PROJECT RISK MANAGEMENT INFORMATION SYSTEM AT CV. ARTHA JAYA

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ABSTRACT

CV. ARTHA JAYA is a company that engaged in construction. In the execution of projects often there is a discrepancy between planning and implementation, the cause is the lack of good risk management which results in technical responsibility in difficulty in determining the importance of the risks that arise and determine how much costs are needed to anticipate the risks that arise. From these problems, a project risk management information system is needed at CV. ARTHA JAYA to assist in managing all the risks that occur starting from identifying, determining the level of importance and determining what is the right treatment for these risks by using the Probability Impact Matrix method and knowing what costs are needed to anticipate the risks that arise using the Expected Monetary Value method. From the results of testing in this study, it can be concluded that the project risk management system can assist the Technical Responsible Part in managing project risk and can provide an overview of the costs that need to be prepared to manage any risks that arise during the project. This system also has evaluation results which will later to be used as recommendations for risk management in subsequent projects.

Keyword: Project Risk Management, Information System, Costs, Probability Impact Matrix, Expected Monetery Value

1. INTRODUCTION

CV. ARTHA JAYA is one of the companies engaged in construction. This company is located in Bandung district.

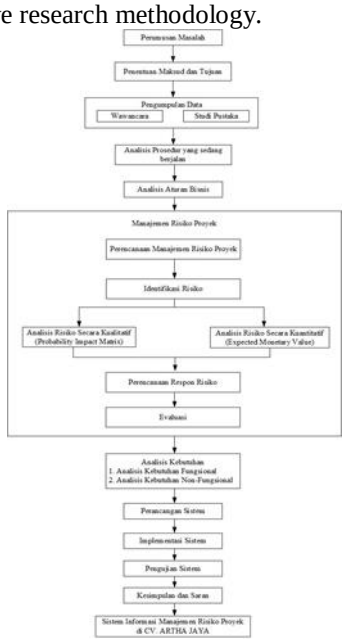
Based on the results of the interview with Mr. Ujang Jaenudin as the Corporate Technical Responsible Officer CV. ARTHA JAYA, stated that in the process of implementing projects that occur in the field, not all projects that are carried out always run smoothly. Often there is a discrepancy between the project plans that have been previously determined with the implementation in the field, such as the Rancaekek Community Health Center Paramedic House Construction project, based on the work budget planning data, showing the planned project cost budget of Rp. 470,902,069, while the costs incurred exceed the planned costs, where the costs incurred in the implementation of the project amounted to Rp. 476,452,069 from the data there was a cost increase of Rp. 5,550,000 caused by unfinished work according to planning, because of the difficulty of rocky foundation excavation fields and high rainfall factors, so that the technical person in charge must add hours of work so that the project processing time is not more than planned. With the addition of these working hours, the person in charge of the technical must add costs to cover the lack of costs that have been used as additional wages for workers who do overtime. This problem occurs because of the negligible risks that arise when working on a project, the absence of risk recording and identification of risks at the beginning that makes the technical person in charge experience difficulties in handling early so that the handling of the problem is too late, and the costs incurred by the company are still estimated rough without an analysis of costs resulting from the risks that arise. So far, the technical person in charge has not made an assessment of the risks that may arise from their operational activities so that the person in charge of the technical does not know for certain about the risks that have a low, medium and high level of importance. Various risk factors that occur in the field include difficult terrain factors, natural disasters or high rainfall, workers who are unable to attend, labor accidents, material damage during delivery, and damage to project work support tools, etc., so that the necessary risk recording is needed. risks that occur can be identified and prepared for handling.

Based on the problems that occur, a solution is needed to answer the problems that often occur in the project, namely the need to apply risk management using the Probability Impact Matrix (PIM) method, which is an analytical method used to analyze risks qualitatively based on opportunities / probabilities and their consequences / impacts [1]. So that the risks that arise during the execution of the project can be handled properly, and the technical person in charge can prepare the handling of each risk that appears. Furthermore, using the Expected Monetary Value (EMV) method to calculate risk costs.

2. RESEARCH RESULT

2.1 Research Methodology

The research methodology used in this research is descriptive research methodology.



Picture 1 Research Methodology

2.2 Project Risk Management Analysis

Stages in project risk management [2]:

1. Risk Management Planning
2. Risk Identification
3. Qualitative Risk Analysis
4. Quantitative Risk Analysis
5. Risk Response Planning
6. Risk Monitoring and Control

2.2.1 Risk Management Planning

The risk management planning process is the process of deciding how to approach and implement risk management activities for a project [2]. At this stage some input data is needed including organizational structure, project coverage statement, project planning in the form of project cost budget and project implementation schedule [2].

At the risk management planning stage, an interview process and discussion is needed for the company, which on this occasion was carried out with Mr. Ujang Jaenudin as the technical person in charge of the CV. ARTHA JAYA to get the output in the form of the types of risks that arise, handling that is done when the risk occurs, the role and responsibility of the risks that arise, the allocation of costs used when the risk occurs, time (when and how often the risk occurs), probability (opportunities) the emergence of risks, the impact that occurs when the risk arises, and the categories of risks that arise.

Table 1 Risk Management Planning

No.	List Risk	Roles & Responsibilities Answer	Budget	Time	Category Risk	Opportunity	Impact
1	Estimate costs that are not corresponding with planning early	Executor Technical	Use Money Typical Company	Not Se ring	Is being	High	High
2	Difficult terrain			Not Often	Is being	Is being	High
3	Condition the weather is not support			Often	Is being	Is being	Is being
4	Security interruption at the project location			Not Often	Is being	Low	Low
5	Pending work caused just right with day highway			Not Often	Low	Low	High
6	Disaster Natural			Not Often	Low	Very Low	Very High
7	Workforce accidents consequence hit by project material			Not Often	High	High	High
8	The technical executor is unable to h a dir because of sick			Not Often	Low	Low	Is being
9	Power Work absent present because of sick			Not Often	Low	Low	Low
10	Tool damage Support			Often	Is being	Is being	Is being
11	Damage materials			Often	Is being	Low	Low
12	Delay in the delivery of material			Not Often	Is being	Is being	Is being
13	Repeat work			Not Often	Low	Is being	Is being

Based on the results of the risk management planning that has been done, the data used will be used at the next stage of risk management.

2.2.2 Risk Identification

Risk identification is the process of determining the risks that affect a project, and documenting its characteristics [2]. In the process of risk identification, some input data is needed including risk management plans, project cost budgets and project implementation schedules [2].

At the risk identification stage, the interview process is needed as well as discussions with the company to obtain output in the form of a list of identified risks, a list of potential responses, the root causes of risk and the latest risk categories.

Table 2 Identification of Risks

No.	List Risk	Type Risk	Code Risk	Response	Cause
1	Estimate costs that are not corresponding withplanning early	Estimation	R1	Cover it withmoney cash	Existenceadditions time andwork
2	Difficult terrain	Risk External	R2	The manager projectincrease working hours for completework excavationoundation	-
3	Condition the weather isnot support		R3	The manager projectadd working hoursfor meet weight	-
4	Security interruption at the project location		R4	Ask protection toparty security	-
5	Pending work caused just right with day highway		R5	The manager projectadd working hoursand power workfor meet work thathas not been doneyet resolved	-
6	Disaster Natural		R6	-	-
7	Workforce accidents consequences hit by project material	Risk Power Work	R7	Rested and givendirection	Ketida heart be careful work in dowork
8	The technical executor is unable to h a dir because of sick		R8	Replaced byforeman	-
9	Power Work absentpresent because of sick		R9	Replace with otherworkers	-
10	Tool damage Support	Risk Tool andTechnique	R 1 0	Replace brokenmachine	No. heart be careful the workerin use tool and usetool that hasfuture
11	Damage materials		R11	Exchangeable material	Lack of attention of suppliers onmaterials to besent
12	Delay in the delivery of material		R12	-	Then traffic jams, e high volume of vehicles
13	Repeat work		R13	Do Repetition	Work less neatand lessexperienced

2.2.3 Qualitative Risk Analysis

Qualitative risk analysis is to assess identified risk priorities using opportunities to occur and their impact on project objectives if that risk occurs [2].

At the stage of qualitative risk analysis, interviews and discussions with the company and data analysis techniques are needed to get the desired results. The data analysis technique uses the Probability Impact Matrix (PIM) method, in the process of risk management analysis there are several stages, namely identifying risks, determining the value of the possibility and the impact of the risks that will occur, and handling those risks.

2.2.3.1 Risk Identification

For the stages of risk identification, we can use table 2, namely the table of results of the risk identification process in which there is a risk register along with the risk code, therefore we can use the table for the stages of risk identification in this process.

2.2.3.2 Determaining Possible Value and Impacts of risk

After the risk identification stage of the project has been carried out, after that the risk will be assessed by providing a value scale using the Boston Square Matrix. The following boston quadrilateral matrix can be seen in table 3 below [3].

Table 3 Boston Square Matrix

Probability						
	Very High	5	10	15	20	25
	High	4	8	12	16	20
	Moderate	3	6	9	12	15
	Low	2	4	6	8	10
	Very Low	1	2	3	4	5
		Very Low	Low	Moderate	high	Very High
		Impact				

Impact assessment criteria and possible measurements can be seen in table 4 and table 5 below [3].

Table 4 Impact / Impact Assessment Criteria

Value	appraisal	Result / Impact
1	Very Low (Slight)	No significant impact is felt, financial loss does not mean anything,
2	Low (Minor)	Necessary treatment on the spot, financial losses into the cost of additional expenditure,
3	Medium (Significant)	Need to be addressed by the Executive, financial loss appreciable.
4	High (Severe)	Failure, a decrease in productivity, significant financial losses, need special handling.
5	Very High (Major)	Error impact on other processes, need handling by personnel in charge of Technical, huge losses, need special handling,

Table 5 Measurement Possibilities

Value	Parameter	Possibility
1	Very Low (Slight)	Occurs rarely, only in certain circumstances.
2	Low (Minor)	Sometimes occur in certain circumstances.
3	Medium (Significant)	Can occur in certain circumstances.
4	High (Severe)	Occur in certain circumstances.
5	Very High (Major)	Often occurs in certain conditions.

According to the boston matrix, the assessment of any chance of risk and the impact made on the scale is 1 to 25 as detailed in Table 6 below [2].

Table 6 Level of Risk Scale

Scale	value Risk
1-5	Low
6-14	moderate
15-25	High

The determination of the likelihood and impact of risk based decisions Responsible Technical CV. ARTHA JAYA appropriate to the risks common in projects that are superbly done before. Value likelihood and impact of the resulting risk can be seen at table 7.

Table 7 Results of Probability and Impact Value

No.	Risk	Risk Codes	probability	Impact
1	**estimation**			
1.1	The cost estimates are not in accordance with the initial planning	R1	4	4
2	**External Risks**			
2.1	Difficult terrain	R2	3	4
2.2	Unfavorable weather conditions	R3	3	3
2.3	Security problems at the project site	R4	2	2
2.4	Bertepatnya missed work due to the feast	R5	2	4
2.5	Natural disasters	R6	1	5
3	**Labor Risk**			
3.1	Labor accidents by falling material project	R7	4	4
3.2	Technical implementation was unable to attend due to illness	R8	2	3
3.3	Workers were unable to attend due to illness	R9	2	2
4	**Supporting Tools and Materials Risk Material**			
4.1	Supporting equipment damage	R10	3	3
4.2	Material damage	R11	2	2
4.3	Delay Delivery of materials	R12	3	3
5	**Operational risk**			
5.1	rework	R13	3	3

2.2.3.3 Determining the Importance of Risk

Having obtained the results of probability and risk impact, then determine the value of the interest level of risk using Probability Impact Matrix. The level of interest risk is calculated using the following 1 [1]:

Risk Score = Probability x Impact (1)
Where :
Risk Score = Importance of Risk
Probability = Value likelihood Happen
Impact = Value of Risk Impact occurred.

Table 8 Results Calculation of interest rate risk

No.	Risk Codes	Possibility	Impact	Importance of Risk
1	R1	4	4	16
2	R2	3	4	12
3	R3	3	3	9
4	R4	2	2	4
5	R5	2	4	8
6	R6	1	5	5
7	R7	4	4	16
8	R8	2	3	6
9	R9	2	2	4
10	R10	3	3	9
11	R11	2	2	4
12	R12	3	3	9
13	R13	3	3	9

Based on Table 8, the calculation results obtained interest level of risk for each risk variable. Below is a description of the results of the risk assessment on the level of interest, can be seen in Table 9 [3].

Table 9 Risk Level

No.	Risk Codes	Importance of Risk	Risk level	consequence
1	R1	16	High	Failure, a decrease in productivity, significant financial losses, need special handling,
2	R2	12	moderate	Need to be addressed by the Executive, financial loss appreciable.
3	R3	9	moderate	Need to be addressed by the Executive, financial loss appreciable.
4	R4	4	Low	Necessary treatment on the spot, financial losses into the

				cost of additional expenditure,
5	R5	8	moderate	Need to be addressed by the Executive, financial loss appreciable.
6	R6	5	moderate	Need to be addressed by the Executive, financial loss appreciable.
7	R7	16	High	Failure, a decrease in productivity, significant financial losses, need special handling
8	R8	6	moderate	Need to be addressed by the Executive, financial loss significant
9	R9	4	Low	Necessary treatment on the spot, financial losses into the cost of additional expenditure,
10	R10	9	moderate	Need to be addressed by the Executive, financial loss significant
11	R11	4	Low	Necessary treatment on the spot, financial losses into the cost of additional expenditure,
12	R12	9	moderate	Need to be addressed by the Executive, financial loss significant
13	R13	9	moderate	Need to be addressed by the Executive, financial loss significant

Based on Table 9, we can conclude the risk variable into a certain risk level. At the level of risk, there are 3 Low risk means low risk category, there are 8 levels of risk Medium risk means moderate risk category, and there is a second risk level High risk means high risk category. From these data the Technical Responsible Person can determine which risks should be addressed immediately.

2.2.3.4 Risk response

Once we know the importance of each risk the next stage is to determine the risk response [3].

Table 10 Response Risk

Risk Codes	Risk	Risk level	Risk response
R1	The cost estimates are not in accordance with the initial planning	High	Reduced Risk
R2	Difficult terrain	moderate	Reduced Risk
R7	Labor accidents by falling material project	High	Risks are transferred
R3	Unfavorable weather conditions	moderate	Reduced risk
R5	Bertepatnya missed work due to the feast	moderate	Reduced risk
R6	Natural disasters	moderate	Reduced risk
R8	Technical implementation was unable to attend due to illness	moderate	Reduced risk
R10	Supporting equipment damage	moderate	Risks Accepted
R12	Delay Delivery of materials	moderate	Risks Accepted
R13	rework	moderate	Reduced Risk
R4	Security problems at the project site	Low	Reduced Risk
R9	Workers were unable to attend due to illness	Low	Reduced risk
R11	Material damage	Low	Risks Accepted

2.2.3.5 Handling Risk

The results of the risk assessment and risk response interests has been done before will be used as reference for the follow-up of risk mitigation or risk control [3].

Table 11 Risk Management

Risk Codes	Risk	Risk level	Risk Management Measures
R1	The cost estimates are not in accordance with the initial planning	High	Utilizing the existing project team by adding working hours and reduce unnecessary costs.
R2	Difficult terrain	moderate	Conducted a survey prior to the location that will be used as the project site
R7	Labor accidents by falling material project	High	Directing the workers to give priority to safety in the project and perform surveillance in order to avoid the bad things that can

			harm workers.
R3	Unfavorable weather conditions	moderate	Add or increase working hours of labor to complete the pending work.
R5	Bertepatnya missed work due to the feast	moderate	Maximize existing resources and immediately pursue the delay by increasing the working hours of employees.
R6	Natural disasters	moderate	Promote the main worker safety and the collection and preservation of components in order to be in a safe place.
R8	Technical implementation was unable to attend due to illness	moderate	Technical Implementation Expert pick one that has been trusted to take his place and always in coordination with the Technical Implementation in what would be done.
R10	Supporting equipment damage	moderate	Immediately replace defective tools so as not to hinder the work and make improvements to supervision and responsibility of the job.
R12	Delay Delivery of materials	moderate	1. Always coordinated to the parties concerned regarding the delivery of materials. 2. Doing work that can be completed without having to wait for the supply of materials overdue material, looking for material on other suppliers.
R13	rework	moderate	Always double-check the work that has been done and improve supervision in order to work in accordance with what was planned.
R4	Security problems at the project site	Low	Negotiate with the parties concerned directly, and appealed to the authorities.
R9	Workers were unable to attend due to illness	Low	Maximizing human resources, and if the impact affects project performance more labor diperlukanya
R11	Material damage	Low	Replace damaged materials or buy back the defective materials, choose materials that can still be used for the implementation of the project and to perform maintenance, supervision of materials.

Based on the results of risk analysis using Probability Impact Matrix in Table 11, the results of the risk analysis used in the monitoring and evaluation stage.

2.2.4 Quantitative Risk Analysis

At this stage of quantitative risk analysis, interviews and discussions diperlukanya to the company and data analysis techniques to get the desired results. Data were analyzed using methods Expected Monetary Value (EMV). EMV is a statistical concept analysis method that calculates the average - average expenditure in the future that may happen or not happen. EMV positive value indicates an opportunity, while a negative value indicates EMV threat or threats that could harm the company. EMV is calculated by multiplying the probability of each risk value multiplied by the possibility of money being spent when the risk occurs [2].

In this method has several stages, stages in this analysis includes risk identification and calculation methods Expected Monetary value.

EMV = Probailitas * Konsekuensi

Rumus 1 EMV

where :
EMV : Expected Monetary Value
Probability : The frequency of occurrence of risk
Consequence : Cost or other compensation which must be removed

Here are the results perhitungan of EMV formulas in Table 12.

Table 12 Calculations EMV

Kode Risiko	Tingkat Risiko	Probabilitas (%)	Konsekuensi (Rp)	EMV (Rp)
R1	Tinggi	80	-5.000.000	-4.000.000
R2	Tinggi	70	-4.000.000	-2.800.000
R3	Tinggi	75	-4.500.000	-3.375.000
R4	Sedang	55	-3.000.000	-1.650.000
R5	Sedang	40	-2.000.000	-800.000
R6	Sedang	35	-1.500.000	-525.000
R7	Sedang	31	-3.000.000	-930.000
R8	Sedang	50	-3.000.000	-1.500.000
R9	Rendah	15	-1.000.000	-150.000
R10	Rendah	20	-1.000.000	-200.000
Jumlah			-28.500.000	-16.330.000

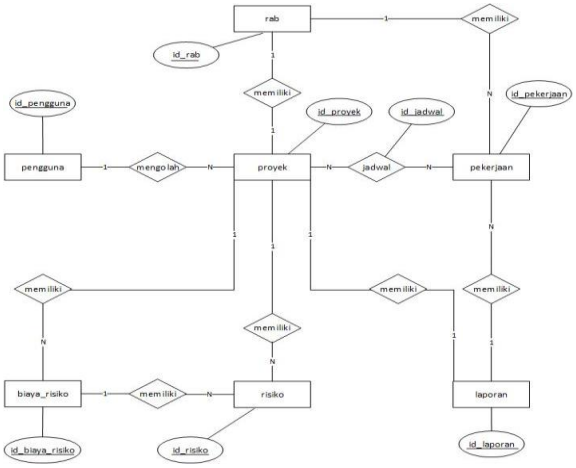
Based on the calculation in table 12. the results of the risk analysis used in the evaluation phase and also we can know how many losses that might occur if the risk occurs.

2.2.5 Evaluation

From the results of the risk assessment of importance that has been done before at this stage of qualitative risk analysis and determination of the cost of risk conducted on a quantitative risk analysis stage will be used as reference for the evaluation phase. Evaluation stage here is the result of the recommendation for the planning to be done kedepanya.

2.3 Analysis Database

Analysis of the database is the analysis stage to describe the desired system in the form of relations between the entities involved in project risk management information system in CV. ARTHA JAYA.



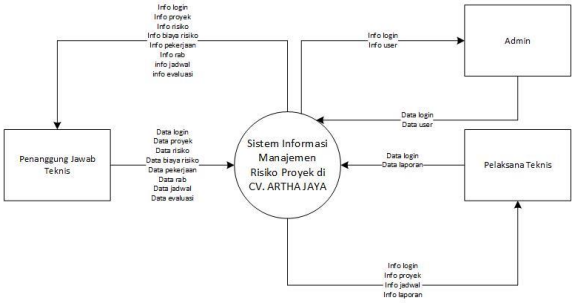
Picture 2 Entity Relational Diagram

Table 1 Description Attributes Entities In ERD

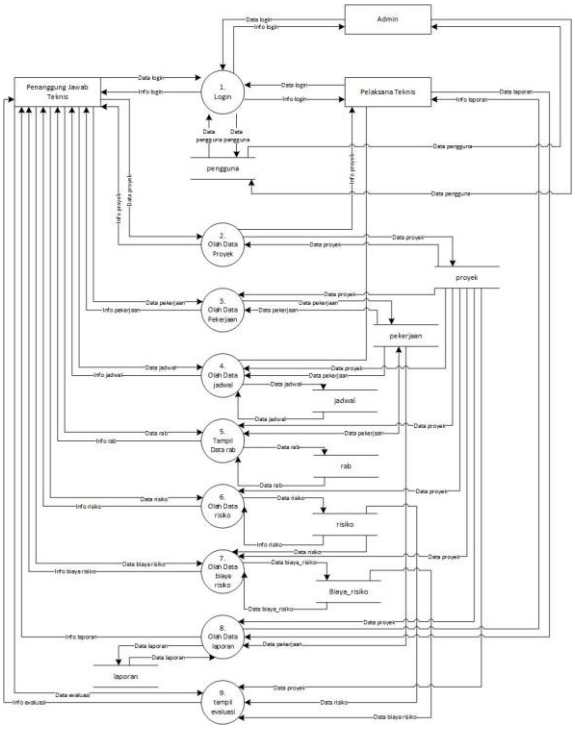
No.	name of Entity	Attribute
1	user	{Id_pengguna, username, name, password, occupation, level}
2	project	{id_proyek, Pemilik_proyek, nama_kontrak, no_kontrak, start_date, end_date, nilai_kontrak, duration, status}
3	work	{id_pekerjaan, Nama_pekerjaan, volume, units, harga_satuan}
4	rab	{id_rab, total price}
5	schedule	{Id_jadwal, tgl_mulai_jadwal, tgl_selesai_jadwal, durasi_jadwal}
6	risk	{id_risiko, Kode_risiko, nama_risiko, level, nilai_dampak, nilai_kemungkinan, level, Konse, response, mitigation}
7	biaya_risiko	{Id_biaya_risiko, probability, the consequences}
8	report	{id_laporan, Weeks, kendala_laporan, penanganan_laporan, biaya_pengeluaran}

2.4 Functional Needs Analysis

Analysis of functional requirements describe the process of the activities to be implemented in the system and explain the necessary requirements for the system to run smoothly and according to need.



Picture 3 diagram Context



Picture 4 DFD Level 1

2.5 System planning

Design System is the depiction, planning, and making a sketch or arrangement of several separate systems into a cohesive whole. This stage includes configuring the software components and hardware of a system.

Picture 5 Relation scheme

2.6 Examination

Testing of the system with a blackbox method performed on functionality in the system to determine whether the function is in conformity with what is expected.

2.6.1 Blackbox Testing

Testing of the system with a blackbox method performed on functionality in the system to determine whether the function is in conformity with what is expected.

2.6.2 Beta Testing

Beta testing is testing conducted objectively where testing is done directly to the field is an agency concerned about user satisfaction with the content of the points is fulfillment of the original purpose of construction of the Project Risk Management Information System at CV. ARTHA JAYA as well as the user interface of the system. Beta testing is done through a data retrieval technique, namely through interviews. Interviews were conducted in beta testing in accordance with existing access rights on the system. Interviews were conducted against Mr. Ujang Jaenudin as Responsible Technical, Mr. Ajad Sudrajat as Executor, as well as the Heryandi Hendra Admin on project risk management information system in CV. ARTHA JAYA.

3 CLOSING

Results of research conducted, we can conclude that the system is built already help section Responsible Technical manage project risk and can give an idea costs to set up to manage the risks involved in future projects.

In this study, there are suggestions that can be done to add things - things that can complement information systems project risk management going forward. As follows:

1. Risk management information system project which can be added features to manage the workforce so it can help Responsible Technical manage labor at the time of the addition of labor resulting from the workforce who are sick and have accidents during the project or help when determining how much labor required to do overtime.

BIBLIOGRAPHY

[1] Sufa'atin , "Implementasi Probability Impact Matriks (PIM) Untuk Mengidentifikasi Kemungkinan dan Dampak Risiko Proyek," *ULTIMA InfoSys*, vol. VIII, no. 1, pp. 43-47, 2017.

[2] Project Management Institute, *A GUIDE TO THE PROJECT MANAGEMENT BODY OF KNOWLEDGE (PMBOK Guide) – Fifth Edition*, 2013.

[3] Widianti, U. D., T. Harihayati, and S. Sufaatin. "Risk project management analysis." *IOP Conference Series: Materials Science and Engineering*. Vol. 407. No. 1. IOP Publishing, 2018.