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Investment Valuation of Loadpro Utilization to Support Coal Hauling Using Discounted Cash Flow Method

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ABSTRACT
Pit A in the Samba Mine Operation has significant coal reserves, approximately 20 million metric tons, based on Life of Mine (LOM) data. However, current conditions show that actual fuel consumption constantly exceeds the set limit, which is problematic as fuel is one of the largest operating costs in the mining industry. To address this, this study aims to evaluate the financial feasibility of using a new coal transportation equipment, Loadpro, which has a lower capacity and fuel consumption than the current equipment. The research method used is the Discounted Cash Flow (DCF) method with Incremental Cost analysis to assess financial feasibility. The results showed that the use of Loadpro resulted in positive financial parameters, namely NPV of Rp. 1.1 billion, Profitability Index (PI) of 1.24, IRR of 23%, and Payback Period of 2.02 years. Sensitivity analysis shows that coal production is the factor that most affects the fluctuation of NPV. Through scenario analysis and Monte Carlo simulation, the worst case scenario resulted in an NPV of -Rp. 781.7 million, while the best case scenario gave an NPV of Rp. 2.2 billion, with an 11% probability that the NPV < 0. The implication of this study is that the use of new equipment can significantly improve operational cost efficiency at Samba Mine Operation, although there remains a risk in coal production that must be managed properly.

Keywords: Discounted Cash Flow, Hauling Coal, Loadpro, NPV, Pit A, Samba Mine Operation.

INTRODUCTION

Indonesia is among the world's largest coal exporters. In 2019, Indonesia's coal exports totalled 454 MT, valued at $21.5 billion (Hanif & Taufiq, 2023). Coal exports increased for the fourth consecutive year in 2019; China and India are Indonesia's two main coal export destinations (Majid & Sukim, 2021). Indonesian coal reserves accounted for 2.2% of global reserves. Indonesia's coal resources and reserves are dominated by low and medium-quality coal. MEMR announced in September 2018 that resources and reserves would be increased to 166 and 37 billion tons, respectively (MEMR, 2018).

Situated in Berau, East Kalimantan, PT BC is one of Indonesia's biggest coal mining businesses. PT BC currently maintains four operational regions: Latu Mine Operation, Samba Mine Operation, Binan Mine Operation, and Gumbang Mine Operation. It uses an open mining system to mine in locations where deposits and minerals have been found.

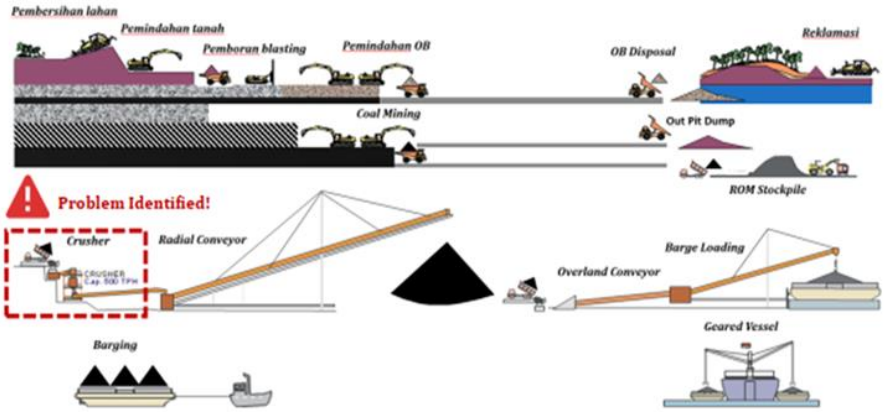

Figure 1. Coal Mining Business Process

The following is attached to the coal mining business process from upstream (coal mining activities in the pit) to downstream (coal barging activities by barge to the mother vessel). In the business process, there is a coal crushing activity in the CPP (coal processing plant), which aims to produce coal products with dimensions by market needs (Ghiffari, 2021).

Fuel costs must be taken seriously because they comprise a significant portion of mining costs (Prasutiyon & Pinto, 2021). Excessive fuel use in several of PT BC's projects results in high fuel consumption. This initiative aims to improve fuel costs, which are consistently higher than the mining contractor has agreed. Pit A of the Samba Mine Operation project will be used for this project's execution. The fuel cost efficiency in Pit A of the Samba Mine Operation project will be examined in several scenarios.

Pits A, B, and C are the three active pits currently mined at the Samba Mine Operation. PT Madhani Tlatah Nusantara and PT Ricobana Abadi are two active mining contractors. PT Madhani Tlatah Nusantara operates in Pit A and Pit B,. In contrast,, PT Ricobana Abadi operates in Pit C. The working area of PT Madhani Tlatah Nusantara's Pit A will be the site of this project.

Figure 2. Samba Mine Operation Concession

According to the life of mine (LOM) mining plan, the Samba project's production would increase in 2024. The graph indicates that production is expected to rise in 2024. Increasing the efficiency of the coal transportation machinery from the pit to the coal processing plant is necessary to support this. Furthermore, it is impossible to separate the cost of fuel, which will rise in tandem with production increases.

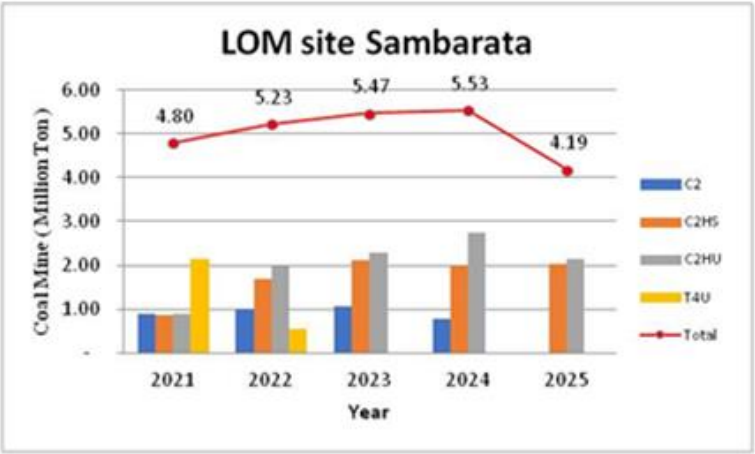

Figure 3. Samba Mine Operation Life of Mine Production

The graph shows that 2022 fuel consumption will be higher than the predetermined amount. Improvements will, therefore, be made to the utilization of new coal transportation equipment with a lower fuel ratio. Currently, DT 30 tons is utilized for coal transportation from ROM temporarily to CPP. In contrast, HD CAT777 is temporarily utilized for coal transportation from pit to ROM. The load X60, which has lower productivity and fuel ratio values, is the new equipment that will be used. However, given this improvement condition, a new weighbridge

must be purchased because the current weighbridge cannot meet the requirements of the new equipment.

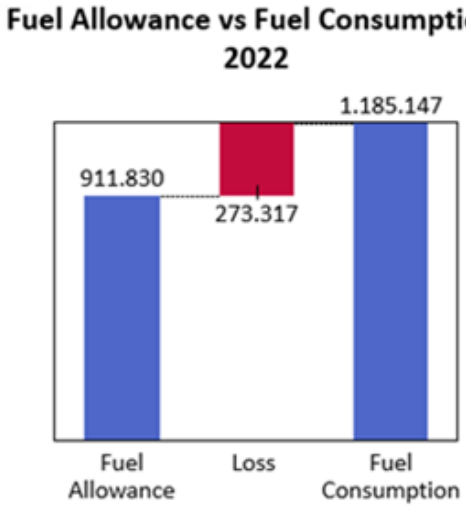

Figure 4. Samba Mine Operation 2022 Fuel Performance

This problem is related to a potential increase in fuel expenses when utilizing the current coal-hauling machinery to fulfil the production targets that are expected to rise by 2024. An improvement scenario is required to minimize fuel consumption in coal hauling equipment, which will affect fuel cost efficiency in 2024. To meet the requirements of the new equipment to be used, specifically the Loadpro X60, the analysis will be added as an investment in a new weighbridge to determine whether this scenario is financially and operationally feasible.

This issue must be solved immediately because fuel is one of the most significant mining costs. So, if this problem remains, there is a significant potential loss. Furthermore, the existing coal-hauling equipment is being utilized now. In that case, the mining contractor will need to add equipment because the existing equipment will fail to meet the production target 2024. As a result, new coal hauling equipment, specifically the load X60, will be critical to meet production targets and reduce fuel costs.

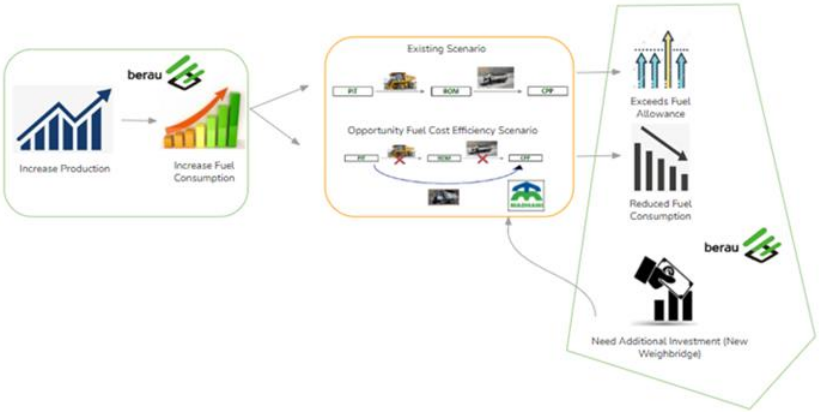

Figure 5. Rich Picture Diagram

According to the rich picture diagram, there are two stakeholders: PT BC and PT. Madhani Tlatah Nusantara. Based on PT BC's mining plan, Pit A's output will increase in 2024, increasing fuel consumption. The fuel consumption will exceed the allowance if we use the current equipment and scenarios. As a result, a new scenario is required to overcome this. This scenario includes using the load X60 equipment, which PT Madhani Tlatah Nusantara already owns. However, the new scenario necessitates investment in a new weighbridge, which PT BC will carry out to meet the specifications of the new equipment, so a study must be conducted to ensure that it is economically feasible and to compare it to the current scenario. In addition, it can also be seen here that the problem owner, problem solver and decision maker is PT BC because the potential loss is in PT BC while PT Madhani Tlatah Nusantara is only an executor on this business issue.

Based on the above background, this study aims to analyze the fuel cost efficiency of coal transportation activities in Pit A, Samba Mine Operation, using a new scenario involving the use of Loadpro X60 equipment. This research will provide PT BC with appropriate recommendations for an efficient fuel cost reduction strategy for coal transportation operations at the Samba Mine Operation. This research can also provide a solid basis for PT BC to make decisions regarding investment in new scales required to support the use of new equipment. In addition, this research is expected to assist PT BC in achieving higher production targets with lower fuel costs by implementing Loadpro X60 usage scenarios. This research can also provide insight for PT Madhani Tlatah Nusantara to optimize the use of coal transport equipment to support the operational efficiency desired by PT BC.

RESEARCH METHODS

This research methodology will be carried out in stages, beginning with a preliminary analysis to identify the root causes of business issues and provide alternative solutions. The second step is to conduct a more in-depth financial analysis of the alternative solutions to determine whether or not their implementation is financially feasible.

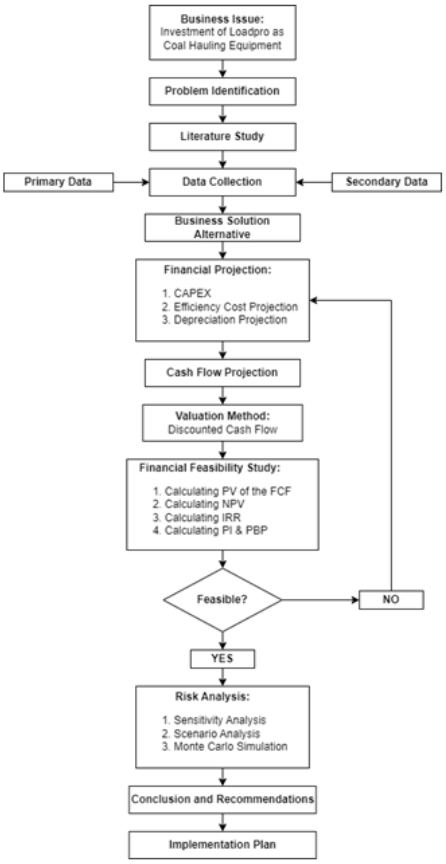

Figure 6. The research framework of the research

Data Collection Method

The author will employ a qualitative and quantitative approach in this research. The data used in this study is primarily from PT. BC Data collection is divided into two categories: primary and secondary data that support the research.

Capital Budgeting Analysis

The process of assessing and choosing long-term investments that support the company's objective of maximizing profit is known as capital budgeting (Gitman & Zutter, 2011). (Gitman & Zutter, 2011) define the capital budgeting process as consisting of five separate but connected steps, which are as follows:

1. Proposal generation,
2. Review and analysis,
3. Decision making,
4. Implementation,
5. Follow up

In PT. XYZ capital budgeting can be used to evaluate proposed projects. Capital budgeting can be used to evaluate coal hauling using the load projects financially in this research. The proposal generation of this research was obtained from the business issue of the fuel

consumption of coal hauling exceeding the approved commitment. Hence, improvements need to be made to reduce the fuel consumption of coal hauling. A new coal hauling tool, load, is used to reduce fuel consumption, which has lower fuel consumption than the current coal truck unit. The evaluation of the proposed coal hauling using the load project will use a discounted cash flow method to evaluate the project financially. The limitation of this project is that it only gives options for the decision-making process for PT. XYZ by financially coal hauling using load option and propose the implementation strategy for the project.

Capital Expenditure (CAPEX)

Capital expenditure is an outlay of funds by the firm expected to produce benefits over a period greater than one year (Gitman & Zutter, 2011). In this project, the capital expenditure is to build a new weighbridge that complies with load specifications after the project is over. This new weighbridge is extremely critical and must be built because the existing weighbridge does not meet the unit specifications in terms of the load that can be weighed or its dimensions.

Operating Lease

An operating lease is a legal agreement wherein the lessor provides an asset's service in exchange for the lessee making regular payments to the lessor (Gitman & Zutter, 2011). In this project, PT. XYZ can use load to transport coal due to the choice of operating lease method. Because the project's duration is less than a year (approximately six months based on the plan) and the initial purchase of load is greater than the operating lease, the leasing method is preferred over the purchasing method. The operating lease for load is acquired from the coal hauling quotation price provided by PT. MTN in Pit A.

Discounted Cash Flow

One technique for estimating the value of an investment is discounted cash flow, which is based on the investment's anticipated future cash flow (Fernando, 2022). When calculating expected future cash flow, the discount rate is applied. Alternatively, the weighted average cost of capital (WACC), based on the financing option chosen by the investor, is frequently used. The following is the present value formula:

Equation 1

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

Where

PV : Present value

FV : Future value

n : Periods from initial investment

r : Interest rate

Cost of Equity

Companies need a specific rate of return on equity investments before they deem them worth the risk. This is known as the cost of equity. In this study, the capital asset pricing model (CAPM), frequently employed in long-term projects, was used to calculate the cost of equity. According to the CAPM approach, the cost of equity is equal to the risk-free rate plus the country risk premium plus the risk premium. The risk premium is obtained by multiplying the security's beta and deducting the market rate of return from the firm's risk-free rate. Where the following formula appears:

Equation 2

$$Ke = Rf + \beta(Rm - Rf)$$

Where

Ke : Cost of equity

Rf : Risk free rate

β : Beta of the security

Rm: Market rate of return

Weighted Average Cost of Capital (WACC)

The average cost of capital for a company, weighted to account for various sources of capital like bonds, common stock, and other debt, is known as the weighted average cost of capital, or WACC. The average interest rate a business anticipates paying to finance its assets is known as WACC (Hargrave, 2022). This is what the WACC formula displays:

Equation 3

$$WACC = \left(\frac{E}{V} \times Ke\right) + \left(\frac{D}{V} \times Kd \times (1 - Tc)\right)$$

Where

E : Market value of the firm’s equity.

D : Market value of the firm’s debt.

V : E + D.

Ke : Cost of equity.

Kd : Cost of debt.

Tc : Corporate tax rate.

Investment Decision Analysis

A number of financial assessment metrics can be employed to determine whether the investments made are financially feasible to carry out. These metrics include the following:

Net Present Value

The difference between the present value of cash inflows and outflows over a given period is known as net present value (Fernando, 2022). Implementing the investment is financially feasible if the net present value is positive and vice versa. Which the following computation indicates:

Equation 4

$$NPV = \frac{Cash\ Flow}{(1+i)^t} - initial\ investment$$

Where :

NPV : Net present value.

i : Required return or discount rate.

t : Numbers of periods.

Payback Period

The payback period is needed to recoup investment costs or reach the breakeven point, whichever comes first (Fernando, 2022). In this study, the payback period value is derived from cash flow from year to year of investment. The payback period used in capital budgeting analysis is a discounted payback period, where future cash flow is discounted using the cash flow.

Net Present Value

The profitability index illustrates the connection between a project's projected costs and benefits (Fernando, 2022). The project is financially viable to implement if the profitability index is more significant than 1,0; if the profitability index is less than 1,0, it is not. A profitability index of 1,0 is the minimum acceptable measure. Which the following computation indicates:

Equation 5

$$PI = \frac{PV\ of\ future\ cash\ flows}{initial\ investment}$$

Where

PI : Profitability index.

Internal Rate of Return

An internal rate of return (IRR) is a financial metric used to assess an investment's profitability while accounting for the time value of money (Fernando, 2022). The IRR value is obtained by setting NPV to zero to find the discount rate, or IRR.

Sensitivity and Probability Analysis

This study used Monte Carlo simulation and sensitivity analysis to model probability analysis and assess which variables impacted the project most. Sensitivity analysis can use high and low swings with allocated percentages to predict which project variables are most and least affected. The impacted variables in the Monte Carlo simulation are then simulated using random values to obtain all potential outcomes of the investment that has been made. This approach makes making better decisions when making an uncertain investment possible.

RESULTS AND DISCUSSION

Capital Expenditure

The cash outflow for this project is capital expenditure (CAPEX). CAPEX is the initial investment for using load in Pit A, where in this project, in the form of purchasing and installing

a weighbridge, which is worth around Rp. 4.5 billion based on the estimation of the owner of PT Berau Coal from the offer of the weighbridge vendor, where the manufacturer is based in Jakarta. Therefore, the details of capital expenditure can be seen in the table below:

Table 1. Capital Expenditure of New Weighbridge

No	Description	Project Cost
1	Preparation	Rp 520,500,000.00
2	Earth Work	Rp 1,073,772,690.00
3	Civil Work	Rp 928,000,000.00
4	Structure	Rp 1,035,000,000.00
5	Mechanical and Electric Work	Rp 850,000,000.00
	Total	Rp 4,407,272,690

Depreciation

According to government regulations, Law Number 3 of 2020 and Government Regulation No. 77/2014 on implementing Mineral and Coal Mining Business Activities, the asset owned by PKB2B's license holder will become state-owned property at the end of mining operations (NEGARA, n.d.). The depreciation calculation in this study is based on the assumption of the infrastructure's economic lifetime, so it is not adjusted for the new weight. Depreciation will be calculated using the straight-line method for a helpful lifetime of ten years. Depreciation is calculated at 0.83% monthly or 10% annually.

Efficiency Cost Projection

Efficiency cost projection in this research is the operation cost difference for coal hauling activity between Loadpro and Scania P460. The cost projection is shown as follows:

Table 2. Efficiency Cost Projection

	2024	2025	2026
Coal Produce (Ton)	2,145,927	2,104,4578	2,249,528
% Produce	100%	100%	100%
Fuel Ratio without Loadpro (L/ton)	0.451	0.451	0.451
Fuel Ratio with Loadpro (L/ton)	0.327	0.327	0.327
Difference in fuel ratio	0.124	0.124	0.124
Fuel Cost/Liter	$ 13,638	$ 13,638	$ 13,638
Incremental	$ 3,629,069,425	$ 3,559,142,353	$ 3,804,273,531

Weighted Average Cost of Capital

PT. BC funds its operational activities from its equity and does not use debt, so the calculation of WACC will be the same as the result of the Cost of Equity. The Component used for calculating the cost of equity are as follows:

Table 3. Cost of Equity

Parameters	Reference	Time Range	Value
Risk-Free Rate (Rf)	IGYSC – 10 Years Government Bonda Yield	3 Years	6,36%
Risk Premium (Rm-Rf)	Damodaran (Indonesia – Equity Risk Premium)	June 2024	7,38%

Parameters	Reference	Time Range	Value
Beta	Damodaran (Indonesia – Beta Unlevered)	June 2024	0,8148%

Calculation of Cost of Equity: $Ke = Rf + \beta\ (Rm - Rf)$ = 6,36% + 0,8148 (7.38%) = 10,16%

The result for the cost of equity that is used to discount the cash flow from the project (WACC) is 10,16% (Damodaran, 2012).

Capital Budgeting Analysis (Discounted Cash Flow Method)

In this research, some criteria will be used to assess the project's feasibility. The four criteria are payback period, net present value (NPV), profitability index, and interest rate of return (IRR). The table below shows the project feasibility result after discounting the cash flow using WACC as a discount rate:

Table 4. Discounted Cash Flow

Stream	Year	2023	2024	2025	2026
		0	1	2	3
Revenue	Incremental (OHDA)		3,620,069,425	3,559,142,353	3,804,273,531
	Total Revenue		3,620,069,425	3,559,142,353	3,804,273,531
Profit & Loss	EBITDA		3,620,069,425	3,559,142,353	3,804,273,531
	(-) Depreciation		(440,727,269)	(440,727,269)	(440,727,269)
	Taxable Income		3,188,342,156	3,118,415,084	3,363,546,262
	Tax Expense		(1,434,753,970)	(1,403,286,788)	(1,513,595,816)
	Net Income		1,753,586,186	1,715,128,296	1,849,950,444
Cash Flow	(+) Depreciation		440,727,269	440,727,269	440,727,269
	CF Operation		2,194,315,455	2,155,855,565	2,290,677,713
	CF Investment (Capex)	(4,407,272,690)			
	Net Cash Flow (EAT)	(4,407,272,690)	2,194,315,455	2,155,855,565	2,290,677,713
	Cumulative Cash Flow	(4,407,272,690)	(2,212,957,235)	(57,101,670)	2,233,576,042
Depreciation Schedule	Beginning Remaining Asset Value		4,407,272,690	3,966,545,421	3,525,818,152
	CAPEX	4,407,272,690			
	Depreciation		(440,727,269)	(440,727,269)	(440,727,269)
	End Remaining Asset Value	4,407,272,690			

Additional Financial Metrics
Payback Period : 2.02
WACC : 10.16%
NPV : 1,074,721,117
IRR : 23%
Profitability Index : 1.24

Based on the capital budgeting analysis, the NPV value is IDR 1.074.721.117, the IRR is 23%, which is greater than the WACC of 10.16%, the Payback Period is 2,02 years, which is shorter than the lifetime use of the asset, and the Profitability Index is 1.24, which is greater than 1.

Sensitivity Analysis

This research uses sensitivity analysis to determine how significant certain variables influence the project's financial feasibility parameters. The variables used in this study include coal production, fuel ratio difference, capex, fuel cost, and WACC. Sensitivity analysis involves changing the base value of e

ach variable by ± 20% and analyzing how these changes affect the volatility of the NPV project value. The following table and chart summarize the outcome of the sensitivity analysis:

Table 5. Sensitivity Analysis

Parameter	Current NPV	+20% Swing NPV	-20% Swing NPV
Coal produce	Rp 1,074,721,117	Rp 2,072,754,959.00	Rp 76,687,274.43
Difference in fuel ratio	Rp 1,074,721,117	Rp 2,072,754,959.00	Rp 76,687,274.43
Fuel Price	Rp 1,074,721,117	Rp 2,072,754,959.00	Rp 76,687,274.43
WACC	Rp 1,074,721,117	Rp 883,444,750.44	Rp 1,277,984,638.76
CAPEX	Rp 1,074,721,117	Rp 291,631,497.77	Rp 1,857,810,735.66

Based on sensitivity analysis, coal production is the most sensitive parameter that affects the increase and decrease of NPV, followed by Capex and Difference in Fuel Ratio. The parameters that are not very sensitive to changes in NPV are Fuel Price and WACC.

Scenario Analysis

Scenario analysis examines the impact of multiple variables on the volatility of the NPV value at the same time, using historical data. The following table summarizes the outcome of the scenario analysis:

Table 6. Scenario Analysis

	Pesimis	Base Case	Optimis
	1	2	3
CAPEX	$ 255,992.00	$ 274,682.00	$ 289,657.00
Coal Produce	$ 0.88	$ 1.00	$ 1.11
Difference Fuel Ratio	9%	12%	14%
Fuel Cost	0.74	0.85	0.89
NPV	-781,739,409	1,074,721,117	2,232,108,107

Based on the scenario analysis, it was found that in the best-case condition, the project implementation generated NPV of Rp. 2.232.108.107, while in the worst-case, the project implementation generated NPV of -Rp.781.739,409. In addition to the NPV parameter, increases and decreases occur in other parameters in the best- and worst-case scenarios. These results indicate that the project implementation will benefit the company (financially feasible) in some conditions because during the worst possible outcome, the project can't generate profits.

Monte Carlo Simulations

In this research, in addition to sensitivity and scenario analysis, risk analysis was performed using Monte Carlo Simulation. Monte Carlo simulation is a method for visualizing all possible outcomes of investment decisions and assessing the consequences of ongoing risks to make the best decisions under uncertain conditions (Dewi & Harsono, 2024). Monte Carlo simulation calculates the model thousands of times, each with a different randomly chosen number. The results describe the likelihood of obtaining variations in results in a model. The simulation results are presented in the table below.

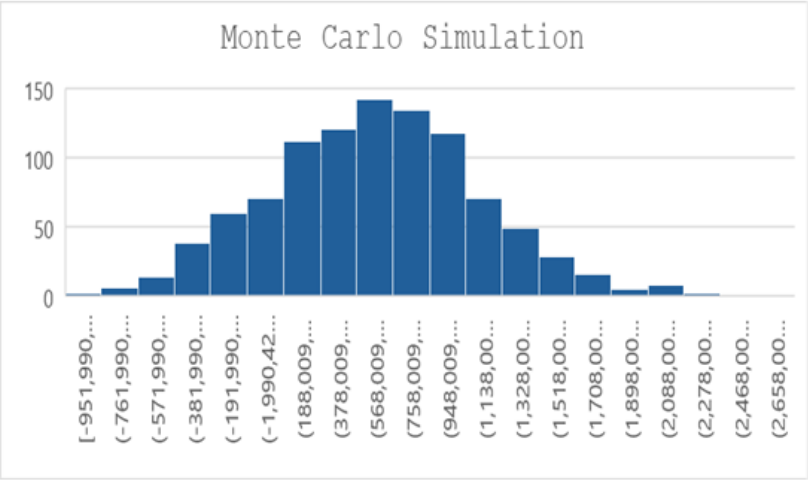

Figure 7. Monte Carlo Simulation

Table 6. Descriptive Statistics of the Net Present Value (NPV) Simulation Results

Descriptive Statistic	Value
Minimum	-Rp 951,990,429.33
Maximum	Rp 2,782,650,272.54
Standard Deviation	Rp 549,407,946.87
Median	Rp 665,835,983.09
Kurtosis	0.09
Skewness	0.14
Prob NPV < 0	11%
Prob NPV > 0	89%
Prob NPV > average	50%

Based on the analysis results using Monte Carlo Simulations, the NPV value obtained on average is IDR 665.835.983. The NPV value in Capital Budgeting Analysis (DCF Method) shows a smaller value compared to this value, this difference shows that the parameter values used in this research are not conservative because there is significant difference in NPV value.

Additionally, the Prob NPV < 0 statement indicates that this project may not be feasible, with a value of 11% based on analysis results. This strengthens the earlier argument in the scenario analysis that the project will still generate profit even if the worst-case scenario occurs.

Business Solutions

Compared to existing methods, the options to utilize load for coal hauling activity are recommended to the company. This is because the implementation of the project generates a positive NPV, which is IDR 1.074.721.117, an IRR of 23%, which is greater than the WACC 10,16%, a Payback Period of 2,02 years, which is shorter than the lifetime use of the asset, and a Profitability Index of 1.24, which is greater than 1.

Furthermore, based on the Scenario analysis and Monte Carlo simulation, it was discovered that the project implementation has a low chance of producing a negative NPV. This research contributes to the literature on capital expenditure analysis and investment decision-making in the mining industry, particularly in the use of new, more efficient equipment for coal transportation. Several previous studies have discussed the importance of CAPEX utilization in supporting operating efficiency and reducing costs. For example, research by (Bae et al., 2022) highlighted how effective CAPEX management can result in improved company financial performance through reduced operating costs. In addition, research conducted by (Palepu et al., 2020) in Corporate Finance shows that capital investments decided using analytical methods such as Discounted Cash Flow (DCF) are often the most reliable method in ensuring long-term project feasibility.

In the mining context, (Samis & Davis, 2014) in the International Journal of Mining Science and Technology also showed that financial analysis using the DCF method, combined with sensitivity analysis and Monte Carlo simulation, can help predict risks and uncertainties in mining projects. This finding is in line with this study, which uses DCF and Monte Carlo approaches to identify the parameters that most influence project feasibility, especially the sensitivity of coal production to NPV.

In addition, research by (Niskanen, 2022) concluded that the Monte Carlo simulation method provides deep insights into various scenarios that may occur in investment projects, and helps companies anticipate possible negative outcomes, as found in this study with an 11% probability of NPV less than 0.

CONCLUSION

Based on the Capital Budgeting analysis, the implementation of this project resulted in several financial parameters, including a positive NPV of Rp. 1,074,721,117, an IRR of 23%, which is higher than the WACC of 10%, a payback period of 2.02 years, which is faster than the asset life, and a profitability index of 1.24, which is greater than 1. These parameters indicate that the project is financially viable. Sensitivity analysis shows that coal production is the most sensitive factor to changes in NPV. A ±20% change in coal production results in a ±93% change in NPV value. The results of the scenario analysis show that under the best condition, the project implementation generates an NPV of Rp. 2,232,108,107, while under the worst scenario, the project generates an NPV of Rp. -781,739,409. Through Monte Carlo simulation, the average NPV obtained is Rp. 665,835,983. The NPV value in the Capital Budgeting analysis (DCF method) shows a smaller value than the simulation results, which indicates that the parameters used in this study may not be conservative. In addition, the probability analysis shows that there is an 11% chance that the project is not feasible (NPV < 0). This study makes a significant contribution in evaluating the financial feasibility of using new coal transportation equipment in the mining industry. Using the Discounted Cash Flow (DCF) method and Monte Carlo simulation, this study not only demonstrates the financial feasibility of the project, but also provides insight into the risks associated with fluctuations in coal production and their effect on financial performance. This research can serve as a reference for decision makers in the mining sector in optimizing operational efficiency through the use of more fuel-efficient technologies.

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