Investment Analysis of New Port Development Project As a Solution to Overload Problems in Long Ports

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	A B S T R A C T
Keywords: Port Services Port Feasibility Study Financial Aspect	The increasing demand for port services at the Panjang port causes high levels of ship queues. The solution to overcome this problem is to build a new port. However, this new port construction project has not yet conducted a feasibility study. The purpose of this study is to assess the feasibility of port development in the Panjang district of Bandar Lampung in terms of investment or financial aspects. The methods are Benefit-Cost Ratio, Net Present Value, Payback Period, and Internal Rate of Return. The results of the feasibility study of the most profitable investment are in the seventh scenario, the Net Present Value (NPV) of Rp. 463,292,122,605.34, the BCR result of 1.2959, the IRR yield of 12.11% and the Payback Period (PP) occur in the year to thirty-seventh with an economic age of 60 years. The conclusion is that the construction of a new port can be a solution to overcome the overload of Panjang port.

Introduction

The country that has the most islands in the world is Indonesia. The islands in Indonesia are around 16,056 islands (BPS, 2018). Indonesia has the second longest coastline in the world (BPP Ministry of Home Affairs, 2017). With this potential, coastal areas can become centers of activity both economically, socially, tourism and ports.

The main potential of the coastal area is the port. Port is an area covering land and / or waters with certain boundaries as a place for government activities and economic activities which are functioned for berths, berths and passenger loading and unloading ships that have shipping safety facilities and supporting port activities as well as a place of transfer between modes of transportation (PM Number 51 Year 2015, Law Number 17 Year 2008; Bambang Triatmodjo, 2010 and Kramadibrata, 2002). The smooth sea transportation system requires transportation support, namely the port. Seaports that constitute the foundation of maritime lines have a complex structure (Demirci, 2003), but the port also has a role related to social, economic, and political factors.

The role of ports in the economic sector is very important and strategic. The economic activity of an area can be generated by the port, because it is part of the economic chain of the

transportation and logistics system. Ports are often recognized as a public good and/or social infrastructure given their important roles in many supply chains and distribution channels related to international commodity trade (Lee & Lee, 2016). However, many port developments are not optimal. Therefore, a comprehensive planning needs to be done. An important step in planning a port is a feasibility study.

The port which is located in Panjang district, Bandar Lampung city, is Panjang port. The high demand for Long Port port services causes problems such as high level of ship queues and high costs at the port. The solution to this problem is to plan a new port. Investments in a port may createadditional capacity, increase productivity, generated added value and income andcreate economic growth "ithin the port and also in other sectors o! Economy (Meersam, 2005). In constructing a port, a feasibility study needs to be carried out to avoid mistakes in planning.

The purpose of the feasibility study is to find out whether an investment plan or project can successfully implement so that it can avoid erroneous expenditure (Poerbo, 1998). The feasibility study conducted to prevent losses, facilitate planning, implementation, supervision, and project control. The feasibility study has many aspects, such as technical aspects, financial aspects, political aspects, social aspects, environmental aspects, security aspects, market aspects, managerial aspects, cultural aspects. The

condition of accessibility to the existing port is very important in supporting the performance of a port (Hamzah, Abdurahman, Saputra, & Aprianti, 2017).

The research objective is to assess the feasibility of developing a new port from the financial aspect. This aspect analyzes the company's finance related to the project. Economic parameters of this study are the Benefit-Cost Ratio, Net Present Value, Payback Period, and Internal Rate of Return.

Method

Based on BNPB on Disaster Risk Assessment (KRB) of North Sumatra Province 2016 - 2020, there are in several Regencies / Cities in North Sumatra Province prone and very prone to landslides. The percentage and vulnerability of high-class landslides, there are 20 in North Sumatra Province, and South Tapanuli Regency ranked third. The very potential areas include Batang Angkola District, Saipar Dolok Hole District, Sipirok District, and Sayur Matinggi District.

1. Research Location

The study located in the coastal region east of Bandar Lampung City, precisely the long sub-district. Precisely in Karang Maritim and Kampung Baru Bahari, Panjang sub-district. The port area is ± 20 Ha with coordinates of SL 05°29'25.60", EL 105°19'31.20", SL 05°29'25.60", EL 105°19'18.91", SL 05°29'09.40", EL 105°19'28.00", SL 05°29'09.40", EL 105°19'08.52".
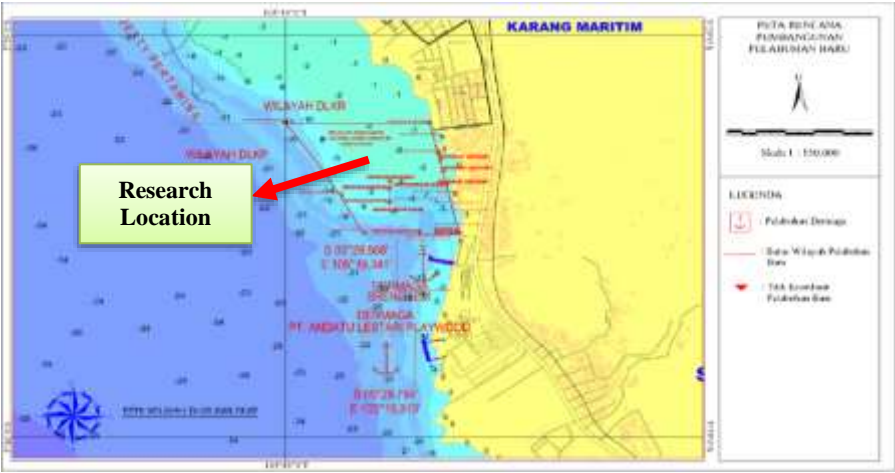

Figure 1. Research Location Map

Information in the form of facts and figures to form research is called research data (Suharsimi, 2002). Data collected from literature and other sources from competent agencies with a focus of study. The data includes a breakdown of the project construction budget (RAB) of port development, port business entity (BUP) revenues, interest rates and inflation rates.

2. Assumption

Assumptions are truths that are believed by researchers to strengthen problems, assist researchers in clarifying, determining research objects, locations and data collection instruments (Rusdin Pohan, 2007). This study assumes the industrial age or the age of use of the port, the income of the port business entity (BUP) during the industrial era, the loan interest rate in 2019-2079, the inflation rate in Indonesia in 2019-2079 and the Weighted average cost of capital.

3. Financial Analysis

This analysis serves to analyze the overall project finance. Port investment decisions are mainly related to productivity improvement strategies or capacity expansion leading to higher capacity utilization and financial performance (Lagoudis, Rice, & Salminen, 2014). As like any other organization, seaports have financial performance measures as a part of the organizations performance management, although there has been always debate exists to the relative importance of financial and non-financial measures (Munim, et al. 2014). This analysis used to establish financial policies, evaluate economic trends, build long-term plans for business activities, and identify projects. This analysis is has done through the assumptions of financial figures and data. Financial parameters of this study are BCR, PP, NVP, and IRR.

4. Benefit-Cost Ratio (BCR)

BCR is a comparison of aspects of profit with aspects of expenditure (cost). The BCR method shows the relationship between relative prices and the benefits of the proposed investment. The formula for calculating the value of the Benefit-Cost Ratio (Giatman, 2006), namely:

$$\text{BCR} = \frac{Benefit}{Cost}$$

There are differences in BCR analysis on private and government projects, which are due to differences in investment objectives. The general benefits enjoyed by the community are the foundation of a government project, whereas the benefits for private projects based on investment returns.

BCR analysis for large projects is difficult to do right because there are so many assumptions and uncertainties that are difficult to measure. The BCR also not provide how much economic value generate, and the BCR is usually used to get a rough idea of the feasibility of the project, and the level of investment returns beyond the discount to find out whether an investment plan is feasible or not, specific criteria needed in the BCR method,

If: BCR > 1, the investment recommended

BCR < 1, then the placement is not recommended

BCR = 1, the investment is not profitable and not loss

5. Net Present Value (NVP)

The NVP method used to calculate the net value (net) at present (Giatman, 2005). This method is a reduction in the net current amount of cash to the current value of the investment. Cash flow in this method discounted because it is to adjust the risk of investment opportunities and to calculate the time value of money. The formula used to calculate NVP values (Peter Bell, 2017) is:

$$\text{NPV}(t) = \sum_{t=0}^{T} \frac{CF(i)}{(1+r)^i}$$

Where:

CF = cash flow

r = discount rate

i = investment life period

t = economic age

To find out whether an investment plan is feasible or not, we need certain criteria in the NPV method, namely:

If: NPV > 0 means it is profitable

NPV < 0 means unprofitable

If the investment plan is not profitable, then the plan is advised not to run, but if the investment plan is declared profitable, it recommended to run. However, the feasibility of an investment plan is not yet the final decision of an investment program, and often certain considerations also influence the decision.

6. Internal Rate of Return (IRR)

IRR is the rate of return that results in the value of income equivalent to expenditure (Mandiyo Priyo, 2012). Thus, the IRR is the interest rate (not bank interest) that describes the rate of return on investment as a percentage when NVP is 0. The formula for calculating IRR is:

$$IRR = i_1 + (i_1 - i_0)\frac{NPV_0}{NPV_0 - NPV_1}$$

Information:

i0 = capital market interest rate

i1 = comparative interest rate

NPV0 = net present value 0

NPV1 = net present value 1

The eligibility criteria for a business or project with the IRR method (Mandiyo Priyo, 2012) are if:

IRR modal capital market interest, meaning that investment recommended.

IRR modal capital market interest, meaning that investment not recommended being carried out.

This method has the advantage of describing the ability of the project to produce a percentage of the average net profit each year throughout the economic life of the investment and the residual value of the assets calculated in revenue.

7. Payback Period (PP)

PP is the time needed for a company to return a sum of money when an investment expected to recover (Mandiyo, 2012). PP is the length of investment reaching the breakeven point. This analysis is useful from a risk analysis perspective because it provides a brief description of the amount of time the initial investment will be at risk. The shorter the payback period means the better investment. The longer the payback period means the investment is not good. The formula for calculating PP at a specific rate of return is:

$$PP = \frac{Investasi}{Kas\ bersih\ per\ tahun}$$

To assess the feasibility of an investment plan using the PP method is if:

PP > age of investment, meaning that finance not recommended to continue.

PP < age of investment, meaning that placement recommended continuing

The weakness of this method is that it does not take into account the concept of the time value of money, where the funds generated in the next period is worth less than the money obtained in the current period. This concept does not consider the existence of additional cash flows that may arise from investments in the period after the return on investment has been reached.

8. Weighted Average Cost of Capital (WACC)

This method is a calculation of the company's capital costs, where each capital category is weighted proportionally. All sources of capital, including bonds, shares, and long-term debt, are included in the calculation. Companies must know the weighted average capital costs as a method for measuring the value of funding future projects. The lower the WACC of the company, the cheaper the company will be to fund new projects. The WACC formula, according to is as follows (Najmudin, 2011):

$$WACC = Wd \cdot Kd \cdot (1 - T) + Ws \cdot Ks$$

Where:

Wd = Proportion of debt

Kd = cost of debt

T = Tax

Ws = Proportion of capital

Ks = Profit level

The WACC concept has advantages and disadvantages. The power is that companies will know the difference between projects to be funded with debt and funded plans with their

Discussion

1. Project Investment

This port has 9 (nine) main buildings. The main building of this port consists of a passenger port, a port terminal, an industrial port, a rented warehouse, a container terminal, an integrated office, an industrial dock, a fast ship dock. Evaluation criteria (direct private profitability and collective benefits/costs) (Musso, Ferrari, & Benacchio, 2006). The port's economic life is assumed to be 60 years.

Financing on this project obtained from 40% of its capital and loan capital of 60% of the total investment costs. The total investment spent on

capital, and this concept takes into account cash flows for the present value and time value of money. The drawback is that the projections made do not take into account capital increases. When capital rises, so does the risk to investors.

the port construction project in this study was Rp. 1,565,519,956,000.00.

2. Assumptions of the Amount of Techno Economy

Inflation

Inflation is a level where money experiences a decrease in purchasing power. To predict the level of inflation that will occur over the next 60 years using the trend formula in the Microsoft Excel program. The inflation assumption value in this study used as the basis for taking the discount factor value that will apply. Assumptions for inflation can be seen in Figure 2.
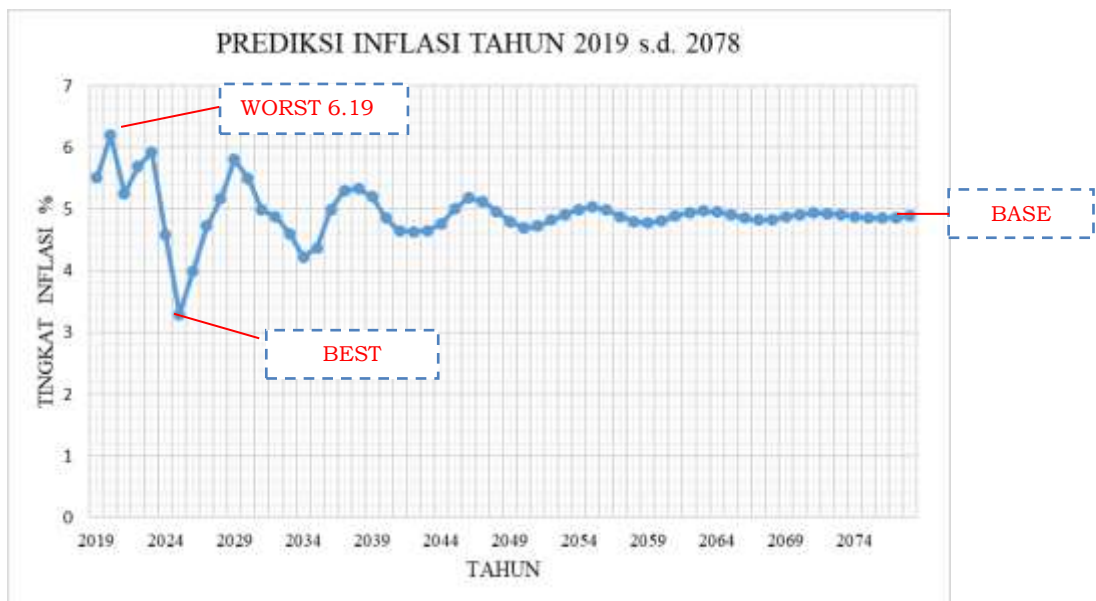
Figure 2. Inflation Prediction of 2019 to 2078

In figure 2, the predicted lowest inflation rate is 3.29%, with an average value of 4.93%, and the highest inflation is 6.19%. From these data taken, the inflation value used as an assumption of 4%, 5%, and 7%.

Loan Interest Rates

The loan interest rate is an amount charged on loan principal by a creditor to a debtor for using the asset. To predict the magnitude of loan interest rates that may occur over the next 60 years using the trend formula in the Microsoft Exel program. The prediction of loan interest rates can be seen in Figure 3.
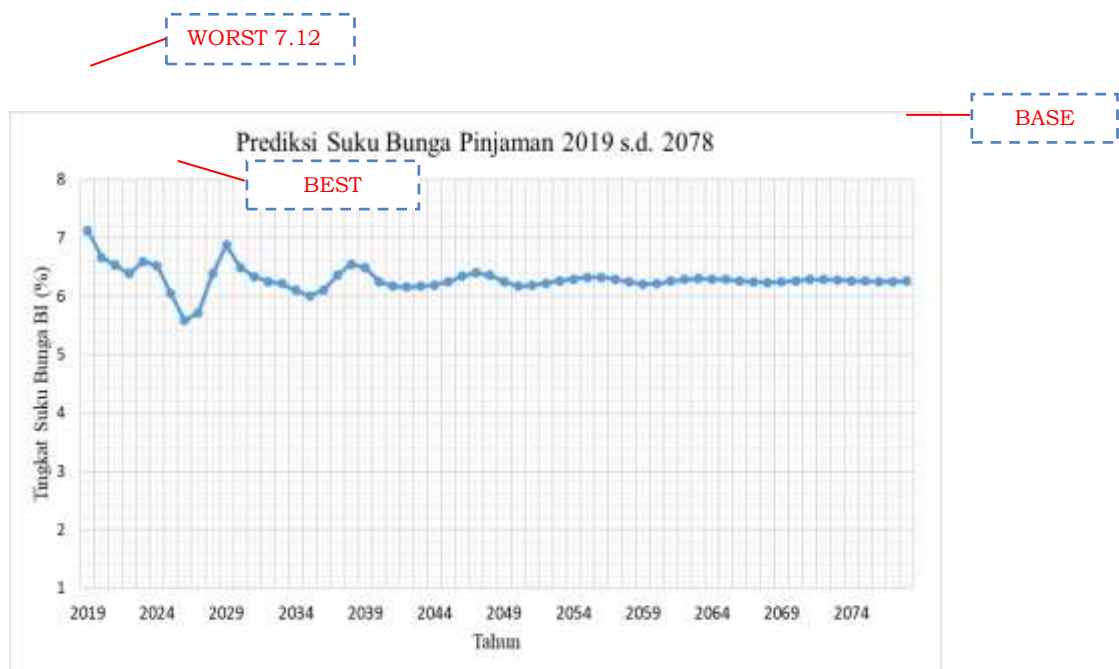
Figure 3. Predicted loan rates of 2019 to 2078

From Figure 3, we get a prediction of the lowest loan interest rate of 5.59%, with an average value of 6.29% and the highest interest rate of 7.12%. From these data, the value of the loan interest rate taken as an assumption of 5.59% with a mean value of 6.29% and the highest inflation of 7.12%.

Weighted Average Cost of Capital

The construction of new ports uses 40% of its capital from the total investment costs, and loan capital is 60% of the total investment costs. The loan interest used in the WACC calculation is 5.59%. Taxes to be paid by the country for 40% of income. The expected profit rate of investors is 10%. So the WACC obtained was 6.01%. The WACC calculation details are below:

Cost of Equity = [Proportion of Capital x Cost of Equity / Equity]

Cost of Equity = [0.4 x 0.1]

Cost of Equity = 0.04

Cost of Debt = [(Proportion of debt x Debt Cost) * (1 -% Tax)]

Cost of Debt = [(0.6 x 0.0559) x (1-0.4)]

Cost of Debt = 0.0201

WACC = Cost of Equity + Cost of Debt

WACC = 0.04 + 0.0201

WACC = 0.0601

WACC = 6.01%

Depreciation

Depreciation or depreciation is the cost incurred due to the use of assets throughout the economic life of a project (Sofyan Harahap, 2002). It can interpret that depreciation is a saving for the purchase of new fixed assets because the old ones can no longer use. The depreciation component at this port includes equipment depreciation and construction depreciation.

Depreciation in this study uses the straight-line depreciation method. This depreciation method assumes the role of construction will be the same throughout the economic life, so that construction experiences the same depreciation from one time to another until the end of the economic growth of the constraction (Sofyan Harahap, 2002). The value of reduction of the tool is 10% every year with an economic life of 10

years, and construction depreciation is 3.33% with an industrial age of 30 years.

Depreciation calculation is done by multiplying the acquisition price by the depreciation rate. The result of the calculation of depreciation of the tool at this port is Rp. 856,088,800.00. While the construction depreciation was Rp. 6,875,010,600.00. Detailed calculation of depreciation of tools and construction:

Table 1. Depreciation Calculation Details

No.	Depreciation	Acquisition Cost	Depreciation Rates	Contraction
		(1)	(2)	(1)*(2)
1	Tool	8,560,888,000	10%	856,088,800
2	Construction	206,250,318.000	3,33%	6,875,010,600

Port Business Entity Revenue

Port business entity income obtained by using data from similar port business entities. Port business entities' revenues come from mooring service tariffs, scouting service delays, contribution to port business services (BUP), mooring services, goods services, navigation services, vessel traffic service (VTS) services, and mining truck entrance tickets. By using the regression formula in the Microsoft Excel program, the equation of income obtained, and then the revenue projection calculated for the following year. Projected revenues of port business entities shown in table 2.

Table 2. Income Projection

Years	Income	Years	Income	Tahun	Income
2020	160,000,000,000.00	2040	780,000,000,000.00	2060	2,920,000,000,000.00
2021	169,720,000,000.00	2041	842,920,000,000.00	2061	3,084,120,000,000.00
2022	180,960,000,000.00	2042	909,760,000,000.00	2062	3,254,560,000,000.00
2023	193,840,000,000.00	2043	980,640,000,000.00	2063	3,431,440,000,000.00
2024	208,480,000,000.00	2044	1,055,680,000,000.00	2064	3,614,880,000,000.00
2025	225,000,000,000.00	2045	1,135,000,000,000.00	2065	3,805,000,000,000.00
2026	243,520,000,000.00	2046	1,218,720,000,000.00	2066	4,001,920,000,000.00
2027	264,160,000,000.00	2047	1,306,960,000,000.00	2067	4,205,760,000,000.00
2028	287,040,000,000.00	2048	1,399,840,000,000.00	2068	4,416,640,000,000.00
2029	312,280,000,000.00	2049	1,497,480,000,000.00	2069	4,634,680,000,000.00
2030	340,000,000,000.00	2050	1,600,000,000,000.00	2070	4,860,000,000,000.00
2031	370,320,000,000.00	2051	1,707,520,000,000.00	2071	5,092,720,000,000.00
2032	403,360,000,000.00	2052	1,820,160,000,000.00	2072	5,332,960,000,000.00
2033	439,240,000,000.00	2053	1,938,040,000,000.00	2073	5,580,840,000,000.00
2034	478,080,000,000.00	2054	2,061,280,000,000.00	2074	5,836,480,000,000.00
2035	520,000,000,000.00	2055	2,190,000,000,000.00	2075	6,100,000,000,000.00
2036	565,120,000,000.00	2056	2,324,320,000,000.00	2076	6,371,520,000,000.00
2037	613,560,000,000.00	2057	2,464,360,000,000.00	2077	6,651,160,000,000.00
2038	665,440,000,000.00	2058	2,610,240,000,000.00	2078	6,939,040,000,000.00
2039	720,880,000,000.00	2059	2,762,080,000,000.00	2079	7,235,280,000,000.00

This port revenue projected for 60 years. Table 2 shows an increase in port revenue in the following years, and this is influenced by inflation that occurs every year and an increase in demand for port services.

Spending

Expenditures are an essential component of investment. A careful calculation of the design of the financing model must be planned well, and seriously, this financing design can be done by doing calculations in detail or by comparing data

elsewhere. Components of port expenditure are operational costs and maintenance costs.

Operating costs and maintenance costs are 10% - 25% of total annual income (Poerbo, 1998). In this study, the mean value was taken, so that building expenditure is 17.5% of the total revenue. After that, the cost calculated after inflation. The calculation of operational costs after the increase will use as input in the cash flow analysis in the next estimation. Details of projected expenses can be seen in table 3.

Table 3. Expenditure Projections

Years	Expediture	Years	Expenditure	Years	Expenditure
2020	29,400,000,000.00	2040	143,325,000,000.00	2060	536,550,000,000.00
2021	31,186,050,000.00	2041	154,886,550,000.00	2061	566,707,050,000.00
2022	33,251,400,000.00	2042	167,168,400,000.00	2062	598,025,400,000.00
2023	35,618,100,000.00	2043	180,192,600,000.00	2063	630,527,100,000.00
2024	38,308,200,000.00	2044	193,981,200,000.00	2064	664,234,200,000.00
2025	41,343,750,000.00	2045	208,556,250,000.00	2065	699,168,750,000.00
2026	44,746,800,000.00	2046	223,939,800,000.00	2066	735,352,800,000.00
2027	48,539,400,000.00	2047	240,153,900,000.00	2067	772,808,400,000.00
2028	52,743,600,000.00	2048	257,220,600,000.00	2068	811,557,600,000.00
2029	57,381,450,000.00	2049	275,161,950,000.00	2069	851,622,450,000.00
2030	62,475,000,000.00	2050	294,000,000,000.00	2070	893,025,000,000.00
2031	68,046,300,000.00	2051	313,756,800,000.00	2071	935,787,300,000.00
2032	74,117,400,000.00	2052	334,454,400,000.00	2072	979,931,400,000.00
2033	80,710,350,000.00	2053	356,114,850,000.00	2073	1,025,479,350,000.00
2034	87,847,200,000.00	2054	378,760,200,000.00	2074	1,072,453,200,000.00
2035	95,550,000,000.00	2055	402,412,500,000.00	2075	1,120,875,000,000.00
2036	103,840,800,000.00	2056	427,093,800,000.00	2076	1,170,766,800,000.00
2037	112,741,650,000.00	2057	452,826,150,000.00	2077	1,222,150,650,000.00
2038	122,274,600,000.00	2058	479,631,600,000.00	2078	1,275,048,600,000.00
2039	132,461,700,000.00	2059	507,532,200,000.00	2079	1,329,482,700,000.00

Cash Flow

All receipts and disbursements of money in a company at a specified interval expressed as cash flow (Nurahma, 2013). Cash flow is a revenue or expense stream that changes a cash account over a given period (Jayanthi & Damayanti, 2015). Because revenues and expenses usually occur at different times, assumptions made which aim to simplify recording. The entire series of expenditures and income, the amount come is assumed to occur at the end of the period, while the current amount occurs at the beginning of the period. Based on the techno-economic calculations that have been made, nine scenarios are made based on the assumption of inflation and loan interest rates and the weighted average cost of capital. Nine scenes are shown in table 4.

Table 4. Cash Flow Scenario

Scenario	Explanation	Scenario	Explanation	Scenario	Explanation
1	Own Capital 40%	4	Own Capital 40%	7	Own Capital 40%
	Loan 60%		Loan 60%		Loan 60%
	The Inflation Rate of 4%		The Inflation Rate of 4%		The Inflation Rate of 4%
	Loan Interest 6.29%		Loan Interest 7.12%		Loan Interest 5.59%

	WACC 6,01%		WACC 6,01%		WACC 6,01%
2	Own Capital 40%	5	Own Capital 40%	8	Own Capital 40%
	Loan 60%		Loan 60%		Loan 60%
	The Inflation Rate of 5%		The Inflation Rate of 5%		The Inflation Rate of 4%
	Loan Interest 6.29%		Loan Interest 7.12%		Loan Interest 5.59%
	WACC 6,01%		WACC 6,01%		WACC 6,01%
3	Own Capital 40%	6	Own Capital 40%	9	Own Capital 40%
	Loan 60%		Loan 60%		Loan 60%
	The Inflation Rate of 7%		The Inflation Rate of 7%		The Inflation Rate of 7%
	Loan Interest 6.29%		Loan Interest 7.12%		Loan Interest 5.59%
	WACC 6,01%		WACC 6,01%		WACC 6,01%

PP, NPV, IRR, and BCR are the outputs of cash flow in this study. Calculation results can be seen in table 5.

Table 5. Scenario Result

Scenario	NVP (IDR)	BCR	IRR (%)	PP (Years)
1	436,450,436,406.63	1.2788	11.94 %	37.6
2	40,960,398,529.19	1.0262	0.13 %	55.1
3	-478,878,243,135.72	0.6941	-	> 60
4	404,828,041,330.44	1.2586	11.73 %	39.6
5	11,270,480,410.98	1.0072	0.04 %	59,2
6	-505,288,013,090.83	0.6772	-	> 60
7	463,292,122,605.34	1.2959	12.11 %	36.7
8	66,161,761,786.90	1.0423	0.21 %	52.5
9	-456,461,131,591.61	0.7084	-	> 60

All the scenarios listed above shows that scenario 7 is a favorable scenario assuming that the source of development funds is 60% of its capital and 40% of loan capital with an inflation rate of 4%, WACC of 6.01%. In contrast, the internal rate of return The resulting yield is 12.11%, positive BCR with a value of 1.2959, and a positive NPV of Rp. 463.292.122.605,34. For the calculation of PP (Payback Period) in this scenario, the payback period is less than the industrial age of the building, in the first year with a time of 36.7 years.

Conclusion

The results of financial analysis on the plan to develop a new port in the town of Bandar Lampung that are profitable is scenario 7 (NPV = Rp. 463,292,122,605.34; BCR = 1.2959; IRR = 12.11%; PP = 37.5 years), scenario 1 (NPV = IDR 436,450,436,406.63; BCR = 1.2788; IRR = 11.94%; PP = 37.7 years), and scenario 4 (NPV = IDR 404,828,041,330.44; BCR = 1,2586; IRR = 11.73%; PP = 39.6 years)). In conclusion, the plan to build a new port is feasible as a

solution to overcome overload at the Panjang Port.

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