

Financial Modelling of Phased Development Effect on The Feasibility of The Trans Sumatera Toll Road PPP Project Using Monte Carlo Analysis (Case Study: Betung-Pekanbaru Section)

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Abstract: The Indonesian government has massively encouraged various kinds of infrastructure development using the PPP scheme, including toll roads, but there are still several toll road PPP projects that require particular action due to their very low financial feasibility, one of them is the Trans Sumatera Toll Road project. The government is currently trying to develop a strategy called Phased Development which is predicted to boost the feasibility of a toll road PPP project. This study aims to describe the possibility and conduct a financial model to calculate the effect of that strategy on the feasibility of Trans Sumatera Toll road. The methodology used in this study is a quantitative method using Monte Carlo Analysis. IRR is used as the primary financial parameter to determine the financial viability of the project. This study shows that the Phased Development strategy will make Trans Sumatera Toll Road Project for Betung-Pekanbaru Section financially viable.

Keywords: Phased Development, Financial Model, Toll Road, Public-Private-Partnership, Monte Carlo Analysis

1. INTRODUCTION

The Development of Infrastructure has become a priority Program for President Joko Widodo and Vice President Maruf Amin, where a large portion of the infrastructure is included in the 7 Development Agenda of President Joko Widodo, one of which is "Infrastructure for the Economy and Basic Services." This agenda is also included in the National Medium-Term Development Plan (RPJMN) for year 2020-2024 was to pursue the target of infrastructure stock availability from 43% of GDP in 2017 to 50% in 2024. to realize that target, Indonesia needs infrastructure investment of Rp6,445 Trillion. This investment value increased by 34.3% from Rp4,79 Trillion (USD 319.7 Bn) in the RPJMN year 2015-2019.

In order to increase Indonesia's infrastructure stock, in the 2020-2024 RPJMN, the need for infrastructure development funds in Indonesia reaches Rp6,44 Trillion, with details of Rp 2,38 Trillion (37%) targeted to come from State Budget (APBN), Rp1,35 Trillion (21%) comes from State Owned Enterprise, and Rp2,70 Trillion (42%) comes from private investment. One of the infrastructure development planned by the government in the 2020-2024 RPJMN is the Trans Sumatra Toll Road. In the RPJMN, the government targets constructing a 2.829 km toll road that connects from Lampung to Aceh. The toll road construction is targeted to decrease the Lampung - Aceh travel time from 48 hours to 30 hours.

In realizing the construction of Trans Sumatera Toll Road, the government needs a considerable investment, which reaches Rp531 trillion. From such an investment, the government was only able to fulfill this, amounting to Rp75 trillion. Therefore, the Government of Indonesia has been working to fill the funding gap with various approaches, one of which is through PPP schemes and the phased development policy.

The PPP scheme is a scheme for providing and funding infrastructure carried out through cooperation between the government and business / private entities. The PPP scheme allows the government to provide financial support and other support for specific infrastructure projects, including support in construction cost assistance/Viability Gap Fund (VGF), support for the land provision, and other facilities. In some cases, support in VGF has contributed significantly to private participation in disadvantaged areas such as Africa (Moykkyen, 2020). Government support can also be in the form of regulations that encourage PPP implementation and infrastructure development (Verhoest, 2015). In Trans Sumatera Toll Road Development, the PPP scheme is used by explicitly assigning a State-Owned Enterprise (BUMN), namely PT Hutama Karya, to build the Trans Sumatera Toll Road. In addition, the government is also planning a phased development policy so that it is expected to reduce the burden on business entities and increase project feasibility.

This study aims to model financing and see the effect of phased development on the feasibility of the Trans Sumatera Toll Road project according to the strategy that the government will use.

2. LITERATURE REVIEW

To understand how the use of the PPP scheme and phased development policies affect the feasibility of the Trans Sumatera Toll Road project, it is necessary to know what the Phased Development Policy and PPP Scheme is to be applied to the Trans Sumatera Toll Road project, the concept of feasibility of a project, and the use of Monte Carlo analysis to describe the feasibility of the Trans Sumatera Toll Road Project.

2.1 Phased Development Policy

The Phased Development Policy in the Toll Road project is a policy whereby toll road sections that have a low feasibility level will first be built with specifications of 2x1 lanes, then after the traffic on that section is high enough, widening to 2x2 lanes is carried out. The income earned during the operational period before the widening will be one of the funding sources for the widening construction.

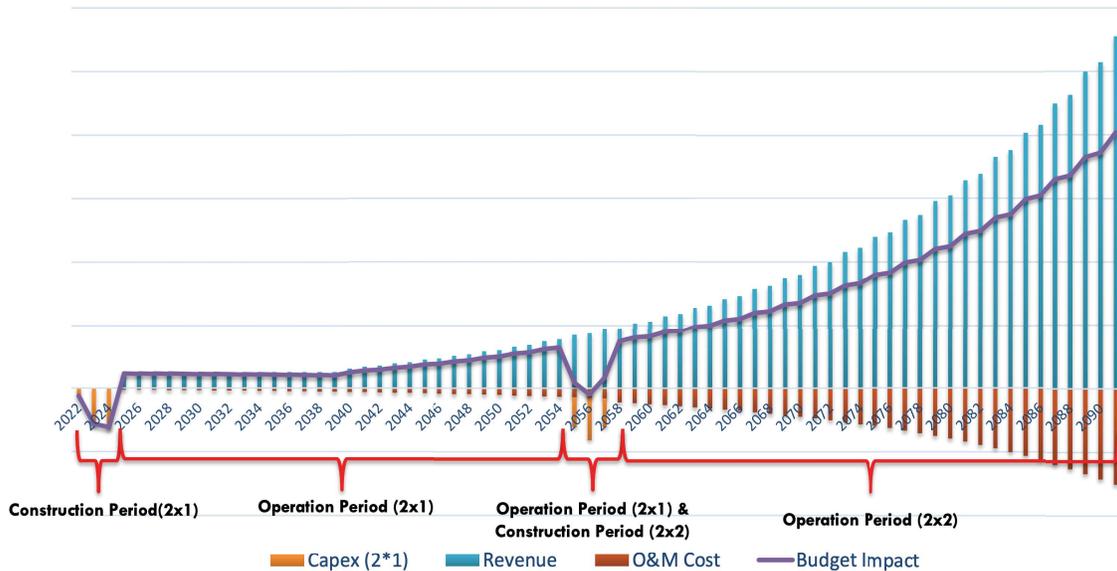


Figure 1. Cash Flow Illustration for Toll Road Project Using Phased Development Policy

The Phased Development Policy on the toll road project itself has never been applied in Indonesia and there are no regulations governing this matter. This makes the Trans Sumatra Toll Road Project one of the pilot projects in the application of the policy.

2.2 Trans Sumatera Toll Road PPP Project

PPP is a collaboration between the Government and Private Sector in the provision of infrastructure by referring to the specifications previously determined by the Minister / Head of Institutions / Heads of Regions / State-Owned Enterprises / Regional Owned Enterprises, which partly or wholly uses the resources of the Business Entity. By taking into account the sharing of risks among the parties (Based on Presidential Regulation No. 38 2015 concerning Government Cooperation with Business Entities in the Provision of Infrastructure).

In funding an infrastructure project, the conventional method places the State Budget (APBN) as the main resource in infrastructure funding, in this case, it also means placing projects in the same position even though each project has different characteristics both from the financial and economic side that must be considered. Therefore, a funding paradigm is made that adapts to the characteristics of the related project. The funding paradigm can be described as follows

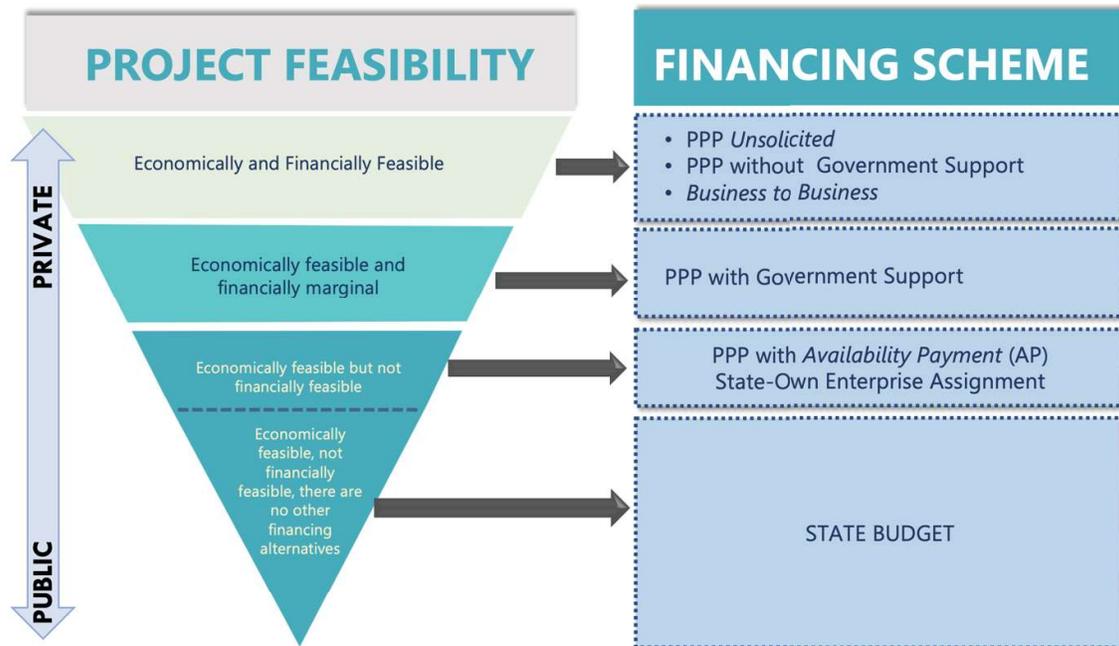
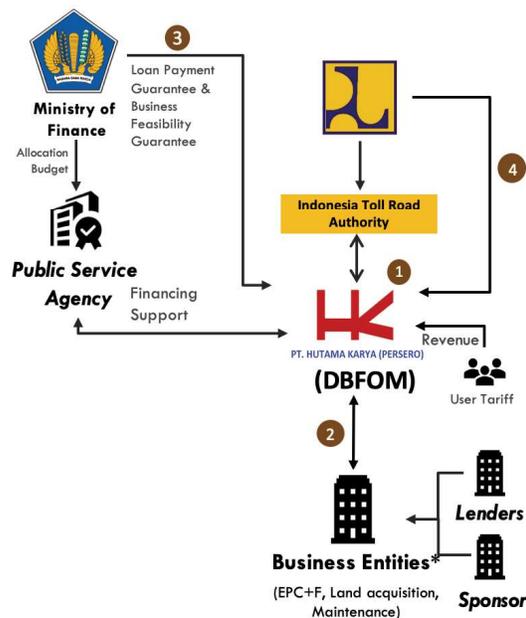


Figure 2. Project Funding Hierarchy

In addition to meeting the needs of infrastructure funding sustainably through private participation, PPP also aims to create a healthy investment climate and realize quality, efficient, effective, and timely infrastructure. Therefore, PPP is carried out with the principles of effectiveness, efficiency, partnership, benefit, and measurable risk management and control.

PPP has risks that are shared between the Government and Business Entities. The division of risk allocation for the Government is (i) Determination of Tariffs, (ii) Regulations / Regulations, (iii) Politics, (iv) Land Acquisition. Meanwhile, Business Entities have an allocation of risk, namely (i) Funding, (ii) Design, (iii) Increase in Construction Costs, (iv) Increase in Operational Costs, (v) Construction Risk.

In the Trans Sumatera Toll Road project, the planned PPP scheme has its characteristics considering that the Trans Sumatera Toll Road project is a strategic government project with a low feasibility level but is needed to encourage economic growth of Sumatera. The implementation of the Trans Sumatera Toll Road project development is regulated through Presidential Regulation No. 117 the year 2015, which explicitly assigns PT Hutama Karya (HK) to the construction of Trans Sumatera Toll Road sections. In carrying out its duties, PT HK gets loan payment guarantees, business feasibility guarantees from the Ministry of Finance, and additional revenue in the form of Availability Payment per year through the Public Service agency which also acts as Minimum Revenue Guarantee. PT HK can also cooperate with other business entities with the EPC + F cooperation scheme in building toll roads.



1. PT Hutama Karya (HK) is assigned by the Government to carry out JTTS concessions with an Annuity Payment Scheme in the form of annual payments paid through Public Service Agency (PSA) and toll revenues collected by HK
2. PT HK collaborates with Business Entities as a third party implementing the EPC + F (1x2 lane) scheme including funding for land acquisition and maintenance. HK widens the road after reaching Degree of Saturation: 0.6.
3. In carrying out the assignment, HK gets loan repayment guarantees and business feasibility guarantees from the Ministry of Finance
4. The government provides construction support for the JTTS section (1x2 lane). After the construction is complete, the assets are handed over to the HK to be managed and widened after reaching Degree of Saturation: 0.6.

Figure 3. Trans Sumatera Toll Road Project Scheme

2.3 Phased Development Policy in Trans Sumatera Toll Road PPP Project

To improve project feasibility, the government, through the Directorate of Financing Implementation System and Strategy Development, the Ministry of Public Works and Housing, plans to reduce Trans Sumatera Toll Road construction costs by using the phased development Policy. In phased development, toll roads with a low feasibility rate will be constructed with 2x1 lane construction first. The feasibility of the toll road is determined by seeing Average Daily Traffic (ADT). ADT is defined as average number of vehicles passing a given point each day (Reksten, 2021). If the ADT for these lanes has grown to a decile > 0.6, PT HK as the will widen the road to 2x2 lanes. A detailed explanation of the scheme can be seen in the Figure 2.

The Ministry of Public Works and Housing of Indonesia is also planning several Trans Sumatera Toll Road development scenarios based on the sections that will first be built until 2024, one of which is the Betung-Pekanbaru section. In this study, the Betung-Pekanbaru section of the IRR Project will be compared by using the initial scenario (2x2 lane) with a phased development scenario (2x1 lane).

2.4 How to Calculate a Project is Feasible or Not

The investment decision-making will calculate financial feasibility parameters, such as Net Present Value (NPV) and Internal Rate of Return (IRR), calculated using standard procedures based on yearly cash flow for each year. Kannapiran (2017) considers that IRR is a more efficient indicator for making investment decisions concerning NPV. IRR was used to reflect the minimal return that the investor willing to achieve. IRR is the rate of return on investment

by calculating the interest rate that equates the present value of an investment with the present value of net cash receipts in the future (Arga, 2021).

$$IRR = I(+)\frac{NPV(+)}{NPV(+)-NPV(-)}(I(-)-I(+))$$

Where,

I(+) = interest rate of NPV(+)

I(-) = interest rate of NPV(-)

NPV(+) = the result of calculation of positive NPV with interest rate I(+)

NPV(-) = the result of calculation of positive NPV with interest rate I(-)

IRR > MARR, investment is feasible;

IRR < MARR, investment is not feasible.

2.5 Monte Carlo Simulation

Monte Carlo simulation is a technique used to understand the impact of risk and uncertainty in financial, project management, cost, and other forecasting models (RiskAMP, 2012). With the Monte Carlo simulation, a random value is selected for each of the tasks, based on the range of estimates. The model is calculated based on this random value. When the simulation is complete, we will have many results from the model, each based on random input values. These results are used to describe the likelihood, or probability, of reaching different results in the model (RiskAMP, 2012). Thus the Monte Carlo simulation can be applied to predict the financial viability by considering risks and uncertainties.

Monte Carlo simulation can be done using the Oracle Cristal Ball Software, which can carry out the risk management process. Some of the tools used from the Oracle Cristal Ball Software include probability results, sensitivity analysis, and scenario analysis. With an algorithmic approach, the Oracle Cristal Ball software can be used in project management by simulating the IRR value.

3. METHODOLOGY

Methodology deals with the procedures and techniques used in the study. The methodology stages include problem formulation, literature study, data, determining uncertainty variables, calculating project cash flow, summarizing Monte Carlo with Oracle Crystal Ball Software. Furthermore, a sensitivity analysis is used to assess the project's multiplicity due to changes in a particular element.

The methodology used in this study is the quantitative method with the financial analysis. IRR is used as the primary financial parameter to determine the financial viability of the project. These financial figures will be analyzed to the standard IRR > MARR, where MARR is the Weight Average Cost of Capital (WACC) of the project. Once there is a gap between the IRR and WACC, we will see which factors significantly influence the IRR value. Then, we need to decide on an appropriate IRR. In this study, a phased construction of the toll road will be made.

4. RESULTS AND DISCUSSION

4.1 Data and Assumption

The financial analysis was conducted to examine the project's financial viability by calculating The IRR of the project. The less financial viability of the project, the less investor is attracted to invest in the project. In order to do the analysis, this study used financial data from PT Hutama Karya Trans Sumatera Toll Road Feasibility Studies (2020).

The Investment Cost of the first scenario (2x2 Lane Scenario) was used in this study as stated in table below:

Table 1: Investment Cost (2x2 Lane Scenario)

Detail	Investment (Rp Billion)
Design Cost	692,06
Toll Facility and Construction (2x2 lane)	69.206,00
setup Fee	1.196,92
Toll Equipment	1.038,09
Supervision	692,06
Escalation	2.830,87
Total Cost before VAT	75.656
VAT (10%)	3.365,6
Overhead	1.730,15
Total Cost after VAT	80,751,75
Financial Cost	775,03
IDC	4.432,11
TOTAL COST	85,958,89
Gov. Support for Construction	42.000
TOTAL COST (AFTER GOV. SUPPORT)	43.958,89

Then the financial modelling assumptions used and the Traffic Volume Assumptions in this study can be seen in the following table:

Table 2: Financial Assumptions

Variable	Assumptions	Unit
Length of Road	574	km
Loan Interest	12%	
Concession Period	70	years
Timeline of Construction	3	years
Timeline of Land Acquisition	2	years
Tol Tariff		
- Gol (Class) I	1.104	Rp/km
- Gol (Class) II	1.656	Rp/km
- Gol (Class) III	2.208	Rp/km
Increasing Tariff	4,72%	Biennial
WACC	9,85%	
Debt Ratio	80%	
Equity Ratio	20%	
Tax	20%	
Inflation	2,36%	
Cost of Equity	10,86	
Minimum Revenue Guarantee (15 years of initial operation)	5.103,5	Rp Billion/year

Table 3: Traffic Volume Assumptions

Traffic	year 2025	unit
Average Daily Traffic (Betung-Pekabaru Section)		
- Gol (Class) I	5.567	car/day
- Gol (Class) II	3.613	car/day
- Gol (Class) III	1.650	car/day
- Gol (Class) III	304	car/day
Traffic Composition		
- Gol (Class) I	65%	
- Gol (Class) II	30%	
- Gol (Class) III	5%	

The project assumptions are defined based on three main categories: investment cost, financial assumptions, and traffic predictions. The land acquisition for the Trans Sumatera Toll Road project is fully implemented by the government, so that the risk is not borne by PT HK. All of these assumptions are taking into the financial model, which will lead to the project's financial feasibility. It is derived from the project cash flow, which comprises calculating the present

value of total revenue minus the investment costs and operational costs. The revenue itself is generated from the daily traffic multiplied by the tariff and top-up from Badan Layanan Umum/Public Service Agency as Minimum Revenue Guarantee (MRG). The amount of MRG that will be provided by the government is assumed to be IDR 5.1 Trillion per year for 15 years of initial operation. The Construction costs are based on PT Hutama Karya studied (2020).

4.2 Monte Carlo Analysis

4.2.1 Defining the Distribution of Significant Independent Variables

The financial model sets up the variable inputs (Table 1) as the independent variable, while the financial viability parameters (IRR) are output or dependent variables. In order to simulate the IRR figures, the study has determined the independent variables that significantly influence the IRR calculation. According to Wirahadikusuma et al. (2014), many risks threaten the financial viability of toll road in Indonesia, among others, are tender duration risk, competition risk, concession contract risk, land acquisition risk, traffic volume risk, toll tariff risk, investment cost risk, overloading risk, construction risk, legal and institutional support risk, inflation risk, and interest rate risk. This study will use four of those risks as the most significant factor that influences the IRR, which are construction cost risk, toll tariff risk, traffic volume risk and inflation risk.

The distribution of that risk factor should be defined, as can be seen in Figure 3.

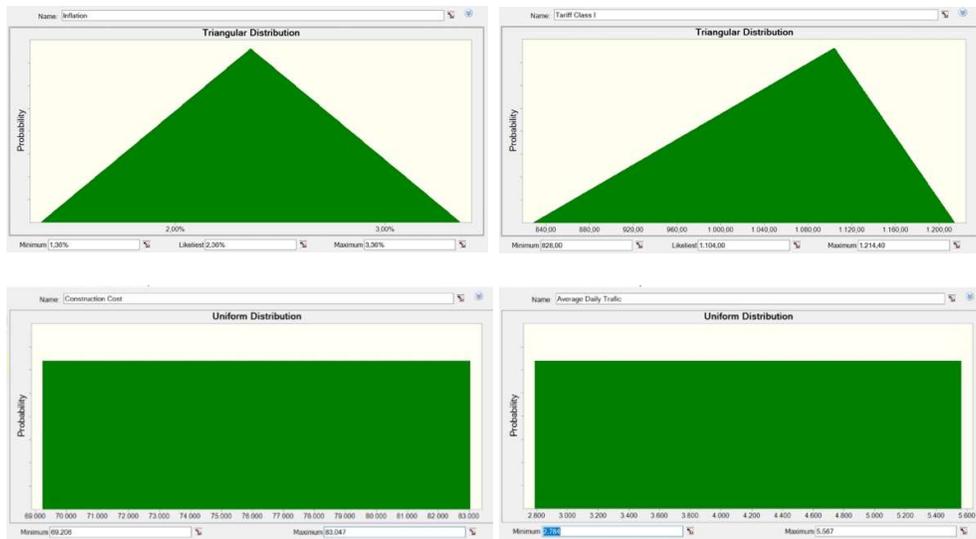


Figure 4. The Risk Distribution of Investment Cost, Inflation Rate, Tariff Class I, and Traffic Volume

The distribution of each risk is also to determine the level of sensitivity of each variable to the result of the IRR project. The distribution assumption of construction costs, inflation, and Tariffs is taken based on assumption of financial modelling using Monte Carlo conducted by Setiawan (2015) on the Trans Sumatra Toll Road project for the Palembang-Indralaya route. The distribution assumption of traffic volume (Average Daily Traffic) is taken based on data

from PT Hutama Karya (2020) related to the evaluation of traffic realization on the Trans Sumatra Toll Road that has been built.

The Construction Cost is defined in a uniform distribution, in which the minimum Investment cost will be Rp69,2 Trillion (PT Hutama Karya, 2020) and the maximum will reach 120% of it. Furthermore, the biennial tariff adjustment and tariff itself are defined as triangular distribution. Regulated by the government, the tariff adjustment will be adjusted to the inflation rate, in which inflation rate used in this study is 2,36%, with the range inflation changing is $\pm 1\%$. For traffic demand, based on traffic realization data on the Trans Sumatra Toll Road sections that has been built, the realized Average Daily Traffic is around 50%-100% of the prediction (PT Hutama Karya, 2020), so the distribution of Average Daily Traffic in Betung-Pekanbaru section ranges from 2.784-5.567 car/day. For the tariff, the range of tariff is minimum 25% below tariff and maximum 10% above tariff, and we use tariff assumption for this study is Rp1.104/km for Class I, as for Class II tariff is 1,5x of Class I tariff and Class III tariff is 2x of Class I tariff.

4.2.2 Monte Carlo Simulation for IRR

The simulation of the IRR number using Crystal Ball can be in Figure 4.

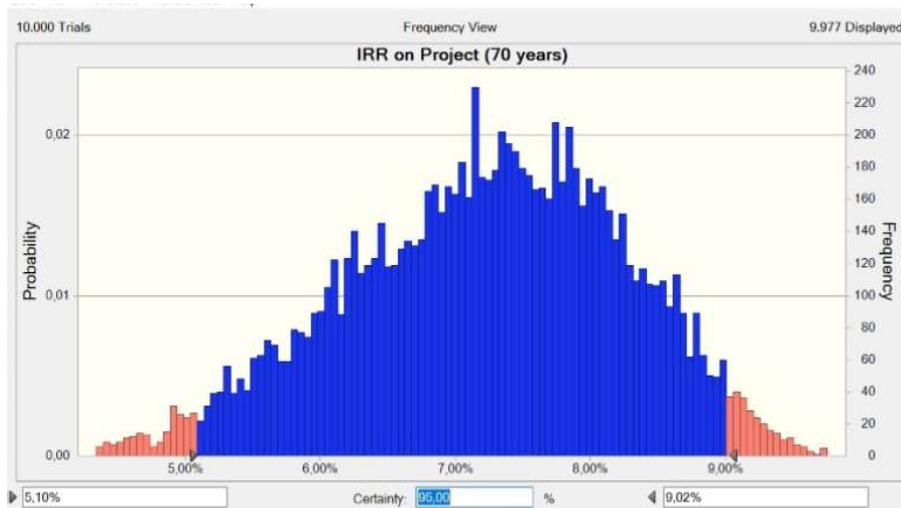


Figure 5. The Simulation of IRR (2x2 Lane Scenario) Using Crystal Ball

Using the confidence level of 95%, the IRR number will range from 5.10% to 9.02% with a base IRR is 10,25%. The figure range is still far below the WACC of this project which is 9,85%

To sum up, by using the Monte Carlo simulation, it also can be confirmed that the Trans Sumatera Toll Road for Betung-Pekanbaru project is financially not viable if it use the First Scenario (2x2 lane). Hence, the project is not attractive to the investors.

4.2.3 Phased Development Scenario to Increase Financial Viability

As it can be seen from Figure 4. above, the project is financially not viable. It makes the government must create a strategy that helps increase the feasibility of the project.

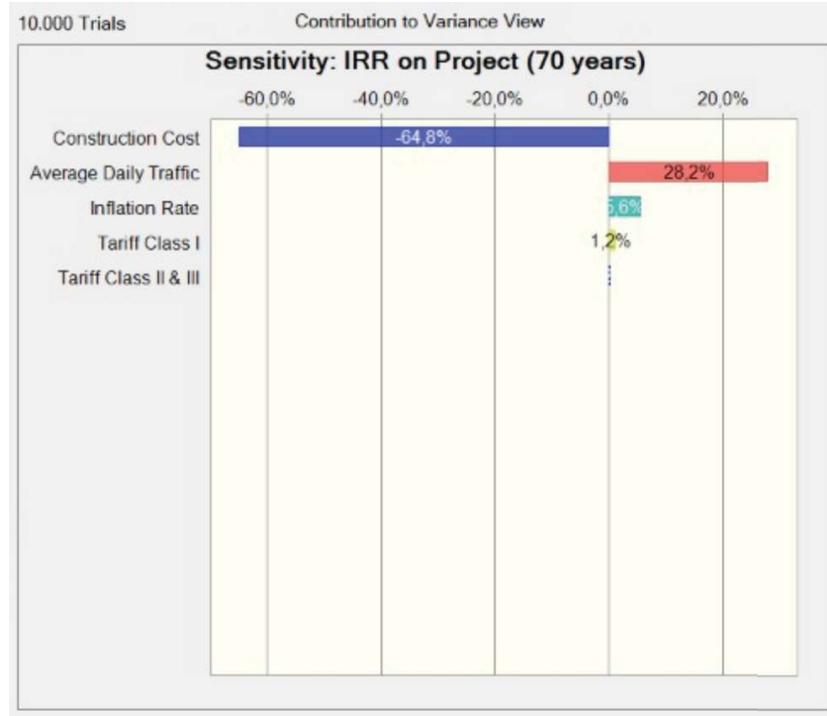


Figure 6. The Sensitivity of Each Variable to the IRR Project

In Figure 6. it can be seen that the variable that has the most influence on the project IRR is the Construction Cost in the opposite way where the increasing of construction cost will result in the decreasing of IRR of the project. This indicates that to increase the IRR of a project, reducing the construction cost will have a very significant impact.

The Ministry of Public Works, through the Directorate of Financing Implementation System and Strategy Development, Directorate General of Infrastructure Financing, plans a development strategy called Phased Development, wherein Phased Development, the Business Entity (in this case PT Hutama Karya) at the first phase will build a 2x1 lane toll road and then widen it to 2x2 lanes after the traffic decile has reached 0, 6. Based on the results of calculations from PT Hutama Karya (2020), especially for the Betung-Pekanbaru Section, this strategy succeeded in reducing construction costs from Rp69.2 trillion to Rp56.2 trillion. The cash flow projection of the project using Phased Development can be seen in figure below

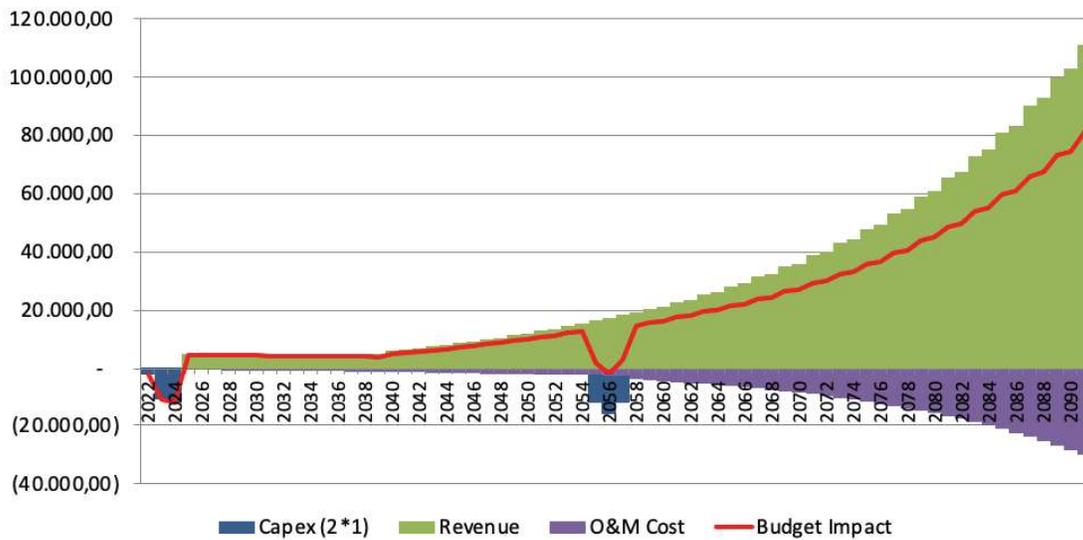


Figure 7. The Projection of Cash Flow for Betung-Pekanbaru Toll Road Project Using Phased Development Policy

From the graph, it can be seen that in the first 3 years, there were costs incurred, namely investment costs. Then in the 4th year until the year the widening was carried out (2055) the project generate positive cash flow from the revenue, where this income became one of the sources of funds for widening the toll road. By simulating it again using Monte Carlo analysis, the new model of the IRR project can be seen in Figure 5.

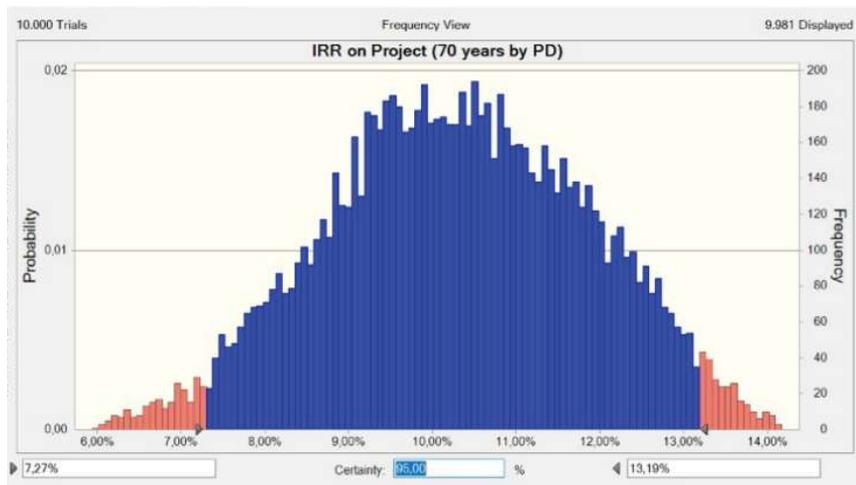


Figure 8. The Simulation of IRR (Phased Development Scenario) Using Crystal Ball

By using the Phased Development Scenario, it can be seen in Figure 5. with confidence level 95%, the IRR will increase significantly within the range of minimum 7,27% to 13,19%. With a phased development strategy the IRR project becomes financially more viable. In conclude, the phased development scenario effectively and significantly elevates the project's financial viability.

5. CONCLUSION

The Phased Development Strategy in the Trans Sumatera Toll Road project for Betung-Pekanbaru Section also adds to the project's IRR beyond the project's WACC so that the project becomes feasible. Before that, the IRR of the project only 5.10% to 9.02%, while using the phased development scenario, the IRR of the project become 7,27% to 13.19%. There need to be further studies regarding the implementation of this phased development strategy so that in the future, it is hoped that this strategy can significantly increase project feasibility and help accelerate infrastructure development in Indonesia. Then it needs support from the government in the form of regulations to regulate the implementation of this policy so that the Implementing Business Entities and related institutions get legal guarantees and protection in implementing the Phased Development Policy in the Toll Road sector.

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