

Sensitivity Analysis to Determine the Prospect of Tollroad Investment: Case Study Krian-Legundi-Bunder-Manyar Tollroad

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Abstract—PT Waskita Bumi Wira as the Toll Road Business Entity (BUJT) is investing in the Krian-Legundi-Bunder-Manyar Toll road with a viability gap fund (VGF) scheme. In the 2016 Toll Road Concession Agreement (PPJT) between BPJT-BUJT-PII, several acceptable investment variables have been agreed, namely: total investment value = Rp12,224,389,000,000, average daily traffic volume (LHR) = 21,874 vehicle / day, loan interest = 12.5%, toll tariff for group 1 = Rp1,250 / km, internal rate of return on equity (IRR_{onEquity}) = 17.64%, payback period of 14 years and net present value (NPV) = Rp. 3,731,695,000,000. During the construction, there was a design change and a delay in land acquisition, this causes cost overrun. With a concession period of 45 years, inaccurate risk factors in the prediction of traffic volume growth rates, specific and non-specific risk factors and other uncertainties greatly affect the investment prospects. Therefore investment needs to be reviewed before this toll road is divested in 2025 by sharpening the minimum attractive rate of return (MARR) and LHR variables, then comparing them with the initial business plan. The estimated selling price of the divestment is also examined in this study. The investment valuation criteria that will be used in the sensitivity analysis are NPV and IRR_{onEquity}. The approach in determining MARR is the use of MARR_{premium} = 15.81%. Sensitivity analysis with a deterministic approach is carried out to obtain limits on changes in investment costs, land acquisition costs, LHR traffic, loans (syndicated loans) to NPV in several tariff scenarios. This research shows that the NPV value is very sensitive to changes in investment costs. It is also known that in the toll tariff scenario according to PPJT compensation can be given in one of the conditions: investment costs increase by more than 7%, LHR traffic is less than 75%, or an increase in loans (syndicated loans) of more than 9%. The analysis of the stochastic approach shows that the probability of not exceeding the investment budget revenue limits due to changes of 37.29% to 46.56%.

Keywords—Sensitivity, IRR_{onEquity}, MARR_{premium}, tol KLB, Stochastic.

I. INTRODUCTION

IN 2016 Waskita Bumi Wira company (WBW) grabbed a toll road investment opportunity through initiative scheme (unsolicited) with a concession period of 45 years. This Supported Built-Operate-Transfer (BOT Supported) Project was carried out by viability gap fund (VGF) financing scheme. Based on Toll Road Concession Agreement (PPJT), WBW has a

concession on 38.399 kilometers of Krian-Legundi-Bunder-Manyar (KLB) toll road in East Java and it obliged to construct 25 kilometers Terbanggi-Lampung with total investment was Rp 12.224.389.000.000 [1].

In terms of design, from basic design into detailed engineering design (DED) and from DED into Final Technical Plan (RTA) there are many changes in design due to the lack of detailed soil investigation data at the beginning of planning period. In terms of land acquisition, until the second year construction period (November, 2018), land acquisition progress section 1 to section 3 was 65%. Meanwhile for section 4 is not acquired yet, it affected the original construction completion in November 2018, for section 4 retreat to November 2021, while the section 1 to section 3 will be completed in May 2020. The delay in construction completion due to design and land became the affect of construction costs and investment costs increasing (cost overrun). Reduced operational period with a fixed concession period will have an effect on the KLB toll road revenue reducing [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15], [16]. Therefore, the accepted limits (sensitivity) of cost variable, revenues variables and capital variables against the net present value should be re-examined before it was divested in 2025.

II. METHOD

This research using minimum attractive rate of return MARR_{premium} = 15.81% and corrected rump-up period traffic.

A. Data

1. Investment cost according to PPJT and the changes in March, 2019
 2. Traffic section 1 – section 4 [17]
 3. Interest of debt
 4. Tollrate
 5. Land acquisition cost
 6. Jakarta interbank offered rate (JIBOR)
- *Investment cost exclude land acquisition

B. Investment Criteria

1. Investment analysis using IRR_{onEquity}, net present value (NPV), payback period, benefit cost ratio (BCR) and profitability index (PI)

Table 1.
Financial Aspects Of PPJT

Number	Description	Amount
1.	Investment cost	Rp 12.224.389.000.000
	Design	Rp 126.020.000.000
	Construction	Rp 8.401.374.000.000
	Tollroad tools	Rp 123.278.000.000
	Supervision	Rp 168.028.000.000
	Escalation	Rp 1.089.376.000.000
	Overhead	Rp 84.014.000.000
	Interest during construction (IDC)	Rp 1.017.338.000.000
	Financial fee	Rp 211.379.000.000
	Debt to Equity Ratio (DER)	70 : 30
2.	Toll rate at beginning, Class I (Rp/km) (2018)	Rp1.250
3.	Tollrate escalation	14% per 2 years
4.	Traffic (vehicle/day) (2019)	21.874
5.	Annual debt interest (i loan)	12,50%
6.	Concession period (years)	45
7.	IRR _{onEquity} (IRR with DER 2 sd 2,5)	17,64%
	IRR _{onProject} (IRR with 100% Equity)	14,59%
8.	Payback period	14 years
9.	Net present value (NPV)	Rp 3.731.695.000.000

2. Analysis of sensitivity using IRR_{onEquity} and net present value (NPV)

C. Variables

Analysis of sensitivity using investment cost, land acquisition cost, all section traffic and debt (syndication loan) as the variables [18].

D. Sensitivity Technique

Measurement of sensitivity by using the deterministic approach sensitivity graph technique and then proceed with a stochastic approach to gain acceptance probability limits of investment.

III. RESULTS AND DISCUSSION

According to PPJT, the financial aspects as the investment indicator shown in Table 1.

Based on design changes, on March 2019 additional construction cost has been approved by Tollroad Regulator (BPJT) Rp 988.780.826.047 to KLBM tollroad and Rp 332.060.333.978 to VGF Terbanggi tollroad.

Additional construction cost affects value-added tax cost (PPN) dan interest during construction (IDC) thus investment cost become Rp13.833.157.828.201. The summary as shown in Table 2 and Table 3.

Ending balance sheet investment credit of KLBM tollroad with additional cost Rp 1.608.768.828.201 shown in Figure 1.

Figure 2 seen that variables influencing the NPV starting with the most influence (indicated by the graph steepest) consecutively were: investment costs, LHR traffic section 3, debt (syndication

Table 2.
KLBM Investment Cost Changes

KLBM Tollroad		Before	After
Number	Description	Amount	Amount
1	Design	Rp 92.458.000.000	Rp 92.458.000.000
2	Construction	Rp 6.163.886.000.000	Rp 7.152.666.826.047
3	Tollroad tools	Rp 123.278.000.000	Rp 123.278.000.000
4	Supervision	Rp 123.278.000.000	Rp 123.278.000.000
5	Escalation	Rp 804.868.000.000	Rp 804.868.000.000
6	Value-added tax	Rp 730.777.000.000	Rp 829.654.882.605
7	Overhead	Rp 61.639.000.000	Rp 61.639.000.000
8	Upfront fee	Rp 12.774.000.000	Rp 12.774.000.000
9	Interest during construction	Rp 748.724.000.000	Rp 865.098.278.768
10	Financial fee	Rp 155.962.000.000	Rp 155.962.000.000
	Investment cost	Rp 9.017.644.000.000	Rp 10.221.676.987.420

Table 3.
VGF Terbanggi Investment Cost Changes

VGF Terbanggi Tollroad		Before	After
Number	Description	Amount	Amount
1	Design	Rp 33.562.000.000	Rp 33.562.000.000
2	Construction	Rp 2.237.488.000.000	Rp 2.569.548.333.978
3	Tollroad tools	Rp -	Rp -
4	Supervision	Rp 44.750.000.000	Rp 44.750.000.000
5	Escalation	Rp 284.508.000.000	Rp 284.508.000.000
6	Value-added tax	Rp 260.031.000.000	Rp 293.236.833.398
7	Overhead	Rp 22.375.000.000	Rp 22.375.000.000
8	Upfront fee	Rp -	Rp -
9	Interest during construction	Rp 268.614.000.000	Rp 308.083.673.405
10	Financial fee	Rp 55.417.000.000	Rp 55.417.000.000
	Investment cost	Rp 3.206.745.000.000	Rp 3.611.480.840.781
	Total investment cost	Rp 12.224.389.000.000	Rp 13.833.157.828.201



Figure 1. Ending balance sheet investment credit of KLBM tollroad with additional cost Rp 1.608.768.828

loan), LHR traffic section 1, LHR traffic section 2, LHR traffic section 4, and land acquisition. This shows that investment cost is the most sensitive to NPV. Known also that on the toll rate scenario based on PPJT the compensation fee can be given in one of the following conditions: increase of investment cost up to 7%, traffic is under 75%, increasing of debt (syndication loan) up to 9%. These limits become the boundary whether or not the compensation from the Government to BUJT result of investment return value does not correspond to the initial agreement.

Once the limits of investment deterministically acceptance of the sensitivity analysis is obtained, further measurements of probabilities. Assuming the type of distribution can be determined based on research, interviews with experts, a data graph of the results of sensitivity analysis, assuming

Table 4.
toll rate scenario

	Toll Rate				
	Class I	Class II	Class III	Class IV	Class V
Toll rate α	Rp 1.250	Rp 1.875	Rp 2.500	Rp 3.125	Rp 3.750
Toll rate β	Rp 1.250	Rp 1.500	Rp 2.084	Rp 2.709	Rp 3.104
Toll rate φ	Rp 1.000	Rp 1.500	Rp 2.000	Rp 2.500	Rp 3.000

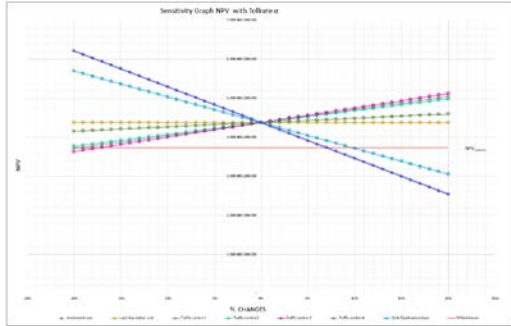


Figure 2. Sensitivity graph NPV with toll rate α

Table 5.
Assumption of Probability Distribution Function

Uncertainty variable	Probability distribution function	Parameter	Note
Investment cost	Normal	Mean μ	$\mu = \text{Rp } 13.833.157.828.201$ 107% = Rp 14.801.476.876.175
		Standar deviasi σ	$\sigma = \text{Rp } 968.319.047.974$
		Static value	static value = μ
Land acquisition cost	Normal	Mean μ	$\mu = \text{Rp } 1.371.355.604.273$ +120% = Rp 1.645.626.725.127
		Standar deviasi σ	$\sigma = \text{Rp } 274.271.120.854$
		Static value	static value = μ
Traffic section 1	Normal	Mean μ	$\mu = 1.368.140.931$ vehicle -81% = 1.108.194.154 vehicle
		Standar deviasi σ	$\sigma = 259.946.777$ vehicle
		Static value	static value = μ
Traffic section 2	Normal	Mean μ	$\mu = 1.358.602.150$ vehicle -79% = 1.073.295.698 vehicle
		Standar deviasi σ	$\sigma = 285.406.452$ vehicle
		Static value	static value = μ
Traffic section 3	Normal	Mean μ	$\mu = 1.373.634.470$ vehicle -83% = 1.140.116.610 vehicle
		Standar deviasi σ	$\sigma = 233.517.860$ vehicle
		Static value	static value = μ
Traffic section 4	Normal	Mean μ	$\mu = 637.280.204$ vehicle -42% = 267.657.686 vehicle
		Standar deviasi σ	$\sigma = 369.622.518$ vehicle
		Static value	static value = μ
Syndication loan	Normal	Mean μ	$\mu = \text{Rp } 9.942.281.160.012$ +109% = Rp 10.837.086.464.477
		Standar deviasi σ	$\sigma = \text{Rp } 894.805.304.401$
		Static value	static value = μ

subjectively based on the preferences of researchers, and others. Based on the sensitivity analysis of data in Figure 2 Sensitivity graph NPV with toll rate α curve is a straight line formed then subjectively all the variables under review are assumed to be normally distributed as shown in Table 5 below :

From the simulation with a confidence level of 95% ($\alpha = .05$) and with 100,000 iterations obtained probability investment

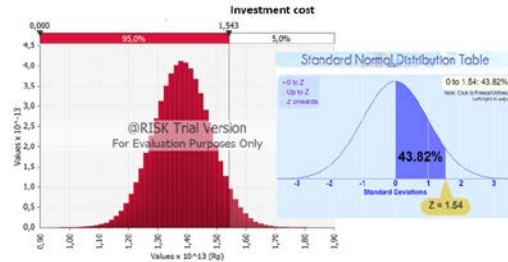


Figure 3. Probability density function of investment cost

costs increased to a maximum of 107% to Rp 14.801.476.876.175 is 43.82% as shown in Figure 3 below:

From analysis through stochastic approach provides information that probability sensitivity investment cost = 43.82%, probability sensitivity acquisition costs = 46.56%, probability sensitivity traffic section 1 = 46.33%, section 2 = 46.56%, section 3 = 45.99%, section 4 = 39.25% and probability sensitivity syndication loan = 37.29%.

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