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INVESTMENT ANALYSIS OF THE CORRUGATED BRIDGE CONSTRUCTION FOR AN EFFICIENCY COST OF HAULING OVER BURDEN (STUDY CASE PT. BERAU COAL)

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ABSTRACT

Mining activities at Pit C2HS, PT. Berau Coal continues to shift which causes the hauling distance between the front loading overburden (OB) and the disposal become further away resulting in an increase in operating costs. The only alternative solution that can be done to shorten the hauling distance is by building a new access road and bridge construction that crosses the Sambarata river. The efficiency cost resulting from the reduction of the overburden hauling distance with the construction of this bridge must be greater than the cost of constructing the bridge itself. The payback period must be less than 2.5 years considering the mining concession permit granted by the government of the Republic of Indonesia to PT. Berau Coal only until 2025. Therefore, investment decisions must go through a comprehensive analysis of economic parameters so that the decision-making process is correct. Capital Budgeting is used to evaluate the financial feasibility of the project, including sensitivity analysis of several economic parameters. It is also carried out to determine what parameters have a significant impact on the project's economy.

Keywords: ***Investment analysis, hauling distance, corrugated bridge, capital budgeting, risk analysis.***

ABSTRAK

Aktivitas penambangan di *pit* C2HS, PT. Berau Coal terus bergeser yang menyebabkan jarak angkut antara area penggalian lapisan penutup atau *overburden* (OB) dengan area pembuangan semakin jauh sehingga menyebabkan peningkatan biaya operasional. Satu-satunya alternatif solusi yang dapat dilakukan untuk memperpendek jarak angkut adalah dengan membangun jalan akses baru dan pembangunan jembatan yang melintasi sungai Sambarata. Efisiensi biaya dikarenakan pengurangan jarak angkut lapisan penutup dengan pembangunan jembatan ini harus lebih besar dari biaya pembangunan jembatan itu sendiri. *Payback period* harus kurang dari 2,5 tahun mengingat izin pengusahaan pertambangan yang diberikan oleh Pemerintah Republik Indonesia kepada PT. Berau Coal hanya sampai tahun 2025. Oleh karena itu, keputusan investasi harus melalui analisis parameter ekonomi yang komprehensif agar proses pengambilan keputusan tepat. Penganggaran modal digunakan untuk mengevaluasi kelayakan finansial proyek, termasuk analisis sensitivitas beberapa parameter ekonomi. Hal ini juga dilakukan untuk menentukan parameter apa yang memiliki dampak signifikan terhadap keekonomian proyek.

Kata kunci: ***Analisis investasi, jarak angkut, jembatan corrugated, capital budgeting, analisa risiko***

1. INTRODUCTION

1.1. Background

PT. Berau Coal applies surface mining or open pit mining methods. In general, the stages in the open pit mining method are first, land clearing, then top soil removal. After that, drilling and blasting of strata or rock/sediment layers is carried out. The blasting process is carried out considering the strata layer is a

very hard layer. Then the overburden is excavated, the overburden is removed and the coal below the strata can be exploited and then brought to the coal processing plant area. After going through the sizing stage, the coal is then transported to the mother vessel as the final stage. One of the important stages in a coal mining activities is overburden (OB) hauling from the front loading to the disposal area or commonly called OB hauling. The distance between the front loading and the disposal area is one of the parameters that must be maintained because it will greatly overall coal mining costs (cost/tones). Mining companies will try to keep this hauling distance as short as possible in order to generate profits as projected, including if they have to invest in infrastructure.

Sambarata Mine Operation is one of the active mining areas owned by PT. Berau Coal has 4 pits, namely Pit C2, Pit C2HS, Pit C2HU and Pit T4U. Of these four Pits, only Pit C2HS and Pit C2HU whose operational activities cross the river, namely the Sambarata River, but until the end of the contract period it is planned that only Pit C2HS requires additional infrastructure in the form of a bridge to be crossed by means of transportation such as off highway truck (OHT) with a capacity of 100 tons. This infrastructure is needed to maintain the hauling distance from the C2HS front loading to the T4 disposal void so that mining activities remain economically valuable.

1.2. Problem Statement

Based on Pit production forecast data for 2023-2025, the average overburden hauling distance (OB distance) for the C2HS pit is around 2,678 Km, while the benchmark hauling distance between PT. Berau Coal with the contractor is 1.9 Km, so there is an excess distance that must be paid by PT. Berau Coal to the contractor of 768 m. One of the alternative solution to reduce the hauling distance/or minimize the excess of this hauling distance is to build a new access road while at the same time building a bridge construction as has been done before (phase 1-IV) and if it is built, this bridge will be phase V. From the simulation results, if the option is implemented, the OB distance in Pit C2HS will be 2,578 Km or the excess distance to be paid will be reduced to 668m or 100m less than before so that there will be efficiency costs in operating costs during the 2023-2025 period. In the other side, the mining permit of PT. Berau Coal from the government of the Republic of Indonesia will expire on Dec 2025 so that investment in the form of capital expenditure will be thoroughly considered and calculated in detail for its economic value. If it is needed for operations, the investment must provide a return that is greater than the cost of capital before the contract expires.

1.3. Research Question

1. Is the corrugated bridge construction phase V project financially feasible?
2. What factors most influencing the corrugated bridge construction phase V?

1.4. Research Objective

To identify whether this project can provide a greater return than the initial investment through efficiency cost in hauling OB on Pit C2HS at Sambarata Mine Operation before the mining permit expires in 2025.

1. Analyze the firm value and coal business situation by using external environment and internal environment analysis
2. Analyze the financial feasibility of the project
3. Analyze the factors that may affect the financial feasibility of this project.

1.5. Research Limitation

All The limitations of this research are:

1. Capital expenditure information is based on the cost of a corrugated bridge project of the same type in 2019 (bridge construction phase IV) and adjusted by inflation rate.
2. This research will focus on analysis the incremental operating cost in OB hauling in Pit C2HS between schemes using a new bridge with an existing bridge which will be an efficiency cost for the company.
3. The risk management of the project is will not written and left to the company to be calculated
4. The value of the bridge construction is assumed to be zero at the end of the project in 2025.
   Due to limited of access to historical company data it is difficult to analyze the cost structure of last financial model

2. BUSINESS EXPLORATION

2.1. Project Valuation Technique

According to Haq, 2009 project valuation techniques are divided into 2 (two) major method which are:

1. Discounted Cash Flow (DCF) Valuation Method
2. Real Option (ROA) Valuation Method.

The research of this project assumed has a low uncertainty of coal business, simple complexity of investment, simple complexity of method and will uses WACC in order to take into account time value of money so that assumed more appropriated method is DCF besides this method is also more familiar for the decision maker for the investment of a project. The concept of DCF is based on idea of the growth of cash invested by investor by certain percentage over time. The calculation formula is as follows:

$$PV = \frac{FV_n}{(1+r)^n} \quad (1)$$

Where:
PV : Present Value
FV : Future Value
n : Periods from initial investment
R : Interest rate

2.2. Capital Expenditure (CAPEX)

Capital expenditure or commonly abbreviated as CAPEX is an amount of costs incurred by a company to buy, repair, or maintain assets, both tangible and intangible for the sake of business continuity. In other words, capex is intended to strengthen the company in increasing the projected profit.

2.3. Operation Expenditure (OPEX)

OPEX is an expenditure made by a company to meet operational needs or costs incurred by the company to maintain the continuity of assets and ensure that the planned company activities can run well. Included in the components of OPEX are rental costs, fuel, insurance, payroll but do not include depreciation, income tax, or interest on loans or financing. The analysis in this research aims to determine whether with the investment of corrugated bridge phase V, the company can get revenue through reduced operating costs or OPEX through reducing OB hauling distances at Pit C2HS, Sambarata Mine Operation.

2.4. Economic Indicator and Investment Evaluation

2.4.1. Weighted Average Cost of Capital (WACC)

Weighted Average Cost of Capital (WACC) is the average return the firm expects to compensate for all the different investors. The basic formula for WACC is as follows:

$$WACC = \left((E/V) * R_e\right) + [((D/V) * R_d) * (1-T)] \quad (2)$$

Where :
E : Market value of the company's equity
D : Market value of the company's debt
V : Total Market Value of the company (E + D)
Re : Cost of Equity
Re : Cost of Equity
T : Tax Rate

A company is generally financed with a combination of equity (stock) and debt (bonds). When the company receives more than one source of financing, A Weighted Average is calculated to discover how expensive it is for companies to get funds to invest both in tangible and in intangible assets.

2.4.2. Net Present Value (NPV)

The net present value (NPV) was found by subtracting a project's initial investment form the present value of its cash inflows discounted at a rate equal to the firm's cost of capital. These method was sophisticated capital budgeting technique and used by most large companies to evaluate investment projects (Giftman & Zutter, 2015)

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - CF_0 \quad (3)$$

Where:
CF : Cash inflows
r : Discount rate at firm's cost of capital
CF0 : Project initial investment
When NPV is used to make accept-reject decisions, the decision criteria are as follows:

- If NPV ≥ 0 accept the project;
- If NPV ≤ 0 reject the project

2.4.3. Internal Rate of Return (IRR)

The Internal Rate of Return is an indicator of the level of efficiency of an investment. The IRR method computes the rate present value of the cash inflows with the present value of the investment. (Anthony, Hawkins, Merch, et al., 2012)

$$\sum_{k=0}^{n} \frac{CF_t}{(1+IRR)^t} = CF_0 \quad (4)$$

The decision criteria for the project shall be assessed

through the following requirement:
- If IRR > cost of capital. Accept the project
- If IRR < cost of capital. Reject the project

2.4.4. Payback Period (PBP)

The payback period is the time it takes the firm to recover its initial investment in project, as calculated from cash inflows. The payback period could be calculated based on two (2) formulations, subject to the nature of the cash flows.

PBP for Uniform cash flow

$$= \frac{Net\ Initial\ Investment}{Uniform\ Increase\ in\ Annual\ Future\ Cashflow} \quad (5)$$

PBP for Non-uniform cash flow
The payback is calculated based on the cumulative cash flow over the period of the time until the initial investment is fully recovered. The disadvantages of this method are:
1. The payback period does not consider the time value of money
2. The payback period does not consider the project's cash flows after payback period

The acceptance criteria for the payback period are:
- If the payback period is < maximum company's acceptable payback period, then the project shall be accepted
- If the payback period > maximum company's acceptable payback period, then the project shall be accepted

The length of the maximum acceptable payback period is determined by management.

2.4.5 Profitability Index (PI)

Profitability Index (PI) is the ratio of present value of cash inflows against the initial investment outflows provided for the financial investment.

$$PI = \frac{\sum_{t=1}^{n} \frac{CF_t}{(1+r)^t}}{CF_0} \quad (6)$$

The acceptance criteria for the project are where the PI > 0, as it means the NPV > 0.

2.5 Sensitivity Analysis

Sensitivity analysis is a procedure to study systematically the effect of changes in the value of key parameter – including coal price, cost of capital, operating expenses, oil price – on the project return. In this study, a tornado chart is used to determine which variable are most important in sensitivity analysis.

2.6 Simulation Analysis

In this study, Monte Carlo simulation method is used to see all the possible outcomes of investment decisions and to assess the consequences of continuous risk, allowing for better decision making under uncertainty.

3. RESULT & DISCUSSION

3.1. Production Forecast

Based on the calculation of life of mine (LOM) made by Mine Plan Department PT. Berau Coal, the total OB removal in the range 2023-2025 range is 49,474,000 BCM with an estimated volume of coal getting is 5,915,000 MT. Stripping ratio (SR) or ratio between volume of OB removal to the volume of coal getting is 8.36 BCM/MT.

3.2. Defining Assumption

The basic assumptions are developed to support the analysis of the project is detailed below:
- The revenue projection, operating expenditure, other operating expenses, market size projection, coal prices projection, royalty and others parameter are assumed to be the same for both of overburden hauling transportation schemes. Those can be ignored in the calculation
- The tax rate based on Republic of Indonesia government's regulation for PKP2B first generation is 45%
- The construction period of corrugated bridge is assumed will be start on January 2023, finish on June 2023 and ready for use on July 2023. So it is assumed that in the same year, the existence of the bridge has generated efficiency costs for the overburden hauling operations in pit C2HS.
- The source of capital is 100% from equity
- The depreciation using straight line method
- The financial modelling will calculate for three years' period (end of the contract)
- The WACC is conducted to define the discount rate of the investment and has been determined by the company upon at 10%.

3.3. Initial Investment

The CAPEX investment for Corrugated Bridge Construction in 2019 is IDR 8,059,603,413.70. Assuming an average inflation rate of 2.21%, the projected CAPEX investment in 2023 is IDR 8,795,466,891.03.

3.4. Depreciation

In accordance with government regulations for PKP2B license holders that all assets owned or purchased with

the CAPEX budget are state property (BMN), including the construction of this corrugated bridge, it is assumed that the salvage value of this construction is 0 at the end of the mining permit. If it is calculated from the first use until the end of the mining permit, the life time of this infrastructure is 30 months. While the straight line depreciation is used in this infrastructure, the depreciation is determined at 3% per month or 20% in the same year after the construction period for 6 months, then 40% in the second year and 40% in the third year.

3.5. Efficiency Cost Projection

Efficiency cost projection of this project is mainly multiplication between incremental distance reduction by construct the corrugated bridge and overburden (OB) hauling distance adjustment rate (OHDA) assumption used in the financial model.

3.6. Financial Feasibility Analysis

Discounted Cash Flow (DCF) method will be used as an approach to valuation this particular project investment. DCF Valuation relation relates the value of an asset to the present value (PV) of expected future cash flows on that asset (Damodaran, 2012, p. 11).

A simple way of measuring FCFF is by using the following formula:

FCFF = EBIT (1-Tax rate) + Depreciation - Capital Expenditure - Δ Working capital (7)

By discounting those listed FCFF using WACC (which is worth by 10%) as the discount rate, it can obtained the result of project feasibility based on five important criteria as shown on the tables below:

Criteria	Result
Payback Period	1.21
Discounted Payback Period	1.40
Net Present Value	IDR 1,913,948,861.93
Profitability Index	1.34
IRR	35.43%

Table 3.1 Financial Feasibility Analysis for Corrugated Bridge Construction
(Source: based on author calculation-summary of project feasibility analysis)

Based on the payback period of 1.21 years, discounted payback period of 1.4 years, positive value of NPV of IDR 1,913,948,861.93, the positive of profitability index of 1.34 and the IRR of 35.43% which greater than WACC of 10%, it can be recommended that PT. Berau Coal take the potential efficiency cost opportunity by investing the project.

3.7. Sensitivity Analysis

In this study, sensitivity analysis is conducted to identify how significant certain variables influence the financial feasibility parameters of the project. In this study, the changes in value of NPV is used to determine the impact of changes in particular variables within the project.

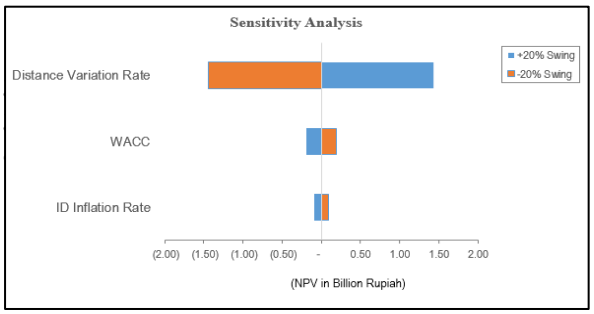

Figure 3.1 Tornado Chart
(Source: based on author calculation-summary of sensitivity analysis)

Referring to NPV tornado chart as shown by Figure 3.1, one variables that most significantly influence project's NPV is distance variation rate, this can be seen from a fairly wide range. While the other two variables, namely WACC and ID inflation rate where, changes in the basic value do not generate significant results in the NPV range.

3.8 Scenario Analysis

In capital budgeting, one of the most scenario approaches is to estimate the NPVs associated with pessimistic (worst), most likely (expected/base), and optimistic (best) estimates of cash inflow. The range can be determined by subtracting the pessimistic-outcome NPV from the optimistic-outcome NPV (Gitman & Zutter, 2015). In this research, the assumption that is used as a reference to determine the calculation parameters for the worst case and base case scenarios is the inflation rate approach, where from the inflation data used, namely January 2019 - May 2022, the max, min and standard deviation are obtained. The scenario in the value of NPV based several variables input is presented in table below

Variables	Scenario		
	Worst Case	Base Case	Best Case
ID Inflation Rate	3.49%	2.21%	1.32%
WACC	11.28%	10.00%	9.11%
Swing in Distance Variance Rate	IDR 3,478.82	IDR 3,510.00	IDR 3,554.99
NPV	IDR 1,456,085,568.73	IDR 1,913,948,861.93	IDR 2,273,822,944.66

Table 3.2 Scenario Analysis
(Source: based on author calculation-summary of scenario analysis)

3.9 Monte Carlo Simulation

In this research, the Monte Carlo simulation method is used to see all possible outputs of investment decisions and to assess the consequences of ongoing risks, to get the right decisions under uncertainty. In a Monte Carlo simulation, a random number will be selected for each variable based on the approximate range. The model will be calculated based on these random numbers. The result of the model is saved and the process is repeated. A typical Monte Carlo simulation calculates a model thousands of times, each time using a different selected random number.

Descriptive Statistics	
Min	1,347,047,263.32
Max	2,413,921,305.42
Mean	1,903,932,269.33
Standard Deviation	168,175,730.25
Median	1,904,957,648.81
Kurtosis	0.10
Skewness	(0.12)
Prob NPV<0	0.00%

Table 3.3 Monte Carlo Simulation Result
(Source: based on author calculation-summary of Monte Carlo simulation)

Based on Monte Carlo simulation result, can explain that the company's revenue will increase through an efficiency cost amount of IDR 1,903,932,269.33 in present value Judging from the distribution, this value falls within the standard deviation range. The best possibility, this project will generate revenue of IDR 2,413,921,305.42 and the worst possibility or if all variables do not meet expectations, then this project will still generate revenue of IDR 1,347,047,263.32 for PT. Berau Coal. The probability of failing this project (NPV<0) is 0%.

4. CONCLUSION

Based on feasibility analysis projection, the corrugated bridge phase V is feasible to implement. PT. Berau Coal covers 100% investment cost or amount IDR 8,795,466,891.03 of CAPEX at 10% WACC. The NPV is expected to reach IDR 1,903,932,269.33 and this value highly influenced by three factors which are distance variation rate, WACC and ID inflation rate. The IRR of PT. Berau Coal is expected to be 35.43% with PBP of 1.21 years. The probability of failing this project (NPV<0) is 0%.

The project's financial projection also mostly sensitive distance variation rate, WACC and ID inflation rate. In term of distance variation rate, the greater the variation rate value, the greater the efficiency cost generated from this project, but on the other hand, a high variation rate value will actually increase operational costs at other mining locations besides the C2HS Pit

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