INFORMATION SYSTEM OF PROJECT RISK MANAGEMENT IN PT. ANANTAGRAHA PRIMAPERKASA

Michael Agustian[1], Gentisya Tri Mardiani[2]

[1,2]Informatic Engineering – Indonesia Computer University
Dipatiukur Street 114-116 Bandung 40132
E-mail : michaelagustian9@gmail.com[1], gentisya.tri.mardiani@email.unikom.ac.id[2]

ABSTRACT

The car showroom is where the car is-Showroom cars are where cars are on display in an effort to increase marketing. PT. Anantagraha Primaperkasa is a company engaged in the field of construction services that have been working on a variety of tender projects one of which is a car showroom. The construction of a car showroom certainly has an uncertain risk and an approach is needed in anticipating risk by conducting risk management. Also needed risk analysis on the construction of a car showroom in order to know the category of risk.

This study aims to conduct project risk management. The method of approach used in project risk management is Failure Mode Effect Analysis (FMEA) which is qualitative. Starting from identifying risk factors, analyzing risk factors by assessing the impact (severity), occurrence, and detection so as to generate a risk priority value (Risk Priority Number) that will be compared with the value critical to know the categories of risk factors, and to plan the handling of these risk factors.

Project risk management can assist Project managers in identifying, analyzing, and handling risks that may arise in mitigating efforts. Physical project work requires not only qualitative, but quantitative approaches to be able to calculate the likelihood of losses incurred by risk factors so that projection can be more pronounced.

Keywords : Failure Mode Effect Analysis, project risk management, car showroom

1. PRELIMINARY

PT. Anantagraha Primaperkasa is a company engaged in construction services. Until now, PT. Anantagraha Primaperkasa has been working on various tender projects such as factories, showrooms, hospitals, apartments, hotels, commercial buildings, and schools.

Based on the interview with Mr. Agus Permana as the project manager of PT. Anantagraha Primaperkasa, currently he has difficulty in minimizing the problems that occur during the execution of project work. This is because he did not know how big the priority of problems encountered, so in handling the problem he was difficult in determining which problems should be done first handling. In addition, he also did not make any predictions about any problems that may arise in the implementation of project work when planning the project, so that on handling the problem was done without prior planning.

From the information it can be seen that the Project Manager requires risk identification to be able to know the risks that may arise in the implementation of project work, then analyzed the risks to differentiate low risk and high risk so that Project Manager can know the priority of risk that needs to be handled first and planning risk handling to reduce and even avoid losses.

Based on the problem, project risk management can be used as a solution to the problem by building a project risk management information system at PT. Anantagraha Primaperkasa that implements Failure Mode and Effect Analysis method. The project risk management information system built is expected to assist the project manager in performing project risk management.

The objective is to assist the project manager in analyzing possible risks and to assist the project manager to plan for possible risk mitigation in mitigating efforts.

1.1 Research Methodology

The research method used in this research is descriptive method, that is research method which aim to make description, description from facts and information in situation which done in research systematically, factual, and accurate. The flow of research methods that will be carried out in the construction of Risk Management Information System Project at PT. Anantagraha Primaperkasa can be seen in Figure 1.

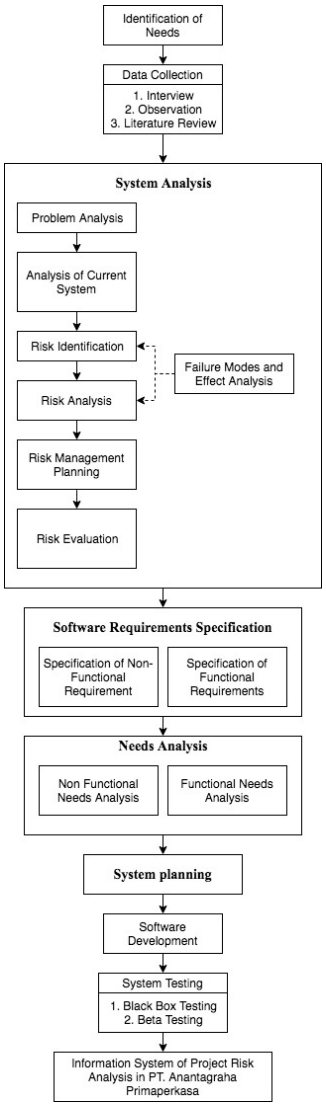


Figure 1 Research Methodology

1.2 Project Risk Management

Steps in project risk management include risk management planning, risk identification, risk analysis, risk management planning, and risk control. Project risk management aims to increase the likelihood of positive events and reduce the likelihood of negative events in the project [1]. Risk management planning is the process of how to conduct risk management activities for a project. Risk identification is the process of determining the risks that can affect a project and documenting its characteristics. Qualitative risk analysis is the process of defining risk priorities for immediate action by assessing the impact and likelihood of occurrence. Quantitative risk analysis is a process of numerically analyzing the effect of identified risks to a project. Risk management planning is the process of developing action options to reduce threats to project objectives. Risk control is the process of implementing risk management planning, tracking identified risks, monitoring residual risk, identifying new risks, and evaluating the effectiveness of risk processes throughout the project.

1.3 Failure Mode and Effect Analysis (FMEA)

Failure Mode and Effect Analysis (FMEA) is a technique used to define, identify, and eliminate known, potential problems, errors, etc. from the system, design, process or service before reaching the customer [2].

FMEA is a systematic methodology that is intended to perform the following activities:

1. Identify and recognize potential failures including their causes and effects.
2. Evaluate and prioritize identified failures.
3. Identify and suggest actions that can eliminate or reduce the likelihood of potential failure.

Identifying known and potential failures is an important task in FMEA. Using the data and knowledge of the process or product, any potential failures and effects are assessed for each of the following three factors:

1. Severity: the consequences of failure when it occurs.
2. Occurrence (Occurence): the probability or frequency of failure that occurs.
3. Detection (Detection): the probability of failure is detected before the impact is realized.

1.3.1 Determining the Value in FMEA Process

Assigning severity, occurrence, and detection is usually done on a scale of 1-10 described in Table 1, Table 2, and Table 3.

Table 1 Severity

Efek	Kriteria: Tingkat Keparahan Efek	Peringkat
Berbahaya (Tanpa Peringatan)	Tingkat keparahan yang sangat tinggi bila mode kegagalan potensial mempengaruhi operasi yang aman dan / atau melibatkan ketidakpatuhan terhadap peraturan tanpa peringatan	10
Berbahaya (Dengan Peringatan)	Tingkat keparahan yang sangat tinggi bila mode kegagalan potensial mempengaruhi operasi yang aman dan / atau melibatkan ketidakpatuhan terhadap peraturan yang memperingatkan	9

Efek	Kriteria: Tingkat Keparahan Efek	Peringkat
Sangat Tinggi	Produk / item tidak bisa dioperasi, dengan kehilangan fungsi primer	8
Tinggi	Produk / barang bisa dioperasikan, namun pada tingkat kinerja yang rendah. Pelanggan tidak puas	7
Sedang	Produk / barang dapat dioperasikan, namun dapat menyebabkan pengerjaan ulang / perbaikan dan / atau kerusakan pada peralatan	6
Rendah	Produk / item dapat dioperasikan, namun dapat menyebabkan sedikit ketidaknyamanan pada operasi terkait	5
Sangat Rendah	Produk / item dapat dioperasikan, namun memiliki beberapa cacat (estetika dan sebaliknya) yang terlihat pada kebanyakan pelanggan	4
Kecil	Produk / item dapat dioperasikan, namun mungkin memiliki beberapa cacat yang terlihat oleh pelanggan yang diskriminatif	3
Sangat Kecil	Produk / barang bisa dioperasikan, namun tidak sesuai dengan kebijakan perusahaan	2
Tidak Ada	Tidak ada efek	1

Table 2 Occurrence

Kemungkinan Kegagalan	Kemungkinan åTingkat Kejadian	Peringkat
Sangat Tinggi: kegagalan hampir tak terhindarkan	≥ 1 dalam 2 kejadian	10
	1 dalam 3 kejadian	9
Tinggi: kegagalan berulang	1 dalam 8 kejadian	8
	1 dalam 20 kejadian	7
Sedang: kegagalan sesekali	1 dalam 80 kejadian	6
	1 dalam 400 kejadian	5
	1 dalam 2000 kejadian	4
Rendah: kegagalan relatif sedikit	1 dalam 15000 kejadian	3
	1 dalam 150000 kejadian	2
Sangat Rendah: kegagalan sepertinya tidak mungkin terjadi	≤ 1 dari 1500000 kejadian	1

Table 3 Detection

Deteksi	Kriteria: Kemungkinan Pendeteksian Oleh Kontrol Desain	Peringkat
Mutlak Tidak Pasti	Kontrol desain tidak akan dan / atau tidak dapat mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya; atau tidak ada kontrol desain	10
Sangat Jauh	Kemungkinan sangat jauh kontrol desain akan mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya	9
Jauh	Kemungkinan jauh kontrol desain akan mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya	8
Sangat Rendah	Kemungkinan sangat rendah kontrol desain akan mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya	7
Rendah	Kemungkinan rendah kontrol desain akan mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya	6
Sedang	Kemungkinan sedang kontrol desain akan mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya	5
Cukup Tinggi	Kemungkinan cukup tinggi kontrol desain akan mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya	4
Tinggi	Kemungkinan tinggi kontrol desain akan mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya	3
Sangat Tinggi	Kemungkinan sangat tinggi kontrol desain akan mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya	2
Hampir Pasti	Kontrol desain hampir pasti akan mendeteksi sebab / mekanisme potensial dan mode kegagalan berikutnya	1

To reflect the priority of the detected failure is sought the value of Risk Priority Number (RPN). RPN is calculated by multiplying the severity, occurrence, and detection values.

$$RPN = S \times O \times D \quad (1)$$

Where S is the severity, O is the probability of occurrence, and D is the detection level. To set the risk category sought for critical value [3]. The critical value is calculated by dividing the total RPN value by the number of risk lists. High risk categories are risks that have a RPN value greater than or equal to the critical value (RPN value ≥ critical value).

$$critical\ value = \frac{total\ RPN}{number\ of\ risk\ lists} \quad (2)$$

2. CONTENT OF STUDY

2.1 Project Risk Management Analysis

Project risk management is indispensable in the implementation of project activities to identify risks that may arise during the project so that risks can be mitigated or even avoided, thus reducing the losses suffered. The steps to identify risks and their analysis using the Failure Modes and Effects Analysis (FMEA) method can be seen in Figure 2.

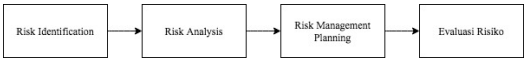


Figure 2 Project Risk Management Flow Chart

2.1.1 Risk Identification

Risk identification is a process for determining the risks that may affect a project. The risk identification process is conducted by interviewing the Project Manager to list the risks associated with the Mitsubishi Medan showroom building project using the previous project case study, the Mazda showroom building project on Jalan Suryopranoto, Jakarta and the Porsche Center Jakarta showroom building project. The results of risk identification are then grouped by type as seen in Table 4.

Table 4 Risk Identification

Kode Risiko	Jenis Risiko	Deskripsi Risiko
R1	Perencanaan	Perubahan desain
R2		Gambar desain lama
R3	Keuangan	Pembayaran macet dari *owner*
R4		Pengeluaran biaya kompensasi untuk lingkungan
R5		Harga material naik mendadak
R6	Personal	Kualitas pekerjaan kurang baik
R7		Pekerja berhalangan hadir
R8	Keselamatan Kerja	Pekerja tertimpa material
R9		Pekerja celaka karena alat kerja
R10	Alat Penunjang Konstruksi dan Material	Tipe material diubah
R11		Material yang dikirim salah
R12		Alat kerja rusak
R13		Pengiriman material terlambat
R14	Eksternal	Penambahan pekerjaan
R15		Bangunan proyek disegel
R16		Pengerjaan ulang (faktor cuaca)

2.1.2 Risk Analysis

Risk analysis is a process for defining emerging risk categories. The risk analysis process is carried out by means of discussion with the Project Manager. Performed assessment based on consideration of Project Manager against the risks that occurred in the previous project, the building projectroom Mazda at Suryopranoto Street, Jakarta and Porsche Center Jakarta showroom building project. Then all the values are documented, for the same risk is taken the average value. The analysis process begins with analyzing the effects of the risk, then scored with a scale of 1-10 for severity with assessment parameters based on Table 1. The results of the risk-effect analysis can be seen in Table 5.

Table 5 Analysis of Risk Effects

Risiko	Efek	S
Perubahan desain	Menunggu gambar desain baru	6
	Pekerjaan utama terganggu	
Gambar desain lama	Pekerjaan selanjutnya tertunda	7
Pembayaran macet dari *owner*	Biaya operasional membengkak	10
Pengeluaram biaya kompensasi untuk lingkungan	Biaya lebih tinggi tidak sesuai rencana	2
Harga material naik mendadak	Biaya lebih tinggi tidak sesuai rencana	7
Kualitas pekerjaan kurang baik	Pengerjaan ulang	6
	Pekerjaan selanjutnya tertunda	
Pekerja berhalangan hadir	Pekerjaan kurang maksimal	5
Pekerja tertimpa material	Biata perawatan	2
Pekerja celaka karena alat kerja	Biaya perawatan	2
Tipe material diubah	Harga material bisa lebih mahal	5
Material yang dikirim salah	Pekerjaan selanjutnya tertunda	8
Alat kerja rusak	Pekerjaan kurang maksimal	10
Pengiriman material terlambat	Pekerjaan selanjutnya tertunda	6
Penambahan pekerjaan	Jadwal tidak sesuai rencana	5
Bangunan proyek disegel	Proyek ditunda	9
	Biaya operasional membengkak	
Pengerjaan ulang (faktor cuaca)	Biaya tambahan untuk perbaikan	8
	Pekerjaan selanjutnya tertunda	

The Project Manager then analyzes the causes that cause the risk to arise and assigns a scale of 1-10 for the probability of occurrence with the assessment parameters based on Table 2. The results of the risk-causing analysis can be seen in Table 6.

Table 6 Risk Causes Analysis

Risiko	Penyebab	O
Perubahan desain	Keinginan *owner*	7
Gambar desain lama	Keputusan *owner* berubah-ubah	5
Pembayaran macet dari *owner*	*Owner* tidak membayar angsuran tepat waktu	7
Pengeluaram biaya kompensasi untuk lingkungan	Lingkungan merasa terganggu karena pekerjaan proyek	5
Harga material naik mendadak	Kenaikan harga dolar	2
Kualitas pekerjaan kurang baik	Pekerjaan dilakukan manual tanpa alat saat malam	3
	Pekerja kurang andal	2
Pekerja berhalangan hadir	Pekerja sakit	3
Pekerja tertimpa material	Kelalaian pekerja	5
Pekerja celaka karena alat kerja	Kelalaian pekerja	5
Tipe material diubah	Tipe material yang dipesan kosong	2
	Keinginan *owner*	3
Material yang dikirim salah	Kesalahan distributor	2
Alat kerja rusak	Pekerja kurang tepat menggunakan alat	3
Pengiriman material terlambat	Jadwal produksi tidak sesuai dengan jadwal proyek	3
	Kendaraan pengirim mengalami kecelakaan	3
	Aturan *red line* untuk material impor	2
Penambahan pekerjaan	*Owner* menambah spesifikasi proyek	8
Bangunan proyek disegel	Bangunan tidak sesuai izin	7
Pengerjaan ulang (faktor cuaca)	Kerusakan karena cuaca buruk	3

The Project Manager also analyzes the controls performed to detect the occurrence of the risk and assigns a scale of 1-1 0 for detection with the assessment parameters based on Table 3. The results of the risk control analysis can be seen in Table 7.

Table 7 Risk Control Analysis

Risiko	Kontrol	D
Perubbahan desain	Tidak ada	10
Gambar desain lama	Penjadwalan proyek	1
Pembayaran macet dari *owner*	Pemberitahuan jadwal pembayaran ke *owner*	2
Pengeluaram biaya kompensasi untuk lingkungan	Tidak ada	10
Harga material naik mendadak	Tidak ada	8
Kualitas pekerjaan kurang baik	Pengawasan lapangan	2
Pekerja berhalangan hadir	Absensi pekerja	1
Pekerja tertimpa material	Hasil laporan	8
Pekerja celaka karena alat kerja	Hasil laporan	8
Tipe material diubah	Hasil laporan	6
Material yang dikirim salah	Memberi daftar tipe material yang dibeli	7
Alat kerja rusak	Hasil laporan	6
Pengiriman material terlambat	Hasil laporan	8
Penambahan pekerjaan	Tidak ada	10
Bangunan proyek disegel	Tidak ada	10
Pengerjaan ulang (faktor cuaca)	Tidak ada	8

After the Project Manager performs the analysis and assessment, then each risk is calculated RPN value to know the value of risk priority by using Equation 1. The result of analysis, risk assessment and calculation of RPN value can be seen in Table 8..

Table 8 Risk Analysis and Assessment

Risiko	S	Penyebab	O	D	RPN
Perubahan desain	6	Keinginan *owner*	7	10	420
Gambar desain lama	7	Keputusan *owner* berubah-ubah	5	1	35
Pembayaran macet dari *owner*	10	*Owner* tidak membayar angsuran tepat waktu	7	2	140
Pengeluaran biaya kompensasi untuk lingkungan	2	Lingkungan merasa terganggu karena pekerjaan proyek	5	10	100
Harga material naik mendadak	7	Kenaikan harga dolar	2	8	112
Kualitas pekerjaan kurang baik	6	Pekerjaan dilakukan manual tanpa alat saat malam	3	2	36
		Pekerja kurang andal	2		24
Pekerja berhalangan hadir	5	Pekerja sakit	3	1	15
Pekerja tertimpa material	2	Kelalaian pekerja	5	8	80
Pekerja celaka	2	Kelalaian pekerja	5	8	80

Risiko	S	Penyebab	O	D	RPN
karena alat kerja					
Tipe material diubah	5	Tipe material yang dipesan kosong	2	6	60
		Keinginan *owner*	3		90
Material yang dikirim salah	8	Kesalahan distributor	2	7	112
Alat kerja rusak	10	Pekerja kurang tepat menggunakan alat	3	6	180
Pengiriman material terlambat	6	Jadwal produksi tidak sesuai dengan jadwal proyek	3	8	144
		Kendaraan pengirim mengalami kecelakaan	3		144
		Aturan *red line* untuk material impor	2		96
Penambahan pekerjaan	5	*Owner* menambah spesifikasi proyek	8	10	400
Bangunan proyek disegel	9	Bangunan tidak sesuai izin	7	10	630
Pengerjaan ulang (faktor cuaca)	8	Kerusakan karena cuaca buruk	3	8	192

After the RPN value of each risk is known, then it can be calculated the critical value. Critical values are used to determine what risks fall within the high-risk category. High risk categories are risks that have a RPN value greater than or equal to the critical value (RPN value ≥ critical value). The critical value is calculated using Equation 2.

$$critical\ value = \frac{total\ RPN}{number\ of\ risk\ lists}$$

$$= \frac{3090}{20}$$

$$= 154{,}5$$

$$\approx 155$$

From the calculation, obtained the critical value equal to 155. Then for any risk that has a value of RPN greater than or equal to 155 fall into high risk category. The results of the category risk grouping can be seen in Table 9.

Table 9 Risk Category

Risiko	Penyebab Risiko	RPN	Kategori
Perubahan desain	Keinginan *owner*	420	Tinggi
Gambar desain lama	Keputusan *owner* berubah-ubah	35	Rendah
Pembayaran macet dari *owner*	*Owner* tidak membayar angsuran tepat waktu	140	Rendah
Pengeluaran biaya kompensasi untuk lingkungan	Lingkungan merasa terganggu karena pekerjaan proyek	100	Rendah
Harga material naik mendadak	Kenaikan harga dolar	112	Rendah
Kualitas pekerjaan kurang baik	Pekerjaan dilakukan manual tanpa alat saat malam	36	Rendah
	Pekerja kurang andal	24	Rendah
Pekerja berhalangan hadir	Pekerja sakit	15	Rendah
Pekerja tertimpa material	Kelalaian pekerja	80	Rendah
Pekerja celaka karena alat kerja	Kelalaian pekerja	80	Rendah
Tipe material diubah	Tipe material yang dipesan kosong	60	Rendah
	Keinginan *owner*	90	Rendah
Material yang dikirim salah	Kesalahan distributor	112	Rendah
Alat kerja rusak	Cara penggunaan kurang tepat oleh pekerja	180	Tinggi
Pengiriman material terlambat	Jadwal produksi tidak sesuai dengan jadwal proyek	144	Rendah
	Kendaraan pengirim mengalami kecelakaan	144	Rendah
	Aturan *red line* untuk material impor	96	Rendah
Penambahan pekerjaan	*Owner* menambah spesifikasi proyek	400	Tinggi
Bangunan proyek disegel	Izin bangunan tidak sesuai	630	Tinggi

Risiko	Penyebab Risiko	RPN	Kategori
Pengerjaan ulang (faktor cuaca)	Kerusakan karena cuaca buruk	192	Tinggi

Then the risk is prioritized starting from the risk with the highest RPN value. The greater the RPN value of a risk, the higher the risk. Risk sorting results can be seen in Table 10.

Table 10 Priority Risk

Risiko	Penyebab Risiko	RPN	Kategori
Bangunan proyek disegel	Izin bangunan tidak sesuai	630	Tinggi
Perubahan desain	Keinginan *owner*	420	Tinggi
Penambahan pekerjaan	*Owner* menambah spesifikasi proyek	400	Tinggi
Pengerjaan ulang (faktor cuaca)	Kerusakan karena cuaca buruk	192	Tinggi
Alat kerja rusak	Cara penggunaan kurang tepat oleh pekerja	180	Tinggi
Pengiriman material terlambat	Jadwal produksi tidak sesuai dengan jadwal proyek	144	Rendah
	Kendaraan pengirim mengalami kecelakaan	144	Rendah
Pembayaran macet dari *owner*	*Owner* tidak membayar angsuran tepat waktu	140	Rendah
Harga material naik mendadak	Kenaikan harga dolar	112	Rendah
Material yang dikirim salah	Kesalahan distributor	112	Rendah
Pengeluaran biaya kompensasi untuk lingkungan	Lingkungan merasa terganggu karena pekerjaan proyek	100	Rendah
Pengiriman material terlambat	Aturan *red line* untuk material impor	96	Rendah
Tipe material diubah	Keinginan *owner*	90	Rendah
Pekerja tertimpa material	Kelalaian pekerja	80	Rendah
Pekerja celaka karena alat kerja	Kelalaian pekerja	80	Rendah
Tipe material diubah	Tipe material yang dipesan kosong	60	Rendah
Kualitas pekerjaan kurang baik	Pekerjaan dilakukan manual tanpa alat saat malam	36	Rendah
Gambar desain lama	Keputusan *owner* berubah-ubah	35	Rendah
Kualitas pekerjaan kurang baik	Pekerja kurang andal	24	Rendah
Pekerja berhalangan hadir	Pekerja sakit	15	Rendah

2.1.3 Risk Management Planning

Risk management planning is a process for determining appropriate treatment measures for each risk. Risk management measures are obtained by means of discussion with the Project Manager. Handling actions for each risk can be seen in Table 11.

Table 11 Risk Management Planning

Risiko	Penyebab Risiko	Kategori	Penanganan
Bangunan proyek disegel	Izin bangunan tidak sesuai	Tinggi	Hubungi *owner* untuk menangani izin
Perubahan desain	Keinginan *owner*	Tinggi	Negosiasi dengan *owner*
Penambahan pekerjaan	*Owner* menambah spesifikasi proyek	Tinggi	Negosiasi dengan *owner*
Pengerjaan ulang (faktor cuaca)	Kerusakan karena cuaca buruk	Tinggi	Klaim asuransi
Alat kerja rusak	Cara penggunaan kurang tepat oleh pekerja	Tinggi	Pelatihan kepada pekerja
Pengiriman material terlambat	Jadwal produksi tidak sesuai dengan jadwal proyek	Rendah	Tidak ada
	Kendaraan pengirim mengalami kecelakaan	Rendah	Jadwal pengiriman dimajukan
Pembayaran macet dari *owner*	*Owner* tidak membayar angsuran	Rendah	Proyek ditunda hingga *owner* membayar tagihan

Risiko	Penyebab Risiko	Kategori	Penanganan
	tepat waktu		
Harga material naik mendadak	Kenaikan harga dolar	Rendah	Negosiasi dengan *owner*
Material yang dikirim salah	Kesalahan distributor	Rendah	Jadwal pengiriman dimajukan
Pengeluaran biaya kompensasi untuk lingkungan	Lingkungan merasa terganggu karena pekerjaan proyek	Rendah	Negosiasi dengan lingkungan
Pengiriman material terlambat	Aturan *red line* untuk material impor	Rendah	Jadwal pengiriman dimajukan
Tipe material diubah	Keinginan *owner*	Rendah	Negosiasi dengan *owner*
Pekerja tertimpa material	Kelalaian pekerja	Rendah	Klaim asuransi
Pekerja celaka karena alat kerja	Kelalaian pekerja	Rendah	Klaim asuransi
Tipe material diubah	Tipe material yang dipesan kosong	Rendah	Negosiasi dengan owner
Kualitas pekerjaan kurang baik	Pekerjaan dilakukan manual tanpa alat saat malam	Rendah	Pengerjaan ulang
Gambar desain lama	Keputusan *owner* berubah-ubah	Rendah	Memberi saran kepada *owner* agar mantap menentukan keputusan
Kualitas pekerjaan kurang baik	Pekerja kurang andal	Rendah	Pelatihan kepada pekerja
Pekerja berhalangan hadir	Pekerja sakit	Rendah	Tidak ada

2.1.4 Risk Evaluation

Risk evaluation is a process to monitor emerging risks and compare them with risk lists to be known for those risk categories and their mitigation. Site Manager performs daily documentation by creating daily reports followed by risks arising from project execution, risk assessment, and handling. So it can be continued risk assessment by the Project Manager on the severity, incidence, and control. Assessment is conducted to determine the risk category whether included in the high or low category as in Table 12.

Table 12 Assessment of Severity, Occurrence, and Control

Risiko	S	Penyebab	O	D	RPN
Kualitas pekerjaan kurang baik	6	Pekerjaan dilakukan manual tanpa alat saat malam	3	2	36

Furthermore, the Project Manager determines the handling steps taken to address such risks as in Table 13.

Table 13 Handling Recording

Risiko	Penyebab	Kategori	Penanganan
Kualitas pekerjaan kurang baik	Pekerjaan dilakukan manual tanpa alat saat malam	Rendah	Pengerjaan ulang menggunakan alat saat siang

After knowing the risks, causes, and categories of risk level, it is expected that the Project Manager can handle the constraints experienced and complete the project work.

2.2 Analisis Kebutuhan Pengguna

A software will run optimally if supported by users who have the ability to operate the software. Characteristics of existing users in PT. Anantagraha Primaperkasa current and needed can be seen in Table 14.

Table 14 User Characteristics Required

Pengguna	Hak Akses	Tingkat Pendidikan	Keterampilan
Direktur	Mengolah data proyek dan pengguna	Min. S1	Minimal mampu menggunakan aplikasi berbasis web
Manajer Proyek	Mengolah data risiko dan mitigasi	Min. SMA	Minimal mampu menggunakan aplikasi berbasis web
Site Manager	Mengolah data laporan proyek	Min. SMA	Minimal mampu menggunakan aplikasi berbasis web

2.3 Functional Requirements Analysis

The system analysis is done using object-oriented analysis and design approach (OOAD) using UML 2.0 tools. Stages in this system analysis are use case diagrams, use case scenarios, activity diagrams, class diagrams, and

sequence diagrams [4]. The following images use case diagrams and class diagrams.

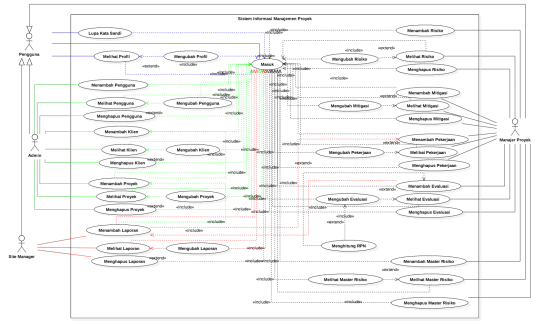


Figure 3 Use Case Diagram

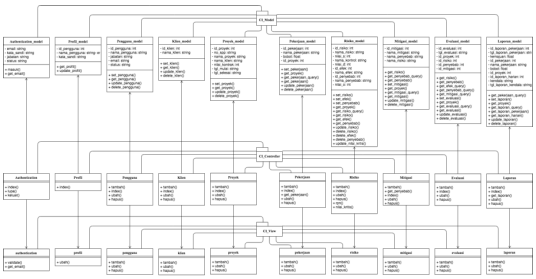


Figure 4 Class Diagram

2.4 System Planning

System design is the depiction, planning, and making a sketch or arrangement of several separate elements into a unified whole. The relation scheme of the system to be built can be seen in Figure 5.

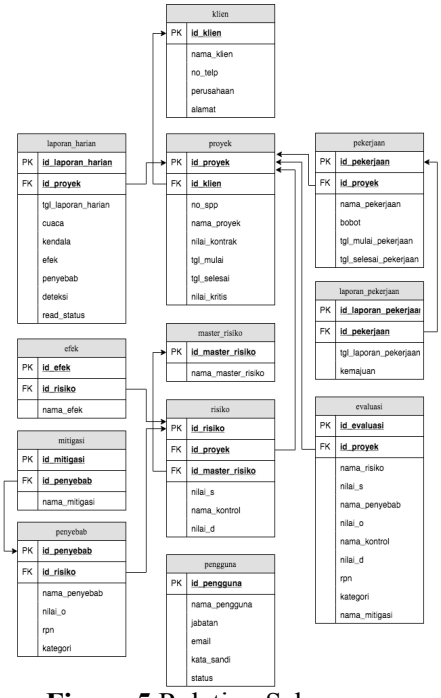


Figure 5 Relation Scheme

2.5 Design Menu Structure

The design of the menu structure is a design to describe the functions that will be provided in the project risk management information system at PT. Anantagraha Primapaerkasa. The menu structure is designed according to the permissions of each user ie admin menu structure, project manager, and site manager. The design of the menu structure can be seen in Figure 6, Figure 7, and Figure 8.

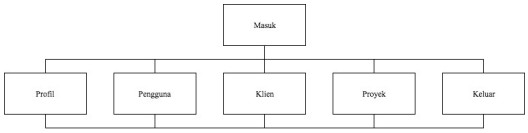


Figure 6 Menu Structure of the Admin

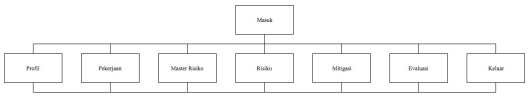


Figure 7 Menu Structure of the Project Manager

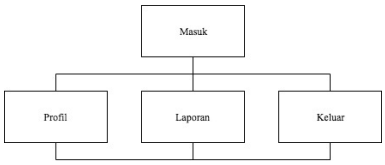


Figure 8 Menu Structure of the Site Manager

2.6 Testing

Testing intends to know the information system created has met the performance in accordance with the design objectives. Test plan to be done is to test the system built in black box and beta. Based on the results of testing black box can be concluded that the system can meet the needs. Based on the results of beta testing can be concluded that the system has met and can assist in performing risk management.

3. CLOSING

After analyzing, designing and testing it can be concluded that, the project risk management information system at PT. Anantagraha Primaperkasa can assist project managers in analyzing possible risks by providing an assessment of the severity, occurrence, and detection. The system can also help project managers to know the value of RPN and risk categories, thereby helping to define risk priorities for planning possible risk handling in mitigation efforts.

In order for the system built to work better, should the project risk management information

system at PT. Anantagraha Primaperkasa is done by adding cost calculation of possible risks so as to provide more information for project managers in considering decision in handling project risk.

BIBLIOGRAPHY

[1] Library of Congress Cataloging-in-Publication Data, A Guide to The Project Management Body of Knowledge (PMBOK Guide) -- Fifth Edition, Newton Square: Project Management Institute, Inc., 2013.

[2] M. Ben-Daya, S. O. Duffuaa, A. Raouf, J. Knezevic dan D. Ait-Kadi, Handbook of Maintenance Management and Engineering, London: Springer, 2009.

[3] E. Sari, "Analisis Risiko Proyek Pada Pekerjaan Jembatan Sidamukti-Kadu di Majalengka Dengan Metode FMEA dan Decision Tree," *J-Ensitec,* vol. 2, p. 44, 2016.

[4] R. Miles dan K. Hamilton, Learning UML 2.0, Sebastopol: O'Reilly Media, Inc., 2006.