CIVED Journal of Civil Engineering and Vocational Education

EISSN: 2622-6774
Vol 10 No.3 September 2023
http://cived.ppj.unp.ac.id/index.php/CIVED

Risk Analysis and Management of Road Infrastructure Using A Single Year Funding System in The Mentawai Islands

Fadhillah Rizky Utami[1]*, Benny Hidayat[2], Taufika Ophyandri[3]
[1,2,3] Civil Engineering, Andalas University, Indonesia
*Corresponding Author: utamidilla01@gmail.com

Received 19th July 2023; Revision 15th August 2023; Accepted 16th September 2023

ABSTRACT

Roads are the basic infrastructure that humans need most to be able to move from one place to another to meet their daily needs. According to the Central Statistics Agency, the Mentawai Islands area, the percentage of stable roads available in the Mentawai Islands is only around 10%, so that for Road infrastructure development in the Mentawai Islands is the main target for the local government. The funding system provided is mostly a single year funding system. Single year funding is defined as project activities where the work implementation period corresponds to or is equal to one budget year. The development of road infrastructure with a single year funding system in the Mentawai Islands will certainly not be without the name project risk. The aim of this research is to create risk management in road construction with a single year funding system in the Mentawai Islands. The interview method was conducted to informants. There are 15 risks identified for the Mentawai Islands Regency. The highest potential loss obtained from the contractor is the delay in the tender and the risk aggregate from the contractor is IDR. 40,300,000,000,- . The highest potential loss obtained from the owner is a natural disaster and the aggregate risk from the owner is Rp. 26,880,000,000,-. The highest potential loss that can be obtained from the contractor is the delay in the tender and the aggregate risk from the contractor is Rp. 40,300,000,000,- . The highest potential loss that can be obtained from the owner is a natural disaster and the aggregate risk from the owner is Rp. 26,880,000,000,-. The highest potential loss that can be obtained from the contractor is the delay in the tender and the aggregate risk from the contractor is Rp. 40,300,000,000,- . The highest potential loss that can be obtained from the owner is a natural disaster and the aggregate risk from the owner is Rp. 26,880,000,000,-.

Keywords: *Mentawai Islands, Single Year, Risk, Potential Loss*

INTRODUCTION

Roads are the basic infrastructure that humans need most to be able to move from one place to another to meet their daily needs. The availability of roads is considered very urgent if the community's economic activities experience significant growth [1]. Mentawai Islands Regency is one of the districts in West Sumatra province with a geographical position between 0°55'00" – 3°21'00" South Latitude and 98°35'00" – 100°32'00" Longitude East with an area of approximately ± 6,011.35 km² and a coastline of ± 1,402.66 km. Geographically, the land of the Mentawai Islands Regency is separated from West Sumatra Province by the sea, namely the northern border is the Siberut Strait, the southern border is the Indian Ocean, the eastern border is the Mentawai Strait, and the western border is the Indian Ocean [2].

EISSN: 2622-6774
Vol 10 No.3 September 2023
http://cived.ppj.unp.ac.id/index.php/CIVED

According to data from the West Sumatra Province Central Statistics Agency, in 2019 the Mentawai Islands area had a road length of ±1127.40 km with good road conditions for National Roads of 22.3 km, good roads in the Province of 6.1 km and good roads in Regency of 92.31 km. km with the percentage of solid roads available in the Mentawai Islands being approximately only around 10%, so that the development of road infrastructure in the Mentawai Islands is the main target for the local government.

In developing road infrastructure, the regional government each year always uses a budget that is more dominant in road infrastructure, and the funding system that is implemented is mostly a single-year funding system. Single year funding is defined as project activities where the work implementation period is in accordance with or equal to one fiscal year. The implementation of road construction in the Mentawai Islands is mostly just road improvement work or land clearing where the length of roads that can be worked on according to LPSE data from the Mentawai Islands Regency Public Works and Spatial Planning Service is only around 2-3 km per each project. with a duration of 8-9 months when using a single year funding system.

mobilization of heavy equipment and including permits when mobilizing heavy equipment and other things that might have an impact on the delay of a project and the loose budget of the project [3]. road improvements carried out in the previous year.

In this case, it is very important to carry out a risk analysis of the construction of road infrastructure with a single year funding system in the Mentawai Islands, in order to identify and overcome the risks that will occur by seriously observing whether the single year funding system for the construction of road infrastructure is suitable for use in the Mentawai Islands. , so that projects in the Mentawai Islands can be carried out effectively in accordance with the budget, time, quality and safety.

MATERIALS AND METHODS

This research uses a combination method of quantitative analysis and qualitative analysis, where this uses research instruments in collecting data externally, namely by using direct interviews with respondents.
The research stages start from the research background and the objectives to be achieved. After that, it was continued by collecting data by identifying risks using the pilot survey method with 2 respondents and literature sources. The identification was carried out to find out what risks would arise and then used as questions in interviews. After the results of the interviews were obtained, it was continued by conducting a risk analysis measured through risk impact and risk events. Furthermore, a risk response will be made based on the risk category and risk value.

Risk Identification

In identifying the risks that exist for infrastructure projects in the Mentawai Islands with a single year funding system, a pilot survey was carried out using a pilot survey, where the pilot survey was carried out on 1 owner and 1 contractor, as can be seen in table 1.

CIVED Journal of Civil Engineering and Vocational Education
EISSN: 2622-6774
Vol 10 No.3 September 2023
http://cived.ppj.unp.ac.id/index.php/CIVED

Table 1: Pilot Survey Respondent Data

No	Respondents	Work experience	Institution
1	JN	> 10 Years	owner
2	C.A	3-4 Years	owner
3	RN	> 10 Years	Contractor
4	EO	4-6 Years	Contractor
5	HF	4-6 Years	Contractor

Sampling of Research Respondents

Sampling for this study using a sampling technique. The sampling technique used is purposive sampling, which is sampling by determining certain criteria [8]. Purposive sampling aims to produce results

a sample that can logically be considered representative of the population. The sample of respondents in this study was 5 respondents consisting of:

a. Owners of 2 people include:

Activity Engineering Implementation Officer

Field supervisor

b. Contractor as many as 3 people include:

SiteEngineer

Field Executive

Technical Staff

Table 2: Respondent Data

No	Institution Name	The type of company	Position
1.	PUPR District Department. Mentawai	owner	Public Works Department staff
2.	PT. X (Private)	Contractor	SiteEngineer

Identify types of impacts

The impact table includes the types of impact that are relevant to the company's experience as seen in the results of determining the internal and external context. Types of impact include:

a. Impact on costs

b. Impact on quality

c. Impact on time

d. Impact on work safety

Determining the Level of Impact

The aim is to determine the level of impact that is sufficient for each impact, especially between levels that are close to each other. The level of this impact is based on one of the sources.

Table 3: Impact Level

Levels	Time	Cost	Quality	K2
Very small	20 million	20 million	10 million	20 million
Small	50 million	50 million	100 million	50 million
Currently	300 million	300 million	500 million	300 million
Big	1 M	1 M	1 M	1 M
Very large	2 M	2 M	3 M	2 M

CIVED Journal of Civil Engineering and Vocational Education
EISSN: 2622-6774
Vol 10 No.3 September 2023
http://cived.ppj.unp.ac.id/index.php/CIVED

Level 1 = Very small = delay < 1 week
Level 2 = Small = delay < 2 weeks
Level 3 = Moderate = delay < 3 weeks
Level 4 = Big = delay < 1 month
Level 5 = Very big = delay > 1 month

Determine the Level of Likelihood

The likelihood level aims to establish sufficient probabilities so that the risk can be assigned an appropriate probable value.

Table 4: Possibility Level

Level	Possibility	Description	Quantitative
1	Very small	Almost impossible	0.2
2	Small	It's unlikely to happen	0.4
3	Currently	It's likely to happen	0.6
4	Big	Most likely to happen	0.8
5	Very large	It's almost certain to happen	0.99

Potential Loss (%)

After obtaining the probability value and the impact of the existing risks, the potential loss calculation is carried out.

$$PL=(P_{(E_o)} \times P_{(E_IM)})+(P_{(E_o)} \times P_{(E_IB)})+(P_{(E_o)} \times P_{(E_IW)})+(P_{(E_o)} \times P_{(E_IK)}) \quad (1)$$

Information:
PL = Potentialloss(%)
$P_{(E_o)}$ = The likelihood of a risk occurring
$P_{(E_IM)}$ = Possible impact on quality
$P_{(E_IB)}$ = Possible impact on costs
$P_{(E_IW)}$ = Possible impact on time
$P_{(E_IK)}$ = Likely impact on K2

***Risk Aggregate*(%)**

After obtaining the value of the potential loss for each risk, an aggregate risk calculation or total potential loss is performed.

$$RA = \sum_{k=0}^{n} \text{PL} \quad (2)$$

Information :
R.A = Risk Aggregate (Rp.)
PL = Potential Loss (Rp.)

Risk Level Criteria

Risk value (a combination of probability and impact values) means the risk level is determined based on the opinion of one of the sources. In table 5 the various levels of risk are grouped based on very low to very high levels. Risk Treatment is given from moderate to very high risk levels, this functions to change the risk value in the future.

Journal of Civil Engineering and Vocational Education
EISSN: 2622-6774
Vol 10 No.3 September 2023
http://cived.ppj.unp.ac.id/index.php/CIVED

Table 5: Risk matrix and risk rating

Rating	Scale
Very low	0 million – 1.3 M
Low	1.4 M – 2.3 M
Currently	2.4 M – 3.3 M
Big	3.4M – 4.4M
Very large	>4.5M

Risk management

There are several important things to know related to the limitations of criteria that are useful in evaluating this risk in table 6 below.

Table 6: Risk level and risk tolerance

Risk Level	*Risk Appetite*	Risk Tolerance
Very large	Unacceptable risk and need control treatment, especially responsive action	The risk is unacceptable and tolerable and needs to be reviewed for improvement or additional treatment, or compensation
Big	The risk is unacceptable and requires control treatment, both preventive and responsive	
Currently	Unacceptable risk and need control especially preventive action	
Small	The risk is unacceptable but the control treatment is only carried out if the benefits outweigh the costs	Unacceptable risk but can be tolerated risk treatment is ALARP (as long as reason ably practicable)
Very small	The risk is acceptable so there is no need for adequate treatment with existing controls, but needs to be monitored by the risk owner	Risk can be accepted and tolerated so that there is no need for sufficient treatment with existing controls but needs to be monitored by the risk owner

RESULTS AND DISCUSSION

Risk identification and analysis

From the risk identification obtained from literature and pilot surveys for road construction in the Mentawai Islands, 15 risks were obtained which can be seen from table 7 below.

Table 7: Sources of risk and impact of risk

No	Risk Type	Risk	Sources of Risk	The impact that occurred
1	*Politics*	Change of government position	Politics/government policy	There was a change in employment policy
2	*economics*	Budget not available	Economics/Financial Policy	Work cannot continue
		Variation order / Addendum	Economics/Financial Policy	A job change occurred

Journal of Civil Engineering and Vocational Education
EISSN: 2622-6774
Vol 10 No.3 September 2023
http://cived.ppj.unp.ac.id/index.php/CIVED

		Lack of supply of raw materials	*Projects*/procurement strategy	There are additional costs and late work
3	*Social*	Low performing local contractors	*Human*/Incompetent	There is no increase in the capacity of local communities
		Incompetent personnel	*Human*/Incompetent	Occurrence of work errors and losses
		Rejection of land acquisition	*Human*/Incompetent	There was a delay in the project
		*Miss*project stakeholder coordination	*Human*/Incompetent	There is a misunderstanding at work
4	*technology*	Material out of specification	Technical/Operational Efficiency	It costs more and takes a long time
5	*Legal*	Tender delays	*Projects*/procurement strategy	There will be delays in project completion
		Refusal of work permit	Licensing	There will be delays in project completion
		Work plans change	*Projects*/procurement strategy	There will be delays in project completion
		Incomplete tender documents	*Projects*/procurement strategy	It costs more and takes a long time
6	*Environment*	The access road is damaged	Environmental impact	It costs more and takes a long time
		Natural disasters	Natural	It costs more and takes a long time

Contractor Assessment

The risk assessment obtained from the contractor can be seen based on table 8 below.

Table 8: Contractor Assessment

No	Code	Risk	Single Year
			$\bar{X}$ Risk Value
			(Rp.)
1	X1	Tender delays	5,413,166,666.67
2	X2	Incomplete tender documents	1,770,666,666.67
3	X3	Variation order / Addendum	3,040,000,000.00
4	X4	Miss project stakeholder coordination	2,904,000,000.00
5	X5	Lack of supply of raw materials	3,927,900,000.00
6	X6	Material out of specification	3,186,666,666.67
7	X7	Natural disasters	2,415,333,333.33
8	X8	The access road is damaged	2,306,666,666.67
9	X9	Rejection of land acquisition	2,550,666,666.67
10	X10	Change of government position	2,513,333,333.33
11	X11	Budget not available	1,886,666,666.67
12	X12	Work plans change	2,356,666,666.67
13	X13	Incompetent personnel	2,322,666,666.67
14	X14	Refusal of work permit	3,614,000,000.00
15	X15	Low performing local contractors	94,433,333.33

Journal of Civil Engineering and Vocational Education
EISSN: 2622-6774
Vol 10 No.3 September 2023
http://cived.ppj.unp.ac.id/index.php/CIVED

After carrying out a risk assessment, the aggregate risk is obtained at IDR. 40,300,000,000,- where of the 15 risks identified there is 1 risk in the very large risk category, 2 large risks and 6 risks in the medium category.

Owner Rating

From the two results according to the owner, the average impact criteria and possibility criteria are obtained where from the average the risk value is obtained

Table 9: Owner's assessment

No	Code	Risk	Single Year
			$\bar{X}$ Risk Value
			(Rp.)
1	X1	Tender delays	2,400,000,000.00
2	X2	Incomplete tender documents	680,000,000.00
3	X3	Variation order / Addendum	2,725,000,000.00
4	X4	Miss project stakeholder coordination	2,800,000,000.00
5	X5	Lack of supply of raw materials	2,320,000,000.00
6	X6	Material out of specification	2,525,000,000.00
7	X7	Natural disasters	4,420,000,000.00
8	X8	The access road is damaged	3,570,000,000.00
9	X9	Rejection of land acquisition	3,535,000,000.00
10	X10	Change of government position	795,000,000.00
11	X11	Budget not available	14,000,000.00
12	X12	Work plans change	100,000,000.00
13	X13	Incompetent personnel	470,000,000.00
14	X14	Refusal of work permit	57,000,000.00
15	X15	Low performing local contractors	470,000,000.00

After carrying out a risk assessment, the aggregate risk is Rp. 26,880,000,000,- of the 15 risks identified, there is 1 risk in the very large category, 2 risks in the large category and 4 risks in the medium category which must be risk mitigated (risk treatment).

Combined Owner and Contractor Assessment Results

From the results of interviews and forms filled in by owners and contractors, 10 risks were obtained from road infrastructure development in the Mentawai Islands with a single year funding system that must be mitigated. These 10 risks can be seen in Figure 1 below.

CIVED Journal of Civil Engineering and Vocational Education
EISSN: 2622-6774
Vol 10 No.3 September 2023
http://cived.ppj.unp.ac.id/index.php/CIVED

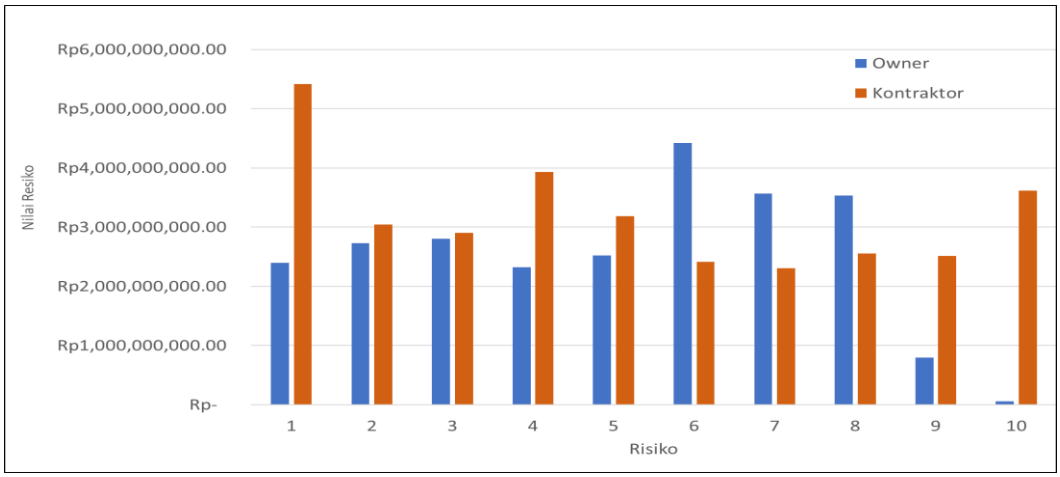

Figure 1: Bar chart of owner vs contractor risk values

In risk usually single year auctions still happen in the middle of the year. The risk of for these risks can still be overcome according to the assessment of the owner. At risk Each contractor has anticipations that will be taken if a natural disaster occurs so that the risk classification is moderate. In the X8 risk of damaged access roads, the risk classification for the owner is in the large category, while the risk classification for the contractor is in the small category, because for the contractor to access the work site, the contractor already has efforts or activities to repair temporary access to the work site and the contractor too. Of course they have surveyed the location of the work they are going to do, but for the owner if access is difficult to reach it can slow down the work and there will be delays.

Contractor one, contractor two, contractor three and owner one are of the view that the risk of tender delays can be mitigated by holding tenders at the beginning of the fiscal year or at the end of the previous year. The mitigation that should be done for the risk of variation orders / addendums is by designing the initial planning carefully and thoroughly so that the addendum during implementation is very unlikely to occur. Work." Based on the statements of owner one and owner two and also supported by the opinions of the three contractors "So that the initial planning is more complete and clear".

The risk of missing project stakeholder coordination, it is best to hold regular and periodic meetings to unite opinions and discuss problematic matters in the field, in accordance with the opinions of the contractor and the owner. It can also be mitigated by creating a WhatsApp group so that problems that occur can be mitigated. conveyed via WhatsApp and responded quickly without having to wait for regular meeting times.
Contractors wishing to take part in an auction in the Mentawai Islands must already know the methods and strategies for mobilizing equipment and materials because it has been confirmed that there is no material and equipment in the Mentawai Islands, and when the contractor is declared victorious, the contractor must immediately mobilize equipment and materials without having to wait for orders from the owner.

Materials that do not meet specifications can be mitigated by building an independent laboratory in Mentawai so that contractors can test materials regularly without having to bring these materials to Padang. Mitigation that should be carried out for risks such as natural disasters, the contractor must be better prepared and have a fast strategy in implementing the

EISSN: 2622-6774
Vol 10 No.3 September 2023
http://cived.ppj.unp.ac.id/index.php/CIVED

project and utilize overtime, according to the opinion of the owner and contractor.
For the risk of damaged road access, the owner should consider road access to the project location so that the contractor has no difficulty bringing equipment and materials to that location. In accordance with the opinion of the contractor and owner that "the owner in the auction has budgeted for repairing the access road or making sequential roads starting from STA 0+000 until the final limit of the road."

From the owner, before conducting an auction on the land to be worked on, he has socialized and notified that work will be carried out on the land and the contractor who will start the work should also carry out initial socialization and write an official letter to the local village head to avoid any rejection of land acquisition by the head. People, contractors and owners also think so.

The initial planning data should be mature and complete and at the Pre Construction Meeting (PCM) the owner, consultant and contractor have also discussed the work items and work plan at the beginning so that there are no changes to the work plan in accordance with the third contractor's statement that "during the initial meeting (PCM) is carried out there and it must be agreed on what will be done or changed from the initial plan, so that there are no changes to work midway." Also supported by the owner's statement, namely "Before the package is handed over to the field there, we must discuss all possibilities that may occur and determine a joint work plan." The contractor can explain in detail the work system that will be implemented so that the contractor will have no difficulty in obtaining work permits both owner side, The management that should be carried out for the risks in the Mentawai Islands, starts with planning that has been carried out as thoroughly as possible and continues with the auction, which should be carried out early so that the package can be auctioned more quickly and implementation can start earlier, and after that an initial meeting will be held. before work begins so that the owner and contractor can agree on what is being done and there are no obstacles whatsoever regarding permits and changes to the work plan.

CONCLUSION

Based on the research objectives and final results of the research above, the following conclusions can be drawn from this research:

1. There are 10 risks that must be mitigated for road project risks in the Mentawai Islands.
2. According to the owner, the biggest risk is a natural disaster
3. According to the contractor, the biggest risk is the delay in the tender.
4. Mitigating the risk of natural disasters, maximizing work as quickly as possible and optimizing overtime hours so that work can be completed more quickly.

Mitigate the risk of delays in tenders, by carrying out auctions at the beginning of the year or at the end of the previous year.

REFERENCE

[1] Abidin, Zainal. 2019. "Policies for Accelerating Development in Disadvantaged Regions." Social Sciences 2.

[2] Sumari, Arwin Datumaya Wahyudi, Sutopo Purwo Nugroho, and Tri Nur Addin. 2016. "Reducing the Risk of Earthquake-Tsunami Disasters at the TNI Au Padang Base Due

to the Mentawai Megathrust." Journal of Defense & State Defense 6(1). doi: 10.33172/jpbh.v6i1.304.

[3] Fitri, Yulia. 2016. "Personnel Scheduling Problem Model with Multiple Shifts and Work Locations." Main Potential University.

[4] Setiawan, Andi, et al. 2014. "Risk Management Analysis on the Cisumdawu Toll Road Construction Project." Construction Journal 11:1.

[5] Faisal, Muhammad, et al. 2021. "Risk analysis at the construction implementation stage of the Cinere-Jagorawi toll road, Depok." Civil Engineering Scientific Journal 4(2):1.

[6] Fanthoni, Ferry. 2014. "Comparative Study Between Single Year Contracts and Multi Year Contracts." Research 4.

[7] Anwar, and Tri Joko Wahyu Adi. 2015. "Analysis of Technical Risks that Influence Time Performance of Coastal Protection Development Projects in West Sulawesi Province." Ten November Institute of Technology.

[8] Guide, PMBOK. 2004. "Analysis of Risk Factors in Projects." Bojonegoro University.

[9] Habib, Muhammad. nd "Comparative Study Between Single Year Contracts and Multi Year Contracts."

[10] Hidayat, Rahmi, et al. 2017. "Analysis of Risk Variables in the Implementation of Road Construction Projects." Civil Engineering Scientific Journal 14:2.

[11] Kalangit, Shanty Von Novita, et al. 2019. "Risk management model for the construction of the Siau North Ring Road to improve project performance." Civil Journal Stat 7:1-14.

[12] Nanang, Hermanto. 2021. "Analysis of Risk Factors Affecting the Construction of the Karang Panasan-Blateran Road in Bangkalan Regency." Transportation Journal 8:1.

[13] Ndale, Fransiskus Transportation Journal 7:1.

[14] Moi, Fransiska IGA, et al. 2021. "Risk Management Analysis on the New Waebetu - Tarawaja Road Construction Project." Talent Journal 14(1):79–84.

[15] Face, I Wayan. 2013. "Risk Analysis on the Sulawesi Denpasar street basement parking development project." Talent Journal 19:2

[16] Priyanti, Anik. 2018. "Cost and Time Risk Analysis of the Gumelem Sikucing Road Improvement Project." Widya Dharma University.

[17] Rahmawati, Nia, et al. 2020. "Analysis of Risk Management in the Construction of the Bekasi Cawang-Kampung Melayu Toll Road." Journal of Civil Engineering 14:1.

[18] Rahmi, Hidayati. 2017. "A Analysis of Risk Variables in Road Construction Project Implementation." Borneo Sustainable University.

[19] Reski, Purnomo, et al. 2015. "Risk Monitoring of Performance Based Contract Implementation of National Road Projects in Java." Ten November Institute of Technology.

[20] Sandhyavitri, Ari, et al. 2013. "Pre-Construction Stage Toll Road Risk Analysis." Journal of Civil Engineering 9:1.

[21] Sandhyavitri, Ari, et al. 2014. "Risk Analysis of Toll Road Construction During the Construction Phase." Journal of Civil Engineering 10:1.

[22] Saputro, cardian Susilo. 2017. "Evaluation and Risk Analysis of Cost, Time and Quality of JLS Construction Lumajang Regency-Jember Regency." Ten November Institute of Technology.

[23] Astiti, Ni Putu Mega, et al. 2015. "Risk Analysis for the Implementation of the Benoa Airport - Nusa Dua Toll Road Construction." Spektan Journal 3:2.

[24] Ana, Dewi Rusim, et al. 2018. "Risk Analysis of implementation time for road infrastructure development in Jayapura." Muhammadiyah University of Surakarta.

[25] Susilo, LJ, & Kaho, VR (2018). Risk Management: A Guide For Risk Leaders and Risk Practitioners.

[26] West Sumatra, Ministry of Religion. nd "Overview of the Mentawai Islands Regency." Retrieved (https://sumbar.kemenag.go.id/v2/post/1556/sekilas-tangan-kabupaten-kepuasan-mentawai.html).

[27] Wardhana, Wira, et al. 2014. "Risk Analysis to determine contingency costs for the implementation of the construction of the Surabaya-Mojokerto toll road project." Surabaya Institute of Technology.

[28] Yohanes, A. S, et al. 2021. "Risk Analysis at the Road Planning Stage." Bandung National Institute of Technology.