E-ISSN: 2963-3699
P-ISSN: 2964-0121
Homepage: https://return.publikasikupublisher.com

THE INFLUENCE OF RISK FACTORS ON PROJECT COST IN THE SIGLI-BANDA ACEH TOLL ROAD PROJECT

Mariama Badjie
Universitas Syiah Kuala, Banda Aceh, Indonesia
mariamabadjie.mb@gmail.com

ABSTRACT

Effective management of risk is critical to the success of any construction project. The importance of risk management has grown as projects have become more complex. This study examines the influence of risk factors on project cost in the Sigli-Banda Aceh toll road project. It identifies 47 common risk indicators and categorises them into six risk factors, emphasize the need for improved risk management strategies in complex construction projects. The research question of this study is to know the influence and relationship of risk factors on project cost in the Sigli-Banda Aceh toll road project. The purpose of this study is to determine the risk factors that influence and relate to project cost in the Sigli-Banda Aceh toll road project. The data was analysed with statistical tools to determine the rank of factors affecting project costs. The research method used quantitative, using hard data on Likert scale, and qualitative, using the opinions of the respondents, with primary sources and secondary data. This research involved the project director, site supervisors, engineers, safety environment officer, and finance manager from PT Hutama Karya. Data collection techniques include the distribution of questionnaires. The data analysis technique uses correlation and multiple linear regression analysis methods with the help of SPSS software. According to the result analysis, all the factors have a moderate relationship with the project cost, and there are four factors that have a significant relationship with the project cost, namely material risk, equipment risk, construction method risk, contractor managerial risk, and construction safety risk.

Keywords: *Influence; Risk Factors; Project Cost*

INTRODUCTION

Construction is a big industry in Indonesia, as it is in other nations, and it plays a vital role in the expansion of socioeconomic development (Khan et al., 2014). The primary criterion for project success is meeting the project's deadlines and budget while maintaining the required level of quality (Serrador & Turner, 2015). Although there has been significant investment in the construction sector in Indonesia, there are still several problems with the sector, including costs that exceed budgets, delays in finishing projects on time, construction faults, and an overreliance on foreign labour (Menolascina et al., 2008).

The construction sector is facing a significant cost-cutting challenge as a result of the expanding demand for building of all kinds and the limited availability of funding (Sami Ur Rehman et al., 2022). Corporations, institutions, and the government would be in a survival race for the remainder of the twentieth century, according to Mendelson and Greenfield (1996). The participant in these sectors (the customer, in particular) is prepared to take on the challenge of assuring efficient use of their resources to achieve value for money in terms of performance due to the accompanying diminishing economic fortune of nations' economies throughout the world (Eshofonie, 2008).

Under typical conditions, it is anticipated that the following costs will add up to the overall cost of construction: Materials, labour, site overheads, equipment/plant, head office expense, and profit, however in many countries, particularly in Indonesia, there are other costs that need to be taken into account (Eshofonie, 2008).

These costs clearly have a negative impact on both the industry as a whole and the major stakeholders in particular. High cost means additional costs to the client beyond those previously discussed at the outset, resulting in worse returns on investment. The additional expenses are passed on to the consumer as higher rental or leasing fees or prices. The consultants interpret this as a failure to provide value for the money spent, which could damage their reputation and cause clients to lose faith in them. If the contractor is at fault, it means a loss of earnings due to penalties

for non-three-quarter completion and bad word of mouth that could jeopardise his or her prospects of gaining more work (Eshofonie, 2008).

A project is a task carried out with constrained time and resources to accomplish preset objectives (Sonelma & Sucita, 2022). A construction project, on the other hand, can be seen as a collection of tasks with distinctive characteristics, constrained time, and resources, necessitating management expertise to handle them (Simanjuntak & Simandjorang, 2019). This series of tasks includes creating plans, creating designs, building things, and maintaining them (Dharmayanti & Jaya, 2018).

A construction project is an activity that involves allocating certain resources in order to achieve the intended work outcome, which is determined by the suitability of time, quality, and cost (Mahapatni, 2019). a building is one of the works of construction that provides a space for habitation as well as for religious, commercial, social, and cultural objectives as well as for certain activities. Because every action requires facilities, a construction project is a construction service that is full of various risks when it is being carried out (Rofiah et al., 2021). To plan or manage ongoing projects, reduce risks, and achieve project goals, project management is required. Risk management, which makes sure that project risks are minimised, is an essential part of project management (Project Management Institute, 2017).

Infrastructure projects, including toll road projects, are inextricably related to risks. Risk is a result of an uncertain situation, which is frequently impossible to foresee with accuracy. Therefore, risk management is essential from the start of the construction project to minimise the impact of potential risks (Cheng et al., 2016).

RESEARCH METHODS

The research methods and research strategy used to achieve the paper's objectives will be covered in this chapter. In order to better understand how risk factors, affect project costs during the construction implementation stage and how to manage them, this study employed quantitative research methods. It focused specifically on the type of flexible pavement used in the Sigli-Banda Aceh toll road project. Three systematic processes made up the quantitative approach: a questionnaire survey, a risk analysis of the results of the questionnaire survey, and.

Research Object and Scope

The relationship between risk factors and project cost, as well as their influence, are the focus of this study. This study's focus is on P.T Hutama Karya, a reputable contractor firm in charge of the Sigli-Banda Aceh toll road project.

Data Types and Sources

Research data types that are related to data sources and the methods chosen to collect research data. The two types of data sources used in this study are as follows:

1. Primary Data

   The primary data for this study came from responses to questionnaires filled out by knowledgeable individuals within the construction firm PT Hutama Karya. Through a questionnaire, this is done to obtain a risk assessment of the Sigli-Banda Aceh toll road project (Hanifah, 2019).

   The primary data for this study came from responses to questionnaires filled out by knowledgeable individuals within the construction firm PT Hutama Karya. Through a questionnaire, this is done to obtain a risk assessment of the Sigli-Banda Aceh toll road project (Hanifah, 2019).

2. Secondary Data

   Secondary data are those that have already been statistically analysed or that have been gathered, statistically processed, and then transferred to another party. Regardless of whether it was made public or not, it refers to data that has previously been obtained and used for another reason (Bagha et al., 2019).

   In this study, secondary data were collected from articles and international journals reading sources, as well as information on the evaluation of direct construction contract documents

for construction services at PT Hutama Karya in the project of the Sigli-Banda Aceh Toll Project. The secondary data were then processed and analysed (Hanifah, 2019).

Population and Sample

A population is a subject or an object that falls within a study topic and satisfies the requirements for individuals to be part of the research unit or analytic unit being analysed (individuals, groups, or organisations). To accurately reflect the population, the sample, which is a small section of the population, is drawn using a particular procedure (Abdussamad & Sik, 2021).

1. Population

   Project director, site office supervisors, engineers, Safety environment officer and Finance Project manager from PT Hutama Karya made up the population in this study because they are the principal decision-makers who are in charge of the initiatives and knows about the risk in the project better, whether they are from private organisations or from people, are included in this group (Altoryman, 2014).

   Engineers, site office supervisors, project director, Safety environment officer and Finance Project manager from PT Hutama Karya made up the population in this study. Whether they work for private businesses or are individuals, these people are the ones who make the important decisions that affect the initiatives (Altoryman, 2014).

   The respondents were chosen by the most skilled and seasoned staff members. 30 samples from PT. Hutama Karya records were used to identify responders, including engineers, site office managers, and project directors, under the assumption that the error value was 10%.

2. Sample

   The sample is part of the population that has certain characteristics or circumstances that will be studied.

   The goal of sampling is to provide a selection that is representative of the population from which it was derived. A "representative" sample of the total population must be used to generalise the research's conclusions (Altoryman, 2014).

   Engineers, site office supervisors, project directors, safety environment officers, and finance project managers from construction business PT Hutama Karya were among the samples used in this study. A list of the building construction projects completed for the Sigli-Banda Aceh toll road project is also provided (Ariska, 2022).

   If the population is less than 100, the entire sample is taken, but if the population is larger than 100, 10-15% or 20-25% of the entire population can be collected, according to Arikunto (2013). The authors used 100% of the population at PT Hutama Karya, or 30 respondents, based on this research because the total population is not larger than 100 respondents.

Table 1 Sample Calculation Results

Population	
Engineers	15
Site office supervisors	15
Project Director	1
Safety environment officer	4
Finance Project manager	1
Total	36
Sample	
Engineers	15
Site office supervisors	15

Project Director	1
Safety environment officer	4
Finance Project manager	1
Total	36

RESULTS AND DISCUSSION

This chapter presents the results of data processing and analysis obtained from the questionnaires that have been distributed according to Chapter III and is given a discussion according to the theory from the literature in Chapter II.

Results of Data Collection

1. General Description of the Research Object

The study's purpose was the road construction project that was carried out on the Sigli-Banda Aceh toll route. Because each activity requires infrastructure, a construction project is a construction service that is rife with dangers during the execution stage. Based on information collected directly from PT Hutama Karya, it was determined that the contracting company completed construction projects on the Sigli-Banda Aceh toll road.

2. Data of Respondents

The questionnaire was distributed for one month, in December 2023. Based on the projects that were put into action in 2022, the results of distributing the questionnaire revealed the frequency and impact of hazards according to level. The data is then processed to provide answers to the research's objectives. Using information from PT Hutama Karya, it will be determined which sample was only obtained during the construction of the Sigli-Banda Aceh toll road project. Purposive sampling is used to estimate the number of withdrawals in each area. Based on purposive sampling, PT Hutama Karya's sample distribution in each industry is as follows: 36 respondents from different PT Hutama Karya divisions responded.

Data processing is done to provide answers to the queries that are the research's goals. The direct distribution of questionnaires to the contractor company took place. The decision-makers and skilled construction service providers of PT Hutama Karya were the respondents in this study. Questionnaire A broad description of the study object is provided in Part I in the form of respondent characteristics and company data. Position, gender, age, most recent education, job history, company information, qualifications, prior company experience, project kind, project value, projected length, and actual duration were the characteristics of the respondents used in this study. Following are some details on the characteristics of respondents and firm information gleaned from the Part I questionnaire:

3. Characteristics of Respondents

Because of the respondents' responses to the questionnaire, the characteristics of the respondents in this study are utilized to describe the respondents' identities. Recapitulation of survey data from respondents Table 2 displays Part I.

Table 2 Respondent Characteristics

No	Characteristics of Respondents	Frequency	Percentage
1	**Position**		
	Engineer	20	55.6%
	Project Director	1	2.8%
	Site Office Supervisor	10	27.8%
	Safety Environment Officer	1	2.8%
	Finance project Manager	2	5.5%
	Technician	2	5.5%
	Total	**Frequency**	100%
2	**Gender**		
	Man	28	77.8%
	Woman	8	22.2%

	Total	**Frequency**	100%
3	**Age**		
	21-30 Years	26	72.2%
	31-40 Years	9	25%
	41-50 Year	1	2.8%
	Total	**Frequency**	100%
4	**Last Education**		
	Senior High School	6	16.7%
	Undergraduate (S1)	29	80.5%
	Post Graduate (S2/S3)	1	2.8%
	Total	**Frequency**	100%
5	**Work Experience**		
	<3 Years	17	47.2%
	6-8 Years	12	33.3%
	>8 Years	7	19.5%
	Total	**Frequency**	100%

According to Table 2, most respondents with positions as engineers are male and between the ages of 21 and 30. Their most recent degree was a bachelor's degree (S1), and they have a minimum of less than three years of work experience. The respondents can be trusted sufficiently to answer the study questionnaire considering the findings.

Results of Data Processing

1. Research Data Test Results

a. Validity Test Results

Validity test is a measure that shows the level of validity or legitimacy of an instrument. A valid instrument has high validity and conversely, if the level of validity is low then the instrument is less valid. In this study, researchers used 36 respondents, so it can be seen that the size of the r table is 0.329 which is obtained from (df= n-2 = 36-2= 34) with an error rate of 5%. The validity test results for each question item on each variable are as follows:

Table 3 Results of Validity Test Risk Frequency

Variable	Question Items	Rcount	R_{tabel}	Information
Material Risk (X1)	X1,1	0,685	0,329	Valid
	X1,2	0,764		Valid
	X1,3	0,727		Valid
	X1,4	0,494		Valid
	X1,5	0,610		Valid
	X1,6	0,630		Valid
Equipment Risk (X2)	X2.1	0,592		Valid
	X2.2	0,601		Valid
	X2.3	0,520		Valid
	X2.4	0,801		Valid
	X2.5	0,659		Valid
	X2.6	0,574		Valid
	X2.7	0,448		Valid
	X2.8	0,536		Valid
	X2.9	0,737		Valid
Construction Method Risk (X3)	X3.1	0,565		Valid

	X3.2	0,711	Valid
	X3.3	0,454	Valid
	X3.4	0,747	Valid
	X3.5	0,753	Valid
Constractor Managerial Risk (X4)	X4.1	0,641	Valid
	X4.2	0,633	Valid
	X4.3	0,721	Valid
	X4.4	0,714	Valid
	X4.5	0,720	Valid
	X4.6	0,780	Valid
	X4.7	0,681	Valid
	X4.8	0,651	Valid
Operational Risk (X5)	X5.1	0,477	Valid
	X5.2	0,684	Valid
	X5.3	0,628	Valid
	X5.4	0,647	Valid
	X5.5	0,539	Valid
	X5.6	0,683	Valid
	X5.7	0,663	Valid
	X5.8	0,762	Valid
	X5.9	0,452	Valid
Construction Safety Risk (X6)	X6.1	0,490	Valid
	X6.2	0,713	Valid
	X6.3	0,655	Valid
	X6.4	0,842	Valid
	X6.5	0,793	Valid
	X6.6	0,690	Valid
	X6.7	0,741	Valid
Project Cost (Y)	Y.1	0,719	Valid
	Y.2	0,834	Valid
	Y.3	0,725	Valid

Source: primary data processed with spss 20.0, 2023

Based on table 3 above, it can be seen that all question items from the variable's material risk, equipment risk, construction method risk, constructor managerial risk, operational risk, construction safety risk, and project cost are declared valid. This is evident from all question items which have calculated r values in the Corrected Item-Total Correlation which are greater than the r table.

2. Reliability Test Results

The reliability test is a measure of a respondent's stability and consistency in answering matters relating to the respondent's constructs which are dimensions of a variable and are arranged in a questionnaire form. An instrument is said to be reliable if the Cronbach's Alpha value is above 0.6 then the instrument is said to be reliable. The reliability measurement using Cronbach's Alpha method can be seen in the table below**:**

Table 4 Results of Reliability Test Risk Frequency

Variable	Alpha Cronbach	N of Items	Information
Material Risk (X1)	0,726	6	Reliable
Equipment Risk (X2)	0,785	9	Reliable
Construction Method Risk (X3)	0,662	5	Reliable
Constractor Managerial Risk (X4)	0,844	8	Reliable
Operational Risk (X5)	0,799	9	Reliable
Construction Safety Risk (X6)	0,830	7	Reliable
Project Cost (Y)	0,618	3	Reliable

Source: primary data processed with SPSS 20.0, 2023

Based on the output of table 4 above, it can be seen that all material risk, equipment risk, construction method risk, constructor managerial risk, operational risk, construction safety risk, and project cost variables have Cronbach's Alpha values above 0.6. This means that each question item on each variable, including material risk, equipment risk, construction method risk, managerial constructor risk, operational risk, construction safety risk, and project cost, is reliable.

Table 5 Correlation Test Results

No	Variable Relationships	Spearman coefficient	Form of Relationship
1	X_1 - Y	0,505	moderate
2	X_2 - Y	0,594	moderate
3	X_3 - Y	0,596	moderate
4	X_4 - Y	0,551	moderate
5	X_5 - Y	0,442	moderate
6	X_6 - Y	0,452	moderate

Source: primary data processed with spss 20.0, 2023

Based on the output of table 5 above, the following interpretation can be given:

a. The relationship between material risk factors and project costs
   The material risk factor has a Spearman correlation coefficient of 0.505, with a significance value of 0.002 <0.05. This means that the material risk factor has a moderate relationship and there is a significant relationship with project costs.
b. The relationship between equipment risk factors and project costs
   The equipment risk factor has a Spearman correlation coefficient of 0.594, with a significance value of 0.000 <0.05. This means that the equipment risk factor has a moderate relationship and there is a significant relationship with project costs.
c. The relationship between construction method risk factors and project costs
   The construction method risk factor has a Spearman correlation coefficient of 0.596, with a significance value of 0.000 <0.05. This means that the construction method risk factor has a moderate relationship and there is a significant relationship to project cost.
d. The relationship between contractor managerial risk factors and project costs
   The contractor managerial risk factors have a Spearman correlation coefficient of 0.551, with a significance value of 0.001 <0.05. This means that the contractor managerial risk factors have a moderate relationship and there is a significant relationship with project costs.
e. The relationship between operational risk factors and project costs
   The operational risk factor has a Spearman correlation coefficient of 0.442, with a significance value of 0.007 <0.05. This means that operational risk factors have a moderate relationship and there is a significant relationship with project costs.
f. The relationship between construction safety risk factors and project costs

The construction safety risk factor has a Spearman correlation coefficient of 0.452, with a significance value of 0.006 <0.05. This means that operational risk factors have a moderate relationship and there is a significant relationship with project costs.

3. Multiple Linear Regression Analysis

a. Regression Model

The multiple linear regression equation is the results of the multiple linear regression test, among others, can be seen in the table below:

Table 6 Multiple Linear Regression Test Results

Variable	Regression Coefficients	t test	
		t_{value}	Sig
Constant	0,067	-0,089	0,929
Faktor Material Risk (X1)	-0,009	-0,110	0,913
Faktor Equipment Risk (X2)	0,162	2,078	0,047
Faktor Construction Method Risk (X3)	0,232	2,249	0,032
Faktor Contractor Managerial Risk (X4)	0,142	3,339	0,002
Faktor Operational Risk (X5)	-0,210	-2,603	0,014
Faktor Construction Safety Risk (X6)	0,106	1,377	0,179

Source: primary data processed with SPSS 20.0, 2023

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.067	.749		.089	.929
	Material Risk	-.009	.082	-.021	-.110	.913
	Equipment Risk	.162	.078	.534	2.078	.047
	Construction Method Risk	.232	.103	.388	2.249	.032
	Contractor Managerial Risk	.142	.043	.466	3.339	.002
	Operational Risk	-.210	.081	-.764	-2.603	.014
	Construction Safety Risk	.106	.077	.328	1.377	.179

Based on the output in table 4.6 above, the regression equation can be written as follows:

$Yi=\beta 0+\beta 1X1+\beta 2X2+.... +\beta 6X6$

$Y = 0{,}067 - 0{,}009\ X_1 + 0{,}162\ X_2 + 0{,}232\ X_3 + 0{,}142\ X_4 - 0{,}210\ X_5 + 0{,}106\ X_6$

Based on the equation above, the regression coefficient in the model can be interpreted as follows:

a. The influence of material risk factors on project costs
   The material risk factor has a regression coefficient of -0.009. This means that the material risk factor has a negative influence and if it is increased, the project cost will decrease by 0.01%.
b. The influence of equipment risk factors on project costs
   The equipment risk factor has a regression coefficient of 0.162. This means that the equipment risk factor has a positive influence and if it is increased, project costs will increase by 16.2%.
c. The influence of construction method risk factors on project costs
   The construction method risk factor has a regression coefficient of 0.232. This means that the construction method risk factor has a positive influence and if it is increased, the project cost will increase by 23.2%.
d. The influence of contractor managerial risk factors on project costs

The contractor managerial risk factors factor has a regression coefficient of 0.142. This means that the contractor managerial risk factors have a positive influence and if it is increased, project costs will increase by 14.2%.

e. The influence of operational risk factors on project costs
The operational risk factor has a regression coefficient of -0.210. This means that the operational risk factor has a negative influence and if it is increased, project costs will decrease by 21%.

f. The influence of construction safety risk factors on project costs
The construction safety risk factor has a regression coefficient of 0.106. This means that the construction safety risk factor has a positive influence and if it is increased, project costs will increase by 10.6%.

a. T Test

The following partial test results can be seen in the following table:

Table 7 Parameter Coefficient Partial Test Multiple Linear Regression Analysis

No	Intermediate Influence	tcount	t_{table}	Sig.	Sig. Decree	Information
1	X_1 - Y	-0,110	2,045	0,913	0,05	No significant effect
2	X_2 - Y	2,078		0,047		Has a significant effect
3	X_3 - Y	2,249		0,032		Has a significant effect
4	X_4 - Y	3,339		0,002		Has a significant effect
5	X_5 - Y	-2,603		0,014		Has a significant effect
6	X_6 - Y	1,377		0,179		No significant effect

Source: SPSS 20 Test Results (processed data, 2023)

Based on the equation above 4.9, the t test results can be interpreted as follows:

a. The influence of material risk factors on project costs
The material risk factor obtained is a value of tcount < ttable, namely -0.110< 2.045 and a significance value of 0.913 > 0.05, so H0 is accepted and H1 is rejected. This means that the material risk factor has no effect and is not significant on project costs.

b. The influence of equipment risk factors on project costs
The equipment risk factor obtained a value of tcount > ttable, namely 2.078 > 2.045 and a significance value of 0.047 < 0.05, so that H0 was rejected and H2 was accepted. This means that the equipment risk factor has a significant effect on project costs.

c. The influence of construction method risk factors on project costs
The construction method risk factor obtained a value of tcount > ttable, namely 2.249 > 2.045 and a significance value of 0.032 < 0.05, so that H0 was rejected and H3 was accepted. This means that the construction method risk factor has a significant effect on project costs.

d. The influence of contractor managerial risk factors on project costs
The contractor managerial risk factor obtained a value of tcount > ttable, namely 3.339 > 2.045 and a significance value of 0.002 < 0.05, so that H0 was rejected and H4 was accepted. This means that the contractor managerial risk factor has a significant effect on project costs.

e. The influence of operational risk factors on project costs
For the operational risk factor, the value obtained is tcount > ttable, namely -2.063 > 2.045 and a significance value of 0.014 < 0.05, so H0 is rejected and H5 is accepted. This means that operational risk factors have a significant effect on project costs.

f. The influence of construction safety risk factors on project costs
The construction safety risk factor obtained a value of tcount < ttable, namely 1.377 < 2.045 and a significance value of 0.179 > 0.05, so that H0 was accepted and H6 was rejected. This means that the construction safety risk factor has no effect and is not significant on project costs.

Discussion

Based on the project manager's perception that data processing and data analysis have been carried out, in this sub-chapter the researcher will provide several discussions. The discussion in this research concerns the influence of risk factors on project cost in Sigli-Banda Aceh toll road project, as well as the form of relationship and influence between the risk factors on the project cost in Sigli-Banda Aceh toll road project.

The discussion can be described as follows. 4.6.1 the influence of risk factors on project cost in Sigli-Banda Aceh toll road project

The relationship between material risk factors and project cost. The relationship between material risk factors and project costs in Sigli-Banda Aceh toll road project has been analysed through spearman correlation. This analysis shows that material risk factor has a moderate relationship and there is a significant relationship with project costs., therefor there is a relationship enough with Spearman coefficients of 0.505, with a significance value of 0.002 <0.05.

The relationship between equipment risk factors and project cost.

The relationship between equipment risk factors and project costs in Sigli-Banda Aceh toll road project has been analysed through spearman correlation. This analysis shows that equipment risk factors have a moderate relationship and there is a significant relationship with project costs., therefor there is a relationship enough with Spearman coefficients of 0.594, with a significance value of 0.000 <0.05.

The relationship between construction method risk factors and project cost.

The relationship between construction method risk factors and project costs in Sigli-Banda Aceh toll road project has been analysed through spearman correlation. This analysis shows that construction method risk factors have a moderate relationship and there is a significant relationship with project costs., therefor there is a relationship enough with Spearman coefficients of 0.596, with a significance value of 0.000 <0.05.

The relationship between contractor managerial risk factors and project cost/

The relationship between contractor managerial risk factors and project costs in Sigli-Banda Aceh toll road project has been analysed through spearman correlation. This analysis shows that contractor managerial risk factors have a moderate relationship and there is a significant relationship with project costs., therefor there is a relationship enough with Spearman coefficients of 0.551, with a significance value of 0.001 <0.05.

The relationship between operational risk factors and project cost.

The relationship between operational risk factors and project costs in Sigli-Banda Aceh toll road project has been analysed through spearman correlation. This analysis shows that operational risk factors have a moderate relationship and there is a significant relationship with project costs., therefor there is a relationship enough with Spearman coefficients of 0.442 with a significance value of 0.007 <0.05.

The relationship between construction safety risk factors and project cost.

The relationship between construction safety risk factors and project costs in Sigli-Banda Aceh toll road project has been analysed through spearman correlation. This analysis shows that construction safety risk factors have a moderate relationship and there is a significant relationship with project costs., therefor there is a relationship enough with Spearman coefficients of 0.452, with a significance value of 0.006 <0.05.

There are 4 factors that have a significant relationship to the project costs in Sigli-Banda Aceh toll road project and 2 factors that have no significant relationship to the project costs in Sigli-Banda Aceh toll road project. Significant relationships are marked on factors that have a Sig value <0.05 (5%).

The material risk factor obtained is a value of t count < t table, namely |0.010| < 2.045 and a significance value of 0.913 > 0.05, so H0 is accepted and H1 is rejected. This means that the material risk factor has no significant effect and is not significant on project costs. The material

risk factor has a regression coefficient of -0.009. This means that the material risk factor has a negative influence and if it is increased, the project cost will decrease by 0.01%.

The equipment risk factor obtained a value of tcount > ttable, namely 2.078 > 2.045 and a significance value of 0.047 < 0.05, so that H0 was rejected and H2 was accepted. This means that the equipment risk factor has a significant effect on project costs. The equipment risk factor has a regression coefficient of 0.162. This means that the equipment risk factor has a positive influence and if it is increased, project costs will increase by 16.2%. This risk often occurs during the implementation of construction projects in Sigli-Banda Aceh toll road project. (Equipment risk) this risk has also occurred in previous studies, which can be seen from the results of Chattapadhyay et al., (2021), Jaber (2019) and Moi and Purnawirati (2021).

The construction method risk factor obtained a value of tcount > ttable, namely 2.249 > 2.045 and a significance value of 0.032 < 0.05, so that H0 was rejected and H3 was accepted. This means that the construction method risk factor has a significant effect on project costs. The construction method risk factor has a regression coefficient of 0.232. This means that the construction method risk factor has a positive influence and if it is increased, the project cost will increase by 23.2%. This risk often occurs during the implementation of construction projects in Sigli-Banda Aceh toll road project. (Construction method risk) this risk has also occurred in previous studies, which can be seen from the results of Enderzon (2020 and Suherdi dkk (2020).

The contractor managerial risk factor obtained a value of tcount > ttable, namely 3.339 > 2.045 and a significance value of 0.002 < 0.05, so that H0 was rejected and H4 was accepted. This means that the contractor managerial risk factor has a significant effect on project costs. The contractor managerial risk factors factor has a regression coefficient of 0.142. This means that the contractor managerial risk factors have a positive influence and if it is increased, project costs will increase by 14.2%. This risk often occurs during the implementation of construction projects in Sigli-Banda Aceh toll road project. (Contractor managerial risk) this risk has also occurred in previous studies, which can be seen from the results of Jaber (2019) and Moi and Purnawirati (2021).

For the operational risk factor, the value obtained is t count > t table, namely |2.063| > 2.045 and a significance value of 0.014 < 0.05, so H0 is rejected and H5 is accepted. This means that operational risk factors have no significant effect on project costs. The operational risk factor has a regression coefficient of -0.210. This means that the operational risk factor has a negative influence and if it is increased, project costs will decrease by 21%.

The construction safety risk factor obtained a value of tcount < ttable, namely 1.377 < 2.045 and a significance value of 0.179 > 0.05, so that H0 was accepted and H6 was rejected. This means that the construction safety risk factor has no effect and is not significant on project costs. The construction safety risk factor has a regression coefficient of 0.106. This means that the construction safety risk factor has a positive influence and if it is increased, project costs will increase by 10.6%. This risk often occurs during the implementation of construction projects in Sigli-Banda Aceh toll road project. (Construction safety risk) this risk has also occurred in previous studies, which can be seen from the results of Rustandi (2017) and Maulana and Santosa (2020).

CONCLUSION

Based on the findings and discussions, it was found that the finding accepted the Influence of risk factors is factor that affects their project cost significantly. The finding indicated that the alternative hypothesis was accepted while the null hypothesis was rejected as the correlation coefficient was .695, and the p-value was .000 which was less than .05 (.000 < .05). It can be implied that there was a significant strong correlation between risk factors and project cost of the Sigli- Banda Aceh toll road project. The study reveals a moderate relationship between material, equipment, construction method, contractor managerial, operational, and construction safety risk factors and project cost, with a Spearman coefficient of 0.505, 0.594, 0.596, 0.551, 0.442, and 0.452 respectively.

REFERENCES

Abdussamad, H. Z., & Sik, M. S. (2021). *Metode penelitian kualitatif*. CV. Syakir Media Press. Google Scholar

Altoryman, A. (2014). *Identification and assessment of risk factors affecting construction projects in the Gulf region: Kuwait and Bahrain*. The University of Manchester (United Kingdom). Google Scholar

Arikunto, S. (2013). *Prosedur penelitian suatu pendekatan praktik*. Google Scholar

Ariska. (2022). *Identify risks in the implementation of building construction projects in Aceh Province Dissertation.* . Syiah Kuala University. Google Scholar

Bagha, L., Sehgal, S., Thakur, A., Kumar, H., & Goyal, D. (2019). Low cost joining of SS304-SS304 through microwave hybrid heating without filler-powder. *Engineering Research Express*, *1*(2), 025035. https://doi.org/10.1088/2631-8695/ab551d Google Scholar

Cheng, Y. L., Lee, C. Y., Huang, Y. L., Buckner, C. A., Lafrenie, R. M., Dénommée, J. A., Caswell, J. M., Want, D. A., Gan, G. G., & Leong, Y. C. (2016). *We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists TOP 1%. Intech*, *11 (tourism)*, *13*. Google Scholar

Dharmayanti, G. A. P. C., & Jaya, N. M. (2018). Analisis kinerja proyek terhadap kepuasan Stakholder. *Jurnal Spektran*, *6*(2). Google Scholar

Eshofonie, F. P. (2008). Factors affecting cost of construction in Nigeria. *Unpublished M. Sc. Thesis, University of Lagos, Akoka*. Google Scholar

Hanifah, D. (2019). *Identifikasi Risiko Pengadaan Langsung Jasa Konstruksi Menurut Perpres Nomor 54 Tahun 2010 Komparasi Perpres Nomor 16 Tahun 2018 Menggunakan Fuzzy Logic* [Thesis, Universitas Jember]. http://repository.unej.ac.id/handle/123456789/93453 Google Scholar

Khan, R. A., Liew, M. S., & Ghazali, Z. Bin. (2014). Malaysian Construction Sector and Malaysia Vision 2020: Developed Nation Status. *Procedia - Social and Behavioral Sciences*, *109*, 507–513. https://doi.org/10.1016/j.sbspro.2013.12.498 Google Scholar

Mahapatni, I. A. P. (2019). *Metode Perencanaan dan Pengendalian Proyek Kontruksi* (Made Novia Indriani). Unhi Press. Google Scholar

Mendelson, S., & Greenfield, H. (1996). Taking value engineering into the twenty-first century. *International Journal of Cost Estimation, Cost/Schedule Control and Project Management*, *37*(8). Google Scholar

Menolascina, F., Bevilacqua, V., Ciminelli, C., Armenise, M. N., & Mastronardi, G. (2008). A multi-objective genetic algorithm based approach to the optimization of oligonucleotide microarray production process. *International Conference on Intelligent Computing*, 1039–1046. Google Scholar

Project Management Institute. (2017). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (5th Edition). Project Management Institute, Inc. Google Scholar

Rofiah, N. H., Kawai, N., & Hayati, E. N. (2021). Key elements of disaster mitigation education in inclusive school setting in the Indonesian context. *Jàmbá - Journal of Disaster Risk Studies*, *13*(1). https://doi.org/10.4102/jamba.v13i1.1159 Google Scholar

Sami Ur Rehman, M., Shafiq, M. T., & Afzal, M. (2022). Impact of COVID-19 on project performance in the UAE construction industry. *Journal of Engineering, Design and Technology*, *20*(1), 245–266. https://doi.org/10.1108/JEDT-12-2020-0481 Google Scholar

Serrador, P., & Turner, R. (2015). The Relationship between Project Success and Project Efficiency. *Project Management Journal*, *46*(1), 30–39. https://doi.org/10.1002/pmj.21468 Google Scholar

Simanjuntak, M. Ronald. A., & Simandjorang, G. H. (2019). Kajian Faktor-Faktor Penting Manajer Proyek dalam Proses Konstruksi Bangunan Gedung Tinggi di Jakarta Pusat. *Prosiding Seminar Nasional Teknik Sipil UMS*. http://hdl.handle.net/11617/10865 Google Scholar

Sonelma, N., & Sucita, I. K. (2022). Pengaruh Kompetensi Project Manager terhadap Keberhasilan Proyek Kontruksi Gedung Apartemen X. *Construction and Material Journal*, *4*(1), 71–81. https://doi.org/10.32722/cmj.v4i1.4483 Google Scholar