RISK ANALYSIS OF CONSTRUCTION WORK FOR THE CONSTRUCTION OF GILMANUK - MENGWI TOLL ROAD, BALI PROVINCE

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ABSTRACT

Risk is the frequency of the emergence of an unfavorable condition and how much the consequences are caused and apply to all aspects of life, one of which is the construction project where the success of a construction project can be seen from how well the project is able to explore the risks that will occur, when viewed from the wide scope of the project, road construction projects have greater risks than building construction projects. The Gilimanuk – Mengwi toll road project is planned to be the second toll road to be built on the island of Bali which has a length of 96.21 km and passes through 3 regencies using a concession scheme with the aim of development to facilitate the flow of logistics transportation on the island of Bali.This study aims to determine the risk of building the Gilimanuk - Mengwi toll road and mitigate the risk that is included as a high risk criteria. The data collection method was carried out with literature studies and interviews using the questionnaire of the selected respondents, namely PUPR Bina Marga who will be directly involved in the implementation of the project. Process the risk level determination data using the probability x impact matrix with the Likert assessment scale. The results were obtained that there were 4 criteria and 12 sub-criteria of risk that were included as high risk with mitigation in general namely strengthening coordination between stakeholders in the preconstruction, always refer to the applicable rules and the application of technical implementation in the field practically and efficiently.

Keywords: mitigation; risk; toll road

INTRODUCTION

Risk is a condition that arises due to uncertainty with all the unfavorable consequences that may occur and becomes part of all aspects of activity, one of which is construction projects. Project risk is an unexpected event or condition beyond what has been planned or a probability of unwanted events occurring and affecting the achievement of project objectives including scope, schedule, cost and quality. According to McIntyre, Gentges & Cranley (2013) the success of a construction project is highly dependent on the ability to manage the risks that occur.According to P.Z.Razi et al (2019) road construction projects have a higher risk compared to building construction projects due to the wide scope of projects so that the main risks posed are more numerous and varied so different risk responses are needed to evaluate and overcome these risks (Pykhtin et al., 2017).

The research object took the construction project of the Gilimanuk - Mengwi Toll Road or better known as the Jagad Kerthi Bali Toll Road which will be the second toll road in Bali Province after the Bali Mandara Toll Road which is planned to be built in June 2022 with a length of around 96.21 Km built through three Regencies namely, Badung Regency, Tabanan Regency, and Jembrana Regency. In this study the stages that will be carried out include identification, risk analysis and risk response. Identification is carried out to look for risk factors that are relevant to the project. This stage is carried out by conducting a literature study about the risks in the toll road construction project which is then validated by a preliminary survey using the interview method. While the risk analysis is carried out on the results of the main survey as a follow-up to the preliminary survey aimed at determining the dominant risk, the method used in the analysis is the Probability-Impact Matrix. The risk response is required for the high level of risk obtained from the results of the risk analysis, in its formulation it is carried out by means of literature studies and interviews with experienced experts to obtain appropriate mitigation (Yan et al., 2019). The purpose of the background is to introduce the concept of project risk and its significance in the construction industry. The specific objective of

the research is to conduct a risk assessment of the Gilimanuk-Mengwi Toll Road construction project in Bali, Indonesia. The study will involve the identification, analysis, and response to risks associated with the project. The ultimate goal is to ensure the successful completion of the project by managing potential risks that may affect its objectives such as scope, schedule, cost, and quality. The study aims to contribute to the existing knowledge of risk management in the construction industry, particularly in road construction projects (Szymański, 2017). By conducting a thorough risk assessment, the study hopes to identify the most significant risks and recommend appropriate risk response strategies to minimize their impact on the project.

METHOD

The research was carried out with a qualitative approach using a case study of the Gilimanuk – Mengwi Toll Road project which aims to identify relevant risks and develop risk responses as a form of mitigation. Primary data is used to obtain validation of the risk variable from the risk tabulation that has been prepared, this primary data collection uses the interview method with the help of a questionnaire aimed at relevant stakeholders who are considered to have competence and are closely related to research case studies in order to obtain a list of relevant risks, secondary data is obtained from site surveys, literature studies and data from related agencies that support this research(Serpella et al., 2014).

Respondents in this study were the government represented by the Ministry of Public Works and Public Housing as Project Managers. The selection of respondents from the government side is due to the Gilimanuk - Mengwi Toll Road construction project using a Public Private Partnership (PPP) scheme where the biggest risk bearer is from the project owner, in this case the Government. The object of this research is the construction project of the Gilimanuk - Mengwi Toll Road with a length of 96.21 Km which passes through 3 Regencies namely Jembrana, Tabanan and Badung Regencies. The type of project funding uses a Public Private Partnership (PPP) between the private sector and the government using the Design Build Finance Operational Maintenance Transfer (DBFOMT) system with a concession period of 45 years.

Figure 1.
Probability Impact Risk

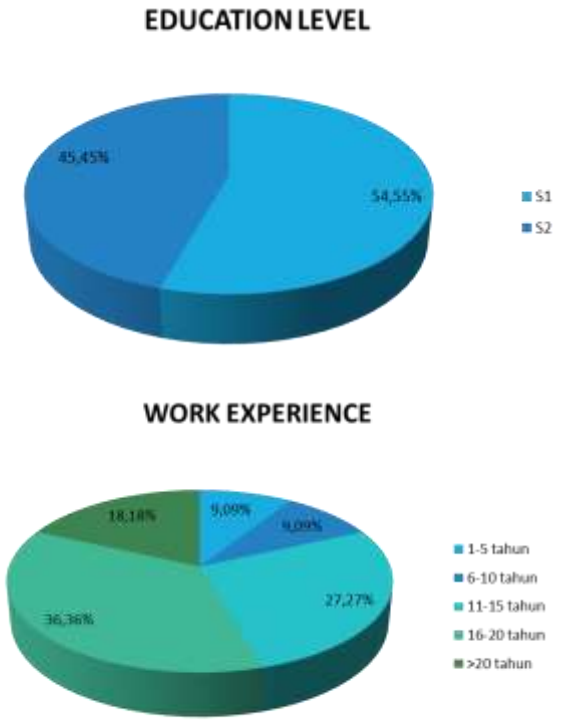
		Risk Impact				
		1	2	3	4	5
Risk Probability	5	high	high	extreme	extreme	extreme
	4	moderate	moderate	high	extreme	extreme
	3	low	moderate	high	extreme	extreme
	2	low	low	moderate	high	extreme
	1	low	low	moderate	high	high

The stages in this study include risk identification, risk analysis and preparing risk responses. Identification is carried out to look for risk factors that are relevant to the project. This stage is carried out by conducting a literature study regarding risks in toll road construction projects which are then validated through a preliminary survey using the interview method. Risk analysis was carried out on the results of the main survey as a follow-up to the preliminary survey aimed at determining the level of risk using the Risk Probability-Impact Table. experienced to obtain appropriate mitigation.

RESULTS

Respondents in this study totaled 11 people who acted as expert judgment, with educational level profiles of 6 Strata I (S1) civil engineering and the remaining 5 Strata II (S2) civil engineering, for work experience in the field of road construction most (36 .6%) have work experience in the field of road construction ranging from 16-20 years, all of whom are employees of the Director General of Highways in charge of the construction of the Gilimanuk - Mengwi Toll Road

Figure 2
Respondent Profile



The results of the literature study obtained 5 risk criteria with 20 risk sub criteria can be seen in table 1 as follows:

Table 1.
Risk Identification

Market		Politik		Hukum		Political		Ekonomi, Sosial dan Budaya	
1A	Price Estimation	2A	Strong political interference	3A	Corruption and bribery	4A	Compliance with due diligence	5A	and Culture
1B	Amendments to tax regulations	2B	Lack of commitment and coordination with stakeholders	3B	Investment Return Guarantee	4B	Land acquisition	5B	Irrigation network

	Market		Politik		Hukum		Political		Ekonomi, Sosial dan Budaya
1C	Commercial Project	2C	Risk sharing	3C	Approval and permission	4C	Understanding of specifications and working methods	5C	Disturbance to sacred sites and cultural heritage
1D	Financial burden			3D	Return on investment	4D	Quarry location		
						4E	Design changes		
						4F	Technology		

The risk criteria obtained at the literature study stage were used as input to the questionnaire which then sought the level of relevance for each sub-criteria using the Validity Test with the Product Moment method, the results of which can be seen in the following table:

Table 2.
Validity Test Results

Sub Criteria Code	r_{xy}	r_{tabel}	Status
1A	0,4703	0,4044	VALID
1B	0,5795	0,4044	VALID
1C	0,2070	0,4044	NOT VALID
1D	0,4184	0,4044	VALID
2A	0,4225	0,4044	VALID
2B	0,5002	0,4044	VALID
2C	0,4656	0,4044	VALID
3A	0,5933	0,4044	VALID
3B	0,3753	0,4044	NOT VALID
3C	0,4267	0,4044	VALID
3D	0,4570	0,4044	VALID
4A	0,4781	0,4044	VALID
4B	0,5151	0,4044	VALID
4C	0,5647	0,4044	VALID
4D	0,4963	0,4044	VALID
4E	0,4578	0,4044	VALID
4F	0,1201	0,4044	NOT VALID
5A	0,5688	0,4044	VALID
5B	0,4743	0,4044	VALID
5C	0,4759	0,4044	VALID

To see the reliability of the questionnaire, a Reliability Test was carried out using the Cronbach Alpha method with the result that the reliability coefficient of the questionnaire was 0.81674 which indicates that the level of reliability/reliability of the questionnaire is very high. Measuring the value of probability (P) and impact (I) of risk is taken by the rounding value of the average using an interval scale of 1-5 with the results of measuring the level of risk obtained which can be seen in table 3 below:

Table 3
Risk Probability Value

Criteria	Sub Criteria	Information	P	I	Level Risk
Market risk	1.A Estimated price	Discrepancies in estimated prices can cause losses from the budget side as well as the emergence of contract addendums that lead to delays in project completion.	2	3	
	1.B Changes in tax regulations	There is a possibility of a change in tax regulations at the initial stage of the project, for example a change in VAT tax regulations from initially 10% to 11% leading to a change in the RAB	2	3	Moderate
	1.D Financial burden	The high financial burden affects the success of the commercialization of the project which leads to the determination of tariffs as a form of return on investment	2	3	Moderate
Political risk	2.A Strong political interference	Approaching the election period which may create a conflict of interest in the project implementation schedule	3	3	Moderate
	2.B Lack of commitment and coordination with stakeholders	The development plan will pass through 3 administrative areas (Badung regency, Tabanan regency and Jembrana regency) as well as through the limited production forest and the West Bali National Park, which will affect the matter of obtaining permits and coordination between stakeholders.	3	3	High
	2.C Risk sharing	Unbalanced risk sharing between the consortium and the government can harm one of the parties	3	3	High
Legal risk	3.A Corruption and bribery	The occurrence of corruption and bribery has far-reaching and long-term impacts not only causing poor project quality both in terms of time and work results	2	3	High
	3.C Consent and permission	Delays in approvals and permits as well as complicated bureaucracy lead to delays in project implementation	3	3	Moderate
	3.D Return on investment	The type of project that is DBFOMT (Design Build Finance Operational Maintenance Transfer) has an effect on the calculation of return on	3	3	High

Criteria	Sub Criteria	Information	P	I	Level Risk
		investment which, if not correct, can cause losses.			
Technical risk	4.A Compliance with due diligence	The feasibility of the project as seen from the Feasibility Study affects whether the project can be implemented or not	3	3	High
	4.B Land acquisition	There is a need for land acquisition of ± 900 ha in which there are ± 200 building units that affect the project implementation schedule	3	3	High
	4.C Understanding of specifications and work methods	The development plan to be carried out by the consortium can cause miscommunication which leads to the implementation of development in the field such as understanding the specifications and work methods in the field	2	3	High
	4.D Quarry Location	The quarry, which is planned to be located in the Banyuwangi area, while the project will be implemented in the Bali area, will affect the mobilization and demobilization of project facilities and material delivery.	*3*	*3*	Moderate
	4.E Design changes	There is no Shop Drawing (still in the form of Basic Design) so design changes can still occur, which if design changes occur frequently can cause delays in the implementation schedule	3	3	High
Economic, social and cultural risks	5.A Irrigation network	Most of the implementation of project development passes through agricultural land which can cause the disconnection of the residents' rice field irrigation network	3	3	High
	5.B Disturbance to sacred sites and cultural heritage	The impact on development of sacred sites and cultural heritage may lead to relocation leading to an increase in the project budget	3	3	High
	5.C Loss of livelihood	The majority of economic activities affected are the restaurant business along the Jembrana – Denpasar National road which can lead to rejection of project development	3	3	High

Risk response as a mitigation measure is carried out only at high risk levels which can be seen in table 4 below:

Table 4.
Risk Response

Risk Criteria	Risk Sub Criteria	Risk Levels	Risk Response
Political Risk	cal interference	High	• There needs to be a legal umbrella in the form of regional regulations that guarantee support for the success of the project
Political Risk	of commitment and coordination with stakeholders	High	• Guarantees from the government must be issued in the form of favorable policies for the success of the project.
Political Risk	haring	High	• There needs to be regular coordination with the local government at the pre-construction stage prior to the feasibility study implementation stage
Legal Risks	Approvals and Permits	High	• In terms of planning, it must comply with the local regional spatial plan
Legal Risks	Return on Investment	High	• Conducting a review of the cooperation contract and adding the contents of the cooperation contract which are deemed to be less specific and detailed
Technical Risk	Due Diligence	High	• Contracts that have been agreed upon must be carried out together with the principle of mutual benefit and no party is harmed.
Technical Risk	Land acquisition	High	• There needs to be coordination with related parties, especially with the Ministry of Environment and Forestry and the West Bali National Park because the planned construction of the Mengwi - Gilimanuk Toll Road will be built on a protected forest
Technical Risk	Quarry location	High	• Minimizing land conversion in the area required for alignment and construction purposes
Technical Risk	Design Changes	High	• The need for an umbrella contract in guaranteeing material prices so as not to affect the calculation of return on investment
Economic, social and cultural risks	Irrigation network	High	• Avoiding change orders during work execution
Economic, social and cultural risks	Disturbance to sacred sites and cultural heritage	High	• Conducting a review of the cooperation contract and adding the contents of the cooperation contract which are deemed to be less specific and detailed
Economic, social and cultural risks	Loss of livelihood	High	• Before conducting a feasibility study in determining the location, it is necessary to refer to the RTRW and environmental permits to minimize incompatibilities with the feasibility study

DISCUSSION

From the analysis results obtained 12 risk sub-criteria with a high level of risk in which 3 sub-criteria fall into the political risk category, 2 legal risk categories, 5 technical risk categories and 2 economic, social and cultural risk categories.In line with research by Dwifajrin and Wiguna (2014) who analyzed project risk using the Public Private Partnership (PPP) scheme between the Government and the private sector, it was found that political risks such as strong political interference and unequal risk sharing were included as a high level of risk, this is based on one of the indicators of project success in terms of the timeliness of completion, which can not be achieved due to politicization in it, for example, the postponement of project completion because certain political figures must carry out the inauguration in addition to the Public Private Partnership (PPP) scheme in terms of risk sharing The imbalance contained in the contract clause is very risky to occur, so it is necessary to pay close attention so that the distribution of risks is not one-sided which can harm one of the parties.

Risks related to law also play a role in influencing the success of a construction project as explained by Suparno (2015) in his study it was stated that licensing and access were difficult and the land acquisition process by the owner took longer to generate costs beyond estimates. From a technical risk standpoint, according to Harapap et al (2015) in his research, it was stated that long delivery of material is included as a risk with a high level of risk, which in the research case study on the construction of the Gilimanuk - Mengwi Toll Road, it is planned that the quarry location will be in the Banyuwangi area. the risk of material delivery being delayed due to having to use 2 modes of land and sea transportation as well as when compared to local materials which are closer. as well as the risk of design changes in research conducted by Sandyavitri (2008) the results showed that design changes affect the time and cost of implementing the project, where careful initial planning is needed in order to guarantee a reduction in the risk of delays in work.

The criteria for Economic, Social and Cultural Risk are also included as a risk with a high level of risk and are closely related to the livelihoods of the surrounding population and disturbance to the sacred places of worship, with the Gimanuk - Mengwi Toll Road the livelihoods of the surrounding population in this case the restaurant industry and souvenirs - In addition, it is also necessary to relocate to a holy place of worship which requires large resources considering that to carry out a relocation one has to wait for a day that is considered good and costs quite a lot in its implementation.

The risk assessment of the Gilimanuk-Mengwi Toll Road construction project identified 12 high-risk sub-criteria falling into four categories: political, legal, technical, and economic, social, and cultural risks. The study by Dwifajrin and Wiguna (2014) also found political risks to be a significant factor in project success, particularly in terms of timely completion, due to politicization and unequal risk sharing in the Public Private Partnership (PPP) scheme. Risks related to law, such as licensing and land acquisition, were also identified as potential obstacles to project success, as stated by Suparno (2015). Technical risks, including long material delivery, design changes, and construction delays, were identified as high-risk factors in the study by Harapap et al (2015) and Sandyavitri (2008). Economic, social, and cultural risks, such as the impact on local livelihoods and the need to relocate sacred places of worship, were also considered high-risk factors in this study.

CONCLUSION

12 sub-criteria with a high level of risk and 5 sub-criteria with a moderate risk level were obtained on 4 risk criteria, namely legal risk, political risk, technical risk and economic, social and cultural risk, of which 17 risk sub-criteria only 12 sub-criteria with a high level of risk which is mitigated in the form of a risk response which generally includes mitigation in the form of strengthening coordination between stakeholders, during the pre-construction and construction stages, it must always refer to the applicable rules and technical implementation in the field.

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