APPLICATION OF THE FAILURE MODE AND EFFECTS METHOD ANALYSIS IN MANAGEMENT INFORMATION SYSTEM PROJECT RISK AT PT. SAMSON JAYA UTAMA

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ABSTRACT

PT. SAMSON JAYA UTAMA is a company engaged in the material block and installation services. The company was founded in 1986, has handled the demand for material blocks and various installation projects in the Bandung area, especially those from Government Agencies and Non-Agencies. This company has a problem in identifying project risks so that the Technical Responsibility has difficulty in determining the level of risk importance and determining the estimated risk costs needed to anticipate risks that arise. The solution to the problem of risk identification uses the Failure Mode End Effects Analysis (FMEA) method to determine the importance of the risk and the Exfected Monetary Analysis (EMV) method to determine the estimated cost of risk. Based on the problems above, a project risk management information system is needed at PT. SAMSON JAYA UTAMA to assist the Technical Responsibility in determining the level of importance of risk and determining the estimated cost of risk. Based on the results of research and testing conducted on the project's risk management system, it can assist the Technical Responsibility Section in identifying project risks and can provide an overview of the estimated risk costs that need to be prepared to manage any risks that arise during project execution. This system also has evaluation results which will later be used as recommendations for risk management in future projects.

Keywords : Project Risk Management, Information Systems, Risk Management, Failure Mode and Effects Analysis, Expected Monetary Value.

1. INTRODUCTION

PT. Samson Jaya Utama is one of the companies engaged in the distribution of block materials and installation services that were pioneered since 1986. This company used to run paving block installation projects originating from Government Agencies and Non-Agencies.

Based on the results of an interview with Mr. Dede J. Sambong as the technical responsible person, stated his difficulty in determining the level of importance of risk. As in the paving block installation project at the Rajasanagara Cinunuk Block A, C, D project on the 6th day, on that day there was material damage and labor accidents. The technical responsible person handles the risk based on which risk is reported first, so the technical person is not aware of the impact of the risk, large or small for the project.

In the paving block installation project at Rajasanagara Cinunuk Block A, C, D, there were some problems, namely Bad weather which did not support the work in accordance with the Project Daily Work Report data on the 6th and 20th days so that there was a mismatch between the weights a target with a weighted realization that causes a swelling of Rp. 1,600,000 due to the holding of overtime for workers on that day so that the project can be completed on time specified. Based on data from the Budget Plan (RAB), showing the total budget of the planned project cost of Rp. 513,211,240 but due to constraints so that the total cost of project expenditures increased to Rp. 514,811,240. If there is a total increase in costs incurred from the planned costs, the company carries out risk control using company cash. The addition of a project cost budget that uses company cash can cause losses to the company and therefore the person in charge has difficulty determining the estimated risk costs that arise.

Based on the description of the problems above, a solution is needed to overcome the problems at PT. Samson Jaya Utama, by creating a system that can help the technical responsible in knowing and assessing the level of risk and knowing the priority of risks that need to be mitigated and reduce or even avoid additional costs that could potentially harm the company by using the Failure Modes and Effect Analysis (FMEA) method). The system to be built must be accessible wherever the user is. Therefore a web-based information system will be built for project risk management which is expected to help problems in the PT. Samson Jaya Utama.

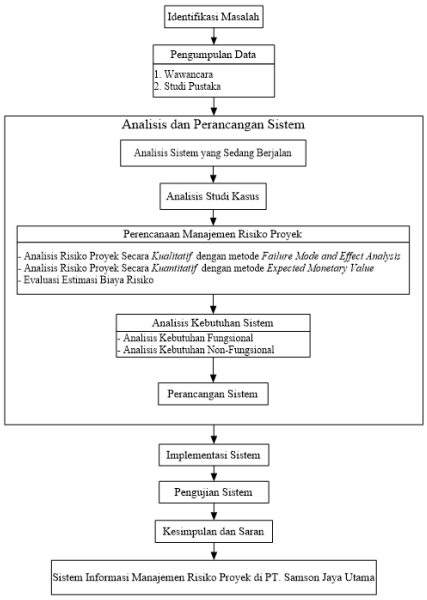
Information systems are a number of components (human, computer, information technology, and work procedures), something is processed (data becomes information), and is intended to achieve a

goal or goal [1]. PHP stands for Hypertext Preprocessor which is used to build a dynamic website [6].

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

The project is a means to fulfill a demand to create a specific product [5]. Project management is the application of science, expertise and skills to achieve predetermined goals and objectives [3]. The analysis of project risk management planning contains an analysis including qualitative risk analysis using Failure Modes and Effects Analysis (FMEA), and quantitative risk analysis using Expected Monetary Value.

2.2.1 Qualitative risk analysis using the Failure Mode and Effects Analysis (FMEA) method.

Qualitative risk analysis using the Failure Modes and Effects Analysis method serves to identify and determine the importance of the risks that may occur in the project [4]. Risk analysis and identification activities are used as a basis for making decisions if a risk occurs by looking at the level of importance of the risk [10].

1. Risk Identification

The risk identification process is carried out to find out and list risks that have occurred in the project or that might occur in the project.

Table 1 Risk Identification

No	Job Name	Risk Code	Obstacles
1	Pekerjaan Land leveling	R1	Bad weather
		R2	Material prices have suddenly risen
		R3	Unforeseen soil conditions
		R4	Material delivery delays
		R5	Material damage
		R6	Damage to project tools
		R7	Material loss
		R8	Labor unable to attend due to illness
		R9	Labor accident
2	Land Compaction Work with Horse Stamper	R1	Bad weather
		R2	Material prices have suddenly risen
		R3	Unforeseen soil conditions
		R4	Material delivery delays
		R5	Material damage
		R6	Damage to project tools
		R7	Material loss
		R8	Labor unable to attend due to illness
		R9	Labor accident
3	Reasoning Paving Work with Abu Batu	R1	Bad weather
		R2	Material prices have suddenly risen
		R3	Unforeseen soil conditions
		R4	Material delivery delays
		R5	Material damage
		R6	Damage to project tools
		R7	Material loss
		R8	Labor unable to attend due to illness
		R9	Labor accident
4	Paving Block Installation Work	R1	Bad weather
		R2	Material prices have suddenly risen
		R3	Unforeseen soil conditions
		R4	Material delivery delays
		R5	Material damage
		R6	Damage to project tools
		R7	Material loss
		R8	Labor unable to attend due to illness
		R9	Labor accident
5	Cor Filler Work	R1	Bad weather
		R2	Material prices have suddenly risen
		R3	Unforeseen soil conditions
		R4	Material delivery delays
		R5	Material damage
		R6	Damage to project tools
		R7	Material loss
		R8	Labor unable to attend due to illness
		R9	Labor accident
6	Paving Block Leveling Work with Baby Roller	R1	Bad weather
		R2	Material prices have suddenly risen
		R3	Unforeseen soil conditions
		R4	Material delivery delays
		R5	Material damage
		R6	Damage to project tools
		R7	Material loss
		R8	Labor unable to attend due to illness
		R9	Labor accident

2. Menetukan Nilai Keparahan, Kejadian, dan Deteksi.

After getting a list of risks obtained from the risk identification process, the risk list is assessed based on Severity, Occurence, and Detection with

parameters that can be seen in Table 2, Table 3, and Table 4 [8].

Table 2 Level Severity

Effect	Criteria: Effect Severity	Ranking
Dangerous (Without Warning)	Work cannot be carried out with damage affecting the tool system but without warning	10
Dangerous (With Warning)	Work cannot be carried out with damage affecting the tool system but there is still a warning	9
Very High	The work could not be carried out because the damage was very severe	8
High	The work could not be carried out because of considerable damage to the equipment	7
Medium	The work could not be carried out because of a little damage	6
Low	Work cannot be carried out normally with or without damage	5
Very Low	The work can be carried out but there is a significant decrease in performance	4
Small	The work can continue to be carried out but there is a decrease in tool performance	3
Very Small	The work continued, only a little disruption	2
Nothing	There is no effect	1

Table 3 Level Occurrence

Effect	Criteria: Rate of Occurrence	Probability	Ranking
Almost always	Risks always occur	> 9	10
Very high	The risk that occurs is very high	> 8 – 9	9
High	The risk is high	> 7 – 8	8
Rather High	The risk that occurs is rather high	> 6 – 7	7
Medium	Risks that occur at a moderate level	> 5 – 6	6
Low	Risks that occur at low levels	> 4 – 5	5
Small	The risks are minimal	> 3 – 4	4
Very Small	The risk is very little	> 2 – 3	3
Almost Never	Risk rarely occurs	> 1 – 2	2
Never	Risk never happens	0 – 1	1

Table 4 Level Detection

Detection	Criteria: Probability of Detection	Ranking
Not Sure	Could not be detected	10
Very Small	Difficult to detect	9
Small	Relatively difficult to detect	8
Very Low	Very rarely detected	7
Low	Relatively rarely detected	6
Medium	Quite easily detected	5
High Enough	Can be detected	4
High	Easily detected	3
Very High	Difficult to detect	2
Almost certainly	Definitely detected	1

The following are Severity, Occurence, and Detection values, one of which is the paving block installation work that has been identified based on the results of interviews with the Technical Responsibility at PT. SAMSON JAYA UTAMA can be seen in Table 5.

Table 5 Level Severity, Occurence, Detection

Code Risk	Risk	Severity	Occurence	Detection
Paving Block Installation Work				
R1	Bad weather	5	7	5
R2	Material prices have suddenly risen	3	6	4
R3	Unforeseen soil conditions	2	4	4
R4	Material delivery delays	3	3	4
R5	Material damage	3	3	3
R6	Damage to project tools	4	3	4
R7	Material loss	4	4	6
R8	Paving installation error	3	4	3
R9	Labor accident	3	3	6

After getting the Severity, Occurence, and Detection values, the risk priority number (RPN) is calculated by multiplying the Severity, Occurence, and Detection values.

RPN = Severity x Occurence x Detection

RPN = value of the priority level of risk
Severity = value of Severity
Occurence = value of Occorence
Detection = value of Detection

The following is a Table of the results of RPN calculations on mobilization & demobilization work using the Failure Mode and Effects Analysis method in Table 6.

Table 6 RPN Calculation Results

Code Risk	Risk	Severity	Occurence	Detection	RPN
Paving Block Installation Work					
R1	Bad weather	5	7	5	175

R2	Material prices have suddenly risen	3	6	4	72
R3	Unforeseen soil conditions	2	4	4	32
R4	Material delivery delays	3	3	4	36
R5	Material damage	3	3	3	27
R6	Damage to project tools	4	3	4	48
R7	Material loss	4	4	6	96
R8	Paving installation error	3	4	3	36
R9	Labor accident	3	3	6	54

3. Determining the Crisis Value

After getting an RPN value of each risk in the job, the critical value is then calculated. Critical value is used to determine the risk included in the high or low category. Risks are included in the high category if the RPN value is greater than the critical value (RPN value kritis critical value). If the RPN value is smaller than the critical value, the risk is included in the low category. Critical values can be calculated by formula:

$$nilai\ kritis = \frac{total\ RPN}{jumlah\ daftar\ risiko}$$

Then obtained a critical value in the installation of paving block projects in Rajasanagara Cinunuk Block A, C, D projects for the installation of paving blocks.

$$nilai\ kritis = \frac{175 + 72 + 32 + 36 + 27 + 48 + 96 + 36 + 54}{9}$$

= 64

Obtaining the critical value for paving block installation jobs is 64 which means that if the RPN value at each risk is above 64 or equal to 64, then it is at high risk. The risk categories can be seen in Table 7

Table 7 Risk Category

Code Risk	Risk	RPN (Risk Priority Number)	Categori
Paving Block Installation Work			
R1	Bad weather	175	High
R2	Material prices have suddenly risen	72	High
R3	Unforeseen soil conditions	32	Low
R4	Material delivery delays	36	Low
R5	Material damage	27	Low
R6	Damage to project tools	48	Low
R7	Material loss	96	High
R8	Paving installation error	36	Low
R9	Labor accident	54	Low

From the risk category data obtained, the Technical Responsibility can find out which risks must be addressed as soon as possible on the job.

4. Handling Risk

From the results of a series of risk analyzes that have been carried out then used as a reference for risk mitigation. The risk management actions are obtained from the results of coordination with the Technical Responsibility at PT. SAMSON JAYA UTAMA. The handling actions for each risk can be seen in Table 8.

Table 8 Handling Risk

Code Risk	Risk	RPN	Categori	
Paving Block Installation Work				
R1	Bad weather	175	High	Adding hours of work (overtime), labor.
R2	Material prices have suddenly risen	72	High	Entered into an agreement with the supplier regarding the price of materials.
R3	Unforeseen soil conditions	32	Low	Conduct proper soil research.
R4	Material delivery delays	36	Low	Communicating with suppliers of materials.
R5	Material damage	27	Low	Store material in a better place.
R6	Damage to project tools	48	Low	Immediately replace damaged equipment so as not to impede work and increase supervision and work responsibilities.
R7	Material loss	96	High	Increased supervision of the material is carried out.
R8	Paving installation error	36	Low	Replacing with other workers
R9	Labor accident	54	Low	Give direction to the workforce to prioritize safety.

Based on the results of a risk analysis using FMEA, the results of the risk analysis are used to assist the Technical Responsibility in identifying the risks that might occur, so that if the risk occurs can be handled quickly based on the level of importance of the risk that can be seen from the risk priority value (RPN) at most High and predetermined risk management measures.

2.2.2 Quantitative risk analysis uses the Expected Monetary Value (EMV) method.

The Expected Monetary Value (EMV) method is used to calculate the cost of a risk if a risk occurs [9]. If the EMV value is positive then it is an opportunity and if the EMV value is negative it means it is a threat that can cause harm to the company. How to get the EMV value is as follows:

EMV = Probability x Consequences

EMV = the amount expected if a risk occurs
Probability = value of probability
Consequences = the value of the impact caused by the risk

Determination of the probability and frequency values obtained from interviews with Mr. Dede J. Sambong as the Technical Responsibility at PT. SAMSON JAYA UTAMA. The probability value is determined based on the results of an interview with the Project Manager for events on the ground and consequences based on the company's financial condition and the value of the project budget. EMV calculation results can be seen in Table 9.

Table 9 EMV Calculation Results

Code Risk	Risk	Probability (%)	Consequences (Rp)	EMV (Rp)
R1	Bad weather	70	-1.500.000	-1.050.000
R2	Kenaikan harga bahan material	50	-2.500.000	-1.250.000
R4	Material delivery delays	30	-500.000	-150.000
R5	Material damage	20	-500.000	-100.000
R6	Damage to project tools	20	-1.000.000	-200.000
R9	Labor accident	30	-1.000.000	-300.000
Total (Rp)				-3.050.000

Based on the results from the table above, a total EMV value of Rp. -3,050,000. The minus value shows the threat of loss to the company in terms of cost. This value will be used to evaluate the estimated risk costs.

2.2.3 Evaluation of estimated risk costs

Evaluation of risk cost estimation is the stage of comparing current project data and case study data, each of which contains a project budget plan, additional costs, estimated risk costs in Table 9, and the total project realization costs. His case study on the paving block installation project at the Rajunegara Cinunuk Block A, C, D project with a total planned cost budget of Rp. 513,211,240 but in the implementation there was a swelling of Rp. 1,600,000 due to additional costs, namely accidents and the existence of overtime, so the total project realization costs are Rp. 514,811,240. the data will be compared with case study data for which the total project cost has been added to the estimated risk cost that has been analyzed using the EMV method in Table 9 of Rp. 3,050,000. The following is an evaluation table of estimated risk costs, which can be seen in Table 10.

Table 10 Evaluation of Estimated Risk Costs

Cost description	Current data (Rp)	Case Study (Rp)
Budget plan	513.211.240,00	513.211.240,00
Additional cost	1.600.000,00	-
Estimated Risk Costs	-	3.050.000,00
Total Project Realization Costs	514.811.240,00	516.261.240,00

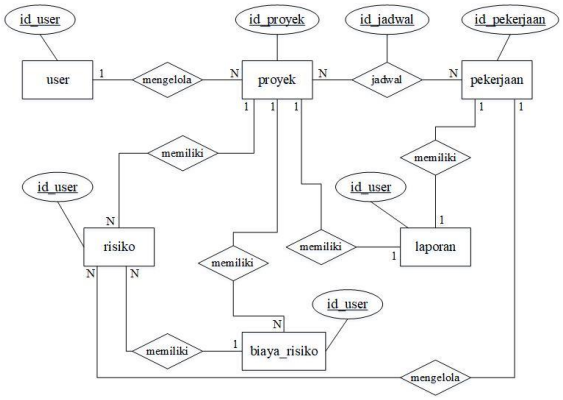
Based on the evaluation table above there is a comparison of current project cost data and case studies, where the total current project cost is Rp. 514,811,240 while the total cost for the case study is Rp. 516,261,240, it can be concluded if the project cost budget plan is added the estimated risk cost is able to anticipate swelling because the total project cost for the case study is able to anticipate cost overruns and even gets the remaining project costs of Rp. 1,450,000 obtained from the total project costs in the case study reduced by the current total project realization, if the evaluation of the estimated risk costs is used as a reference when planning future projects, it may be able to anticipate additional costs caused by risks that arise in project implementation.

2.3 User Analysis

User analysis is the user who will use the system. There are two user access rights, namely:
1. Technical Person in Charge: Manage risk management, view project evaluation data, view and manage work data, manage schedule data, and view realization data.
2. Technical Implementer: View project data, manage daily reports, see evaluation data.

2.4 Database Analysis

Database analysis uses Entity Relationship Diagrams (ERD). Describe relations between databases [7].



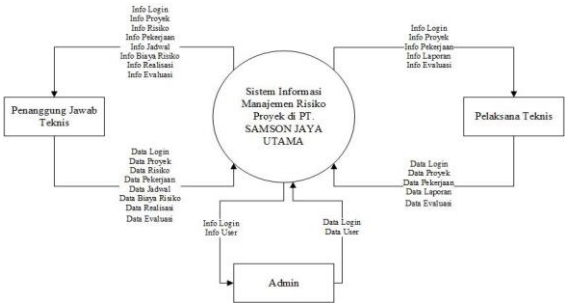
Picture 2. ERD

Table 11 Explanation ERD

No	Entity Name	Attribute
1	user	id_user, username, password, jabatan
2	proyek	id_proyek, nama_proyek, pemilik_proyek, no_perjanjian_kontrak, nilai_kontrak, tanggal_mulai, tanggal_selesai, durasi, status
3	pekerjaan	id_pekerjaan, nama_pekerjaan, volume, satuan, harga_satuan, ket
4	risiko	id_risiko, nama_risiko, nilai_keparahan, keparahan, nilai_kejadian, kejadian, nilai_deteksi, deteksi, rpn, mitigasi
5	biaya_risiko	id_biaya_risiko, nama_risiko, probabilitas, konsekuensi, emv
6	jadwal	id_jadwal, tgl_mulai_jadwal, tgl_selesai_jadwal, durasi_jadwal, ket_jadwal
7	laporan	id_laporan, minggu, kendala_laporan, penanganan_laporan, pengeluaran_laporan, ket_laporan

2.5 Context Diagram

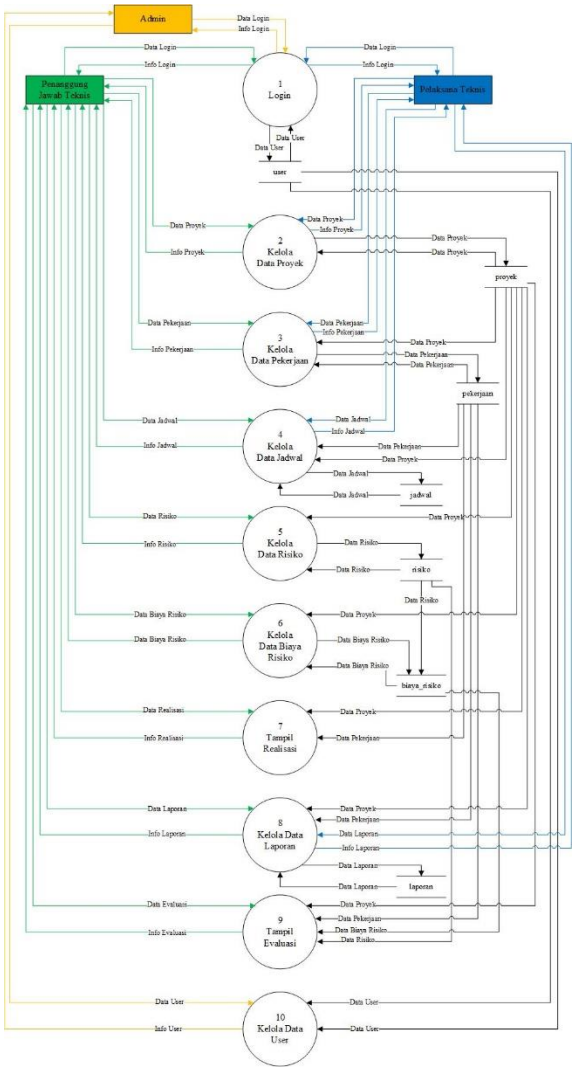
Context diagram illustrates the flow of data on the system.



Picture3. Context diagram

2.6 Data Flow Diagram

DFD is a tool to show the flow of processes in a system. DFD consists of data stores, processes, data flow, and entities [2].



Picture 4. DFD

2.7 Testing

Testing is the process of evaluating the system to find faults and deficiencies in the system being tested [11].

2.7.1 Blackbox Testing

Based on the results of black box testing that has been done on the Project Risk Management Information System at PT. SAMSON JAYA

UTAMA, it can be concluded that the application that was built has been tested by the system to produce output that is as expected. The form of error display is easy enough to understand in giving direction to the user to enter the correct data. This system has produced the expected output.

2.7.2 Beta Testing

Based on the answers from the results of interviews with the Technical Responsible, Technical Implementers and Administrators at PT. SAMSON JAYA UTAMA, the system can assist the Technical Responsible Agency because the system makes it easy to determine the importance of risk, makes it easy to calculate risk costs, the evaluation feature can find out the results of the comparison if the estimated risk costs are applied as recommendations when planning future project costs, know the name risk, the priority value of risk, and the cost of each risk, the system can help the Technical Implementer because he can know the list of existing projects, work on each project, schedule of each job, can manage project reports, and the system can help administrators manage user data.

3. CLOSING

Based on the results of research and testing conducted on the Project Risk Management Information System at PT. SAMSON JAYA UTAMA, the following conclusions can be obtained, namely: The system built can assist the Technical Responsibility in determining the level of importance of risk by determining the priority value of risks that arise so that it can be easily handled which risks are handled first based on the level of importance of the risk and there are evaluation results that will later be used as recommendations for managing risks in subsequent projects and this system can assist the Technical Responsible Agency in determining the estimated risk costs needed if risks occur. so the company can allocate costs for the risks that occur when the project takes place later.

The suggestion of this research is, in the next research it is expected to be able to add project planning features so that the output of the evaluation in this study can be implemented by the system and added features to manage the workforce so that it can assist the Technical Responsible in managing the workforce when adding the workforce. caused by workers who are sick and have an accident when working on the project or help when determining how many workers are needed to do additional work hours.

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