission pipes.

Based on the calculation results, the needs of investment for DWPS in Lembata Regency were up to Rp. 26,763,390,000.00. The highest allocation was in the provision and installation of transmission pipes with a diameter of 150 MM and a length of 10.800 m.

4.2 Analysis of Investment Feasibility

1) The Calculation of Basic Costs and Tariff

The basic costs and tariffs were calculated to determine Lembata residents' willingness to pay the tariff. To calculate the tariff, the basic costs were counted firstly as follows:

Table 2. Calculation of Basic Costs

Components	Unit	Nominal
Operational costs	Rp/year	995,596,896
Depreciation costs	Rp/year	1,338,191,000
Loan Interest	Rp/year	-
Other Operational Costs	Rp/year	-
Total Business Costs	Rp/year	2,333,787,896
Inflation (2018)	%	3.07%
The Estimation of Business Cost Tariff in 2020 Tariff	Rp/year	2,405,435,184
The volume of the Produced Water	m ³ /year	1,232,742
The Standard Rate of Water Loss		20%
The volume of the Standard Water Loss	m ³ /year	246,548
Basic Costs	Rp/m³	2,439

Source: Analysis Results, 2019

Based on the calculation results of the basic costs, a tariff was determined and compared to the people's willingness to pay (WTP). Based on the results of field identification, the residents in Ile Ape and East Ile Ape could pay Rp. 1500.00. Meanwhile, the recommendation for Value Gap Funding (VgF)/feasibility support was Rp. 20000.00. The calculation results of tariffs based on WTP and VgF in Lembata Regency are presented as follows:

Table 3. Calculation of Basic Tariff

Basic Tariff	Rp/m ³	3,500
Low Tariff	75% of the Basic Tariff	2,625
Full Tariff	200% of the Low Tariff	5,250

Source: Analysis Results, 2019

Based on tariff calculation results, the determined basic tariff was Rp. 3,500.00 with the highest tariff of Rp, 5,250.00.

2) Determining Financial Assumption

The calculation of the investment costs mentioned before relied on the unit price standard of the Lembata Regency work. Prices/costs were costs in the base year 2019. The price projection used a rate of an average inflation rate of 6% per year. Prices in the coming year could be calculated with an estimated price increase of 10% per year.

Expenses included investment and operational costs. The investment costs used the values calculated in the table. Depreciation costs were calculated from the investment value divided by the concession period. Other assumptions include:

- (a) Inflation based on data in 2018
- (b) Basic tariff based on the average price of Municipal Waterwork in Lembata and Water Tariff in Larantuka
- (c) Calculation of low and high tariffs based on the formulation in the Study of Water Price of Municipal Waterworks in Malang City.
- (d) The stage of water sales was assumed to be 50% in the first year, and increase by 10% in the next year.
- (e) The water selling price used the average basic, high, and low tariffs, namely Rp 3,792,- /m³
- (f) The fixed water price during 20 years concession
- (g) The number of house water connection was calculated from clean water production divided with the need of 60L per day divided by five people (household)
- (h) Assumption of meter rent of Rp 3,000 per house water connection
- (i) Assumptions of electricity and fuel of Rp 300/m³
- (j) Chemical substances of 100/m³
- (k) Labors of 2.5 million/month for four people
- (l) Overhead 40% of the labor cost
- (m) Discount factor (DF) of 12%
- (n) Maintenance costs consisting of:

• Intake building, pump and gura houses	74,000,000
• Generator engine	40,000,000
• Fuel Tank	40,000,000
• Centrifugal Pump	85,500,000
• Pipes and equipments	95,000,000
• TOTAL	334,500,000

3) Analysis of Investment Feasibility

Analysis of investment feasibility was to assess the feasibility of long and short terms investment planning. The analysis of investment feasibility included:

- A. Internal Rate of Return (IRR)

The internal rate of return is the amount of interest that will be used as the total present value of the cash flow to be received. The feasibility of a project is considered good if the results of the IRR calculation show a value higher than the prevailing credit interest rate.
- B. Net Present Value (NPV)

Net present value is a feasibility assessment method by calculating the "value for money" at present. The feasibility of the project is considered good if the results of the NPV calculation show a value equal to or higher than zero. The NPV calculation used a bank loan interest rate of 12% per year.
- C. Benefit-Cost Ratio (BCR)

The benefit-cost ratio is the ratio between the NPV of all gross revenues and the NPV of all costs incurred. BCR shows good feasibility if the value is higher than 1.

D. Payback Period

The payback period is required to recoup investment expenditures using net cash flow. The payback period describes the duration spent for the funds invested to be fully recovered. The calculation of the payback period, NPV, IRR, and BCR can be seen in table 4.

Based on the analysis results of investment feasibility, the conclusions are as follows:

- a. Based on the calculation of the Net Present Value with a Discount Factor of 12% per year, the result was negative (Rp.66,789,000, -), meaning this project was unfeasible.
- b. Based on the calculation of the Internal Rate of Return, the result was 3%, lower than the discount factor of 12%. It indicated this project was unfeasible to run.
- c. Calculation of benefit/cost ratio at 2.05
- d. The payback period for this project was ten years.
- e. Based on the indicators mentioned before, the economic feasibility of this project was unfeasible

4.3 The Estimation of Financing Risks

Risk is the possibility of undesired things during the continuity of a project. The risks can be assessed qualitatively or quantitatively. The risk analysis process consists of risk identification, allocation, assessment, and mitigation. Through risk analysis, the stakeholders can obtain the maximum benefit through the risk management process including eliminating, minimizing, transferring, and absorbing/accepting the risks. One of the risks in investing arises in financing. Based on the investment feasibility analysis, the unfeasibility of investment in the Drinking Water Sector is also supported by the existence of financing risks that will arise in the pre- to post-construction period. The financing risks that may arise include:

1. Risks that arise due to uncertainty in terms of continuity of financing fund source (next year), and thus leading to the risk of delays and overhead costs.
2. The increase in material prices during the implementation period
3. The increase in the price of land acquired during the execution of the work
4. Additional work at an unequal price
5. Project schedule delay affecting the project costs
6. The uncertainty in the loan interest rate that must be paid during the construction period
7. Errors in estimating and planning the cost budget for materials
8. The increase in costs for non-technical factors

The changes in the country's economic conditions and government policies on finance

5. CONCLUSION

The study of the investment feasibility of DWPS establishment in Lembata Regency concluded as follows:

1. Calculation of Investment Feasibility

- a. This drinking water establishment project in Lembata Regency generated profits, but in terms of feasibility, the drinking water establishment in Lembata Regency was unfeasible for investment.
- b. Based on the calculation of the payback period, the return on capital will be fulfilled after 10 years.

2. Financing Risks

There are nine financing risk factors derived from the calculation of investment feasibility, where the risk relied on changes in financial conditions that may occur in the implementation of the work.

3. Financing related to drinking water establishment in Lembata Regency

- a. The drinking water establishment in Lembata Regency using the PPP scheme was unfeasible to carry out.
 - b. This is because the technical conditions of the DWPS to be built were not balanced by the wide range of services that would expand customer potential to calculate the returns and the amount of profit.
4. Recommendation for financing that can be undertaken other than this PPP scheme is budget sharing with the State Budget. By this scheme, the construction of DWPS will be sorted based on the type of work to be conducted.

Limitations and Suggestions

This research relied on a calculation basis in a certain year according to manufacture. When the research was published, the standards or price assumptions may occur. In addition, this research needs to show a comparison of economic feasibility studies between the types of PPP to identify whether the provision of drinking water can be carried out with certain types of PPP.

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