Risk Factors and Value of Risk Factors on Toll Road Investment Project in Indonesia

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Abstract. One indicator of economic performance to make a developing country into a developed country is infrastructure. The development of infrastructure to support economic activities in Indonesia is very necessary. However, more government funds have resulted in the construction of new road networks needing to be faster, so a solution to the financing pattern is needed through the cooperation of the private government in the form of private participation in infrastructure development. This study aims to evaluate the feasibility of investing in toll road investment projects in Indonesia after identifying the factors that affect investment performance by applying risk analysis techniques. The risk estimation technique used in this paper indicates the elements of investment costs supported by risk analysis. The risk factors that will be identified will be a constraint in the investment performance of the project. This research is expected to be used to optimize investment performance in toll road projects.

Keywords: Risk Factor · Infrastructure · Investment Project

1 Introduction

As a developing country among various developing countries in the world, Indonesia needs to increase its competence in the direction of national development and sustainable national development by the 1945 Constitution [1]. Based on this basis, Indonesia made a development plan structure to achieve these goals; this planning structure is long-term and is called the National Long Term Development Plan (RPJPN) 2005–2025. The RPJPN is divided into several stages called the National Medium-Term Development Plan (RPJMN). When writing this work, Indonesia implemented the RPJMN phase 3 (2015–2019).

Based on the Phase 3 RPJMN evaluation, it was noted that the construction of toll road land infrastructure only reached 51% of the planned target set at the beginning of the 2015–2019 RPJMN. According to Karsaman et al., In their study to assess the feasibility of toll road investment in Indonesia, only toll roads located on the island of Java could be considered investment worthy. Other toll roads in Java that he examined in his writings needed to meet investment feasibility. Quoted from CNN, the World Bank stated that many international investors have the will to invest in infrastructure in Indonesia. Still, they are reluctant to realize their investments due to 2 critical things. This is due to the

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segmented foreign and domestic investors market and the weak risk mitigation system for investment products or mechanisms to parse risks.

The lag of JPMN stage 3 can impact many objects in Indonesia, the government, the private sector, or the economy. At the national level, according to Gaal & Afrah [4], lagging physical infrastructure that supports economic activity in a country can lead to a low standard of living, a financial deficit, a decline in state productivity, and a decline in free-trade global markets. At the middle level, the lack of infrastructure is detrimental to companies involved in all toll road investment processes, whether owners, contractors, or operators. The impact at the middle level is the weakening of public perception of the companies involved and the company's material and immaterial losses. At the micro level, the impacts affect the story of the toll road project. The effect is in the form of uncertainty about the project's success, increasing processing time, rising costs, and reducing the quality of the result [5].

The lag in achieving the targets in the RPJMN in the field of toll road infrastructure development is due to several factors. I look at the construction and operational risk factors in this research proposal. In the construction industry, the industry is vulnerable to several dynamic risks which, if left untreated, will negatively affect project objectives, including cost, time, and quality of the final result. Several studies have been conducted globally, and it was found that each region has different potential risks [6].

It is indicated that investment activities in the construction and operation of toll roads in Indonesia have a risk of investment failure that needs to be considered [7].

2 Methods

We first validate our risk variables by studying the literature and gathering all the possible variables. Then we validate the risk variables with an expert interview.

The risk level analysis is based on the equation of investment risk factors, where the magnitudes of these factors illustrate the level of investment risk that occurs.

The risk factor equation is defined as the multiplication between the magnitude of the impact and the probability of a risk event, which is calculated from the following equation:

$$FR = L + I - (LxI) \tag{1}$$

Source: PUPR 2005 [7].

where FR is the risk factor number with a scale from 0 to 1, L is risk likelihood, I is the magnitude of the risk impact in the form of increased costs.

3 Investment Risk Factor Validation

Data collection at the initial stage was carried out by distributing questionnaires and interviews to 5 experts to verify, clarify and validate variables to determine whether the variables were complete and properly structured. The validation process results at this stage will be used to implement the second stage of the questionnaire. The description of the respondents is shown in the Table 1.

From this stage, input is obtained regarding the investment risk variables for inner-city toll roads that affect project investment performance. The variables proposed to the expert in the first stage were 46 variables, and after going through the expert validation process, the variables filtered or approved became 41 variables (Tables 2, 3 and 4).

Table 1. The description of the respondent.

No	Expert	Working Scope	Latest Education	Experience
1	Expert 1	Ministry of Public Works	Master's Degree	20 Years
2	Expert 2	SOE – Investor & Contractor	Doctoral Degree	15 Years
3	Expert 3	SOE – Investor & Contractor	Master's Degree	17 Years
4	Expert 4	Educator	Doctoral Degree	15 Years
5	Expert 5	Educator	Doctoral Degree	16 Years

Table 2. Pre-Construction Risk Validation.

No	**Risk**	**Risk Factor**	**Description**	**Approved**
1	Project Permit	Tender process	The less transparent tender process	Approved
		Contract documents	Contract documents that do not regulate in detail about mitigating investment risk	Approved
2	Study	Data used	Unrealistic economic growth and traffic assumptions	Approved
		Assumptions taken	Improper use of planning standards	Approved
	Design	Standard	Improper use of planning standards	Approved
		Mis-Interpretation	The consultant who misinterprets the wishes of the taskmaster	Approved
	Land Acquisition	Land availability	The land needed for toll road development cannot be fully provided by the government	Approved
		Compensation process	The compensation process is difficult to implement, and the compensation price is above the estimated budget provided	Approved

(*continued*)

Table 2. (*continued*)

No	Risk	Risk Factor	Description	Approved
		Community rejection	Some of the existing lands are difficult to acquire due to community refusal	Approved
		Number of intermediaries	The number of brokers or intermediaries in land acquisition creates price uncertainty	Approved

Table 3. Construction Risk Validation

No	Risk	Risk Factor	Description	Approved
1	Funding	Continuity of funding sources	Uncertainty in terms of the continuity of funding sources	Approved
		Construction period Interest	There is uncertainty in loan interest rates	Approved
		Bonds/Obligation	Uncertainty regarding the availability of bonds as an alternative investment financing.	Approved
		Loan repayment	Obligations to repay short-term loans during the construction period.	Not Approved
2	Construction	Field conditions	Difficult and unpredictable field conditions	Approved
		Weather conditions	Unfavorable weather conditions	Approved
		Material supply	Uncertainty in the availability of required materials	Approved
		Theft	Security conditions at the project site that may pose a risk of loss of project materials or logistics	Approved
		Specification	Poor implementation quality	Approved

(*continued*)

Table 3. (*continued*)

No	Risk	Risk Factor	Description	Approved
		Mis-Management	Poor project implementation management	Approved
		Strike	Possibility of strike due to dissatisfaction of project workers	Approved
		Schedule	Preparation of a schedule for the implementation of work that is not good	Approved
		Estimated construction cost	Inaccurate estimation of construction costs	Approved
		Inflation	Possible increase in material prices due to inflation	Approved
		dishonesty	The presence of dishonest workers or implementers	Approved
3	Equipment	Import	There is equipment that must be imported	Approved
		Performance	The performance of the equipment used is not good or not as planned	Approved
4	Force Majeure	Disaster	The occurrence of natural disasters in the project site area	Approved
		Nationalization	There was a revolutionary political change, namely the demand for the nationalization of projects whose shares were owned by foreign parties.	Approved
		Revolution	There was a tremendous political upheaval	Approved

Table 4. Post-Construction Risk Validation

No	Risk	Risk Factor	Description	Approved
1	Operation & Maintenance	System	Less effective and efficient operation and maintenance system	Approved
		Disabled	Defective and poor building construction conditions	Approved
		Estimated operating & maintenance costs	Inaccurate estimates of O&M costs	Approved
		Operation & maintenance cost inflation	Risk due to inflation on operating and maintenance costs	Approved
		Vandalism	There are parties who destroy existing buildings, causing material losses.	Approved
		Accident rate	Losses due to the high rate of traffic accidents in toll road operations	Approved
		Kabtibmas	Conditions of security and public order that are not conducive, such as demonstrations	Approved
2	Profit	Estimated traffic volume	Inaccurate traffic volume estimates	Approved
		Initial rate & tariff adjustment	Determination of initial tariffs and non-transparent and inconsistent tariff adjustment mechanisms	Approved
		Competition	There is business competition, routes, or other modes of transportation around the location	Approved
		Inefficiency/KKN	High level of political intervention in toll road operations	Approved
3	Obligation	Exchange rate	There is a sudden change in currency exchange rates	Approved
		Interest rate	There is a significant change in loan interest rates	Approved

(*continued*)

Table 4. (*continued*)

No	Risk	Risk Factor	Description	Approved
4	Force Majeure	Disaster	The occurrence of natural disasters in the toll road	Approved
		Nationalization	A revolutionary political change is a demand for the nationalization of projects whose shares are owned by foreign parties.	Approved
		Revolution	There was a tremendous political turmoil	Approved

Table 5. Risk Category

FR Number	Category
>0.7	High Risk
0.4–0.7	Medium Risk
<0.4	Low Risk

Source: PUPR 2005[7]

4 Investment Risk Factor Validation

Variables resulting from verification, clarification and validation by experts are then used as research variables to fill in by stakeholders involved in toll road investment planning. The stakeholder's answer is in the form of an assessment (scoring) of the influence and frequency of each variable, totaling 40 pieces. Questionnaires were distributed to personnel representing interested parties in the planning and construction process of the Trans Sumatra Toll Road Investment Project. There were 53 questionnaires distributed, and 40 were returned.

The risk level analysis is based on the equation of investment risk factors, where the magnitude of the risk factors illustrates the level of investment risk that occurs. The risk factor equation is defined as the multiplication between the magnitude of the impact and the probability of the risk event, which is calculated from Eq. 1 in the literature review. The next step in risk analysis is to categorize the risks into several categories, as listed in Table 5.

Based on Tables 5, 6, and 7, the risk probabilities measured in the questionnaire at each stage tend to be smaller than the typical probabilities provided by the Ministry of PUPR in 2005 (Table 8).

Table 6. Measurement of Pre-Construction Risk Factors and Risk Categorization

No	Risk Factor	Likelihood	Impact	Risk Factor	Category
Pre-Construction					
1	Tender process	0.213	0.394	0.523	Medium Risk
	Contract document	0.194	0.278	0.419	Medium Risk
2	Data used	0.191	0.210	0.361	Low Risk
	Assumptions taken	0.203	0.181	0.348	Low Risk
3	Standard	0.191	0.225	0.373	Low Risk
	Misinterpretation	0.201	0.197	0.358	Low Risk
4	Land availability	0.172	0.213	0.348	Low Risk
	Compensation process	0.350	0.531	0.695	Medium Risk
	Community rejection	0.194	0.219	0.371	Low Risk
	Number of intermediaries	0.176	0.228	0.364	Low Risk

Table 7. Measurement of Construction Risk Factors and Risk Categorization

No	Risk Factor	Likelihood	Impact	Risk Factor	Category
Construction					
1	Continuity of funding sources	0.247	0.519	0.638	Medium Risk
	Construction period Interest	0.210	0.210	0.375	Low Risk
	Bonds/Obligation	0.121	0.106	0.214	Low Risk
	Loan repayment	0.213	0.222	0.388	Low Risk
2	Field conditions	0.185	0.172	0.325	Low Risk
	Weather conditions	0.167	0.185	0.321	Low Risk
	Material supply	0.066	0.091	0.151	Low Risk
	Theft	0.191	0.178	0.335	Low Risk
	Specification	0.232	0.203	0.388	Low Risk
	Mis-Management	0.191	0.185	0.341	Low Risk
	Strike	0.172	0.194	0.333	Low Risk
	Schedule	0.244	0.506	0.627	Medium Risk
	Estimated construction cost	0.425	0.338	0.619	Medium Risk
	Inflation	0.084	0.089	0.166	Low Risk
	dishonesty	0.103	0.109	0.201	Low Risk

(*continued*)

Table 7. (*continued*)

No	Risk Factor	Likelihood	Impact	Risk Factor	Category
3	Import	0.210	0.203	0.370	Low Risk
	Performance	0.091	0.356	0.415	Medium Risk
4	Disaster	0.044	0.325	0.355	Low Risk
	Nationalization	0.178	0.181	0.327	Low Risk
	Revolution	0.210	0.175	0.348	Low Risk

Table 8. Measurement of Post-Construction Risk Factors and Risk Categorization

No	Risk Factor	Likelihood	Impact	Risk Factor	Category
Post-Construction					
1	System	0.158	0.248	0.366	Low Risk
	Disabled	0.158	0.319	0.426	Medium Risk
	Estimated operating & maintenance costs	0.160	0.151	0.287	Low Risk
	Operation & maintenance cost inflation	0.169	0.170	0.311	Low Risk
	Vandalism	0.319	0.578	0.713	High Risk
	Accident rate	0.300	0.556	0.689	Medium Risk
	Kabtibmas	0.073	0.134	0.197	Low Risk
2	Estimated traffic volume	0.160	0.260	0.378	Low Risk
	Initial rate & tariff adjustment	0.139	0.228	0.335	Low Risk
	Competition	0.173	0.235	0.368	Low Risk
	Inefficiency/KKN	0.213	0.226	0.391	Low Risk
3	Exchange rate	0.163	0.238	0.362	Low Risk
	Interest rate	0.148	0.475	0.553	Medium Risk
4	Disaster	0.044	0.325	0.355	Low Risk
	Nationalization	0.178	0.181	0.327	Low Risk
	Revolution	0.210	0.175	0.348	Low Risk

5 Conclusion

This paper has presented the qualitative result of updating relevant risk factor variables listed on Pd-T-01-2005 and quantitative results of analyzing risk factor likelihood, impact, and FR number through expert interviews and stakeholder surveys. Expert interviews show that five risk factors variables are not as relevant as when Pd-T-01-2005 was made. There are five risks with a minimal likelihood that experts think the risk should be removed. As for the quantitative results, the results show that probabilities are much lower than the typical probabilities provided by the Ministry of PUPR on Pd-T-01-2005. The lower likelihood is due to the willingness of the surrounding community to cooperate and support toll road infrastructure projects being higher than before.

The study is the first stage for analyzing Investment Feasibility Evaluation in Indonesia's Toll Road Infrastructure Development Based on Risk to solve the problem of no update regarding the typical average probability and impact on infrastructure development projects in Indonesia and to help stakeholders to analyze the feasibility study more detailed through, to further increase the effectivity and efficiency of infrastructure investment projects.

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