

# **SCHEDULING AND RISK CONTROL INFORMATION SYSTEM AT PT. CIPTA KERTASARI MAS**

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## **ABSTRACT**

*PT. Cipta Kertasari Mas is a company engaged in construction services. From projects that have been done, companies often experience obstacles by several factors that cause project implementation to be hampered because the schedule used does not provide information that supports the decisions that will be given by the project manager, so they have difficulty in determining the focus of work that can be done first when there is a delay. The neglect of risks that arise during project work and the absence of risk recording causes the project manager to experience difficulties in handling risks. Based on the existing problems, it is necessary to develop a risk scheduling and control information system at PT. Cipta Kertasari Mas. The goal is to make it easier to determine the focus of work using the critical path method to help determine which work focus can be delayed and cannot be delayed. Helping in controlling risk with probability impact matrix method so that the risks that arise can be handled early and the expected monetary value method to control the project risk costs. Based on the test results concluded that this system has helped scheduling by displaying critical paths to facilitate the project manager in determining the focus of work and assisting in controlling the risks that arise along with handling them.*

*Keywords : Scheduling, Risk Control, Critical Path Method, Probability Impact Matrix, Expected Monetary Value.*

## **1. INTRODUCTION**

*PT. Cipta Kertasari Mas is a construction services company that has completed the construction of large projects in the field of Apartments and other infrastructure development. This company has experience since 1980, and was founded by Mr. Ir. Teddy Budianto who is the director of the company.*

*From the results of the interview with Mr. Ir. Tifriwan as the project manager of PT. Cipta Kertasari Mas stated that from projects that have been done often experience obstacles that occur*

*during project work, as in scheduling so far does not provide information that supports the decisions that will be given by the project manager if the project work is delayed.. The project manager does not know which other work can be done first, it is due to several factors, such as the rainfall factor which is quite high, the project workforce who is unable to attend, and the current schedule is still in the form of a s curve, which is only a matter of count. week start and finish. From the delay the project manager has difficulty in determining which focus of work can be postponed and cannot be delayed, so that it can cause overall project delays.*

*In addition to constraining the project due to lack of work focus, often the risks that arise during project work are often ignored, there is no risk recording and handling if the risk arises so that the project manager has difficulty in handling it early, it causes the risk had happened to a previous project, it happened back to the project that was being worked on. Various risk factors in the field include factors of natural disasters or rainfall that are quite high, workers who are unable to attend, delays in the delivery of raw materials, workers experiencing accidents, and damage to project performance supporting tools so that the need for recording risks so that risks can be identified and prepared handling.*

*Based on the results of interviews that have been presented by Mr. Ir. Tifriwan as the project manager of PT. Cipta Kertasari Mas, a solution is needed to answer the problems that often occur in project execution, namely the need for the application of project scheduling using the Critical Path Method (CPM) method, which is a method of analyzing the path of activities or activities by showing the longest total time and the fastest project completion time by predicting the total duration of the project time, so that it can help the project manager in determining the focus of work that can be delayed and cannot be delayed. [1]*

*The next solution to the risk problem that often arises is the need to apply risk control by using the Probability Impact Matrix (PIM) method, which is a risk approach developed using two criteria to measure risk, so that the risks that arise during project work can be mitigated properly. And the project manager can prepare the handling for each*

risk that appears every week. Furthermore, using the Expected Monetary Value (EMV) method to control project risk costs, namely a statistical concept analysis method that calculates the average future expenditures that may occur or not occur. [2]

Problem solving solutions described above, the authors intend to create a Risk Scheduling and Control Information System at PT. Cipta Kertasari Mas. With the development of this information system, it is expected that the work in the project carried out by PT. Cipta Kertasari Mas can work well as desired.

### 1.1. Stages of Research

The stages of the research carried out in the development of Risk Scheduling and Control Information Systems at PT. Cipta Kertasari Mas on picture 1.

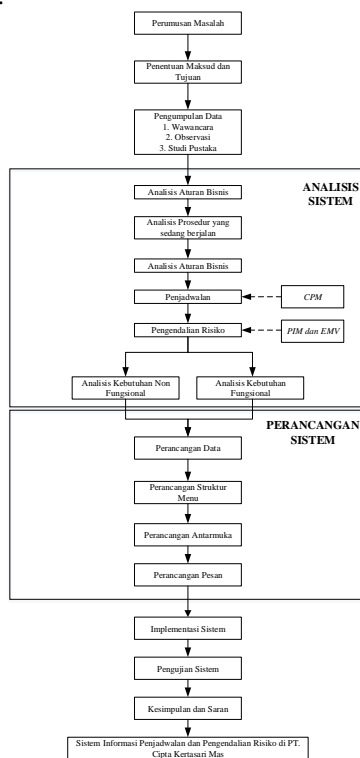


Figure 1 Stages of Research

### 1.2. Information Systems

According to Robert A. Leitch and K. Roscoe Davis, information systems are systems within an organization that bring together daily transaction processing needs, support operations, are managerial and strategic activities of the organization's time and provide certain external parties with the required reports. [3]

The information system has several components, namely:

- Hardware
- Software
- Brainware
- Data
- Procedures or methods

### 1.3. Project Management

Project Management is the application of science, expertise, and skills, the best technical way and with limited resources to achieve the goals and objectives that have been determined in order to get optimal results in terms of cost performance, quality and time and work safety. [4]

The area of project management science (PM-BOK) is a document that explains a number of knowledge areas that are within the scope of the project management profession. The PM-BOK applies to all types of projects with the understanding that the application must be adjusted to the type or size of the project concerned. [1]

### 1.4. Critical Path Method (CPM)

Critical Path Method (CPM) is a method of analyzing the path of an activity or activity by showing the longest total time and the fastest project completion time by predicting the total duration of the project time. [1]

The terms in CPM are as follows [1] :

- $E$  (earliest event occurrence time) is the earliest time an event occurs.
- $L$  (latest event occurrence time) is the last time that is still allowed for an event to occur.
- $ES$  (earliest activity start time) is the earliest start of an activity. If the time starts to be stated in hours, then this time is the earliest time the activity starts.
- $EF$  (earliest activity finish time) is the earliest time to complete an activity.  $EF$  is a previous activity =  $ES$  next activity
- $LS$  (latest activity start time) is the slowest time the activity can begin without slowing down the overall project
- $LF$  (latest activity finish time) is the time the activity is completed at the latest without slowing the completion of the project.
- $D$  (activity duration time) is the period of time needed for an activity.

The Calculating Critical Path Method technique is as follows [1] :

- Forward Pas)

Starting from the Start (initial event) to Finish (terminal event) to calculate the fastest completion time of an activity ( $EF$ ), the fastest time of the activity ( $ES$ ) and the fastest start of an event ( $E$ ).

$$EF(i-j) = ES(i-j) + D(i-j)$$

- Backward Pass

Starting from Finish to Start to identify when an activity occurs at the latest ( $LF$ ), the time that an activity occurs at the latest ( $LS$ ) and at the latest an event occurs ( $L$ ).

$$LS(i-j) = LF(i-j) - D(i-j)$$

- Total Float

Total Float shows the amount of time allowed by an activity to be postponed, without affecting the overall project completion schedule.

$$TF = LF(i-j) - EF(i-j) D(i-j)$$

### 1.5. Project Risk Management

According to Wideman, project risk in risk management is the cumulative effect of uncertain chance of events, which affect the goals and objectives of the project. The purpose of risk management is to minimize losses and increase opportunities or opportunities. If a loss occurs, risk management can cut the chain of loss events, so that the dominance effect will not occur. Basically risk management is a prevention against losses or accidents. [4]

#### 1.4.1. Probability Impact Matrix (PIM)

Probability Impact Matrix (PIM) is a risk approach developed using two criteria to measure risk, namely:

- Probability is the possibility that risk will occur.
- Impact is the impact on the project in the event of a risk.

Probability Impact Matrix is a matrix that is built by giving a level of risk (very low, low, medium, high, and very high) to the risk measured by a combination of probability and impact scales. [2] To measure risk can use the formula:

$$R = P \times I$$

Where :

R = Risk level of interest.

P = Probability (risk) will occur.

I = Impact if risk occurs.

For the probability and impact matrix used, the Boston square matrix can be seen in Figure 2.

Probabilitas	Sangat Tinggi	5	5	10	15	20	25
	Tinggi	4	4	8	12	16	20
	Sedang	3	3	6	9	12	15
	Rendah	2	2	4	6	8	10
	Sangat Rendah	1	1	2	3	4	5
		1	2	3	4	5	
		Sangat Kecil	Kecil	Sedang	Besar	Sangat Besar	
		Dampak					

Figure 2 Boston Square Matrix

Levels of low, medium, and high probability and the impact of each risk can be seen in Table 1.

Table 1 Risk Scale Value

Nilai Skala Risiko	Skala Level Risiko
1 – 5	Rendah
6 – 14	Sedang
15 – 25	Tinggi

#### 1.4.2. Risk Management

Risk management is carried out so that the type and cost of risk that the nominal value has been calculated can be handled so that the solution and the person responsible for the risk can be determined. There are several ways to determine risk management based on the classification of risk forms, [4] that is :

- Risk is acceptable**, namely the form of risk that is overcome by the company because the consequences are considered quite small. For example, the cost of promoting a company to get a project in the future.
- Reduced risk**, namely the form of risk that can be handled by handling an alternative action whose consequence value can be zero or at least the consequences borne are smaller. For example, rain weather during concrete casting is anticipated by speeding up the casting time by revising the scheduling time.
- Reduced risk**, that is a form of risk that the impact of the loss can be reduced by minimizing the likelihood of the occurrence or the consequences thereof. For example, reworking due to repeated mistakes in some project experiences is a solution, then doing training for employees who will be promoted or recruited.
- Risk transferred**, namely a form of risk that can be transferred to other parties in part or in whole. For example, for work safety and health programs, the company guarantees its employees to insurance companies by paying the premium.

#### 1.4.3. Expected Monetary Value (EMV)

Earn Monetary Value (EMV) method is a method of analyzing statistical concepts that calculates the average future expenditure that may occur or not occur. Positive EMV values indicate opportunities, while negative EMV values indicate threats or threats that can harm the company. EMV is calculated by multiplying the probability value of each risk multiplied by the possibility of the money spent when the risk occurs. [2]

Earn Monetary Value (EMV) is used to calculate the portion of the cost, which is finalized in the form of risk costs. EMV is the result of doubling the probability of an event with the magnitude of the consequences. [4]

$$EMV = \text{Probabilitas} * \text{Konsekuensi}$$

[4]

#### Formula 1 Earn Monetary Value (EMV)

Where :

EMV = (Earn Monetary Value) or money that is expected when risk occurs

Probability = risk probability value

Consequences = the value of the impact caused by risk

## 2. CONTENTS OF RESEARCH

### 2.1. Project Scheduling Analysis

Scheduling analysis is an analysis of work activities in a certain order and time. The details of the description of work activities in the Green Park

View Tower G development project can be seen in table 2.

**Table 2 Description of Job Activity**

No	Nama Pekerjaan	Kode	Tgl Mulai	Tgl Selesai	Durasi (Minggu)
I	Pekerjaan Persiapan	I	22/10/2013	31/12/2013	10
II	Pekerjaan Tanah	II	03/01/2014	28/03/2014	12
III	Pekerjaan Sub Struktur	III	04/04/2014	08/08/2014	16
IV	Pekerjaan Upper Struktur	IV	18/08/2014	10/05/2015	35
V	Pekerjaan Luar	V	03/01/2015	01/06/2015	67
VI	Pekerjaan Atap	VI	11/05/2015	31/07/2015	9
VII	Pekerjaan Dinding dan Pelapis Dinding	VII	03/08/2015	06/02/2016	25
VIII	Pekerjaan Kusen, Pintu, dan Jendela	VIII	07/02/2016	20/11/2016	36
IX	Pekerjaan Pelapis Lantai	IX	07/02/2016	23/09/2016	32
X	Pekerjaan Plafond	X	21/11/2016	26/02/2017	13
XI	Pekerjaan Cat	XI	01/03/2017	24/09/2017	25
XII	Pekerjaan Sanitary	XII	25/09/2017	12/11/2017	7
XIII	Pekerjaan Mekanikal	XIII	13/11/2017	31/03/2018	18
XIV	Pekerjaan Elektrikal	XIV	13/11/2017	29/04/2018	22
XV	Pekerjaan Luar Bangunan	XV	01/05/2018	29/07/2018	10

The logical relationship between work on the Green Park View Apartment G Tower construction project can be seen in table 3.

**Table 3 Hubungan Antar Pekerjaan**

No	Nama Pekerjaan	Kode	Kegiatan Pendahulu	Pekerjaan Pengikut	Durasi (Minggu)
I	Pekerjaan Persiapan	I	-	II, V	10
II	Pekerjaan Tanah	II	I	III	12
III	Pekerjaan Sub Struktur	III	II	IV	16
IV	Pekerjaan Upper Struktur	IV	III	VI, VII	35
V	Pekerjaan Luar	V	I	XI	67
VI	Pekerjaan Atap	VI	IV	VII	9
VII	Pekerjaan Dinding dan Pelapis Dinding	VII	IV, VI	VIII, IX	25
VIII	Pekerjaan Kusen, Pintu, dan Jendela	VIII	VII	X	36
IX	Pekerjaan Pelapis Lantai	IX	VII	X	32
X	Pekerjaan Plafond	X	VIII, IX	XI	13
XI	Pekerjaan Cat	XI	V, X	XII	25
XII	Pekerjaan Sanitary	XII	XI	XIII, XIV	7
XIII	Pekerjaan Mekanikal	XIII	XII	XV	18
XIV	Pekerjaan Elektrikal	XIV	XII	XV	22
XV	Pekerjaan Luar Bangunan	XV	XIII, XIV	Selesai	10

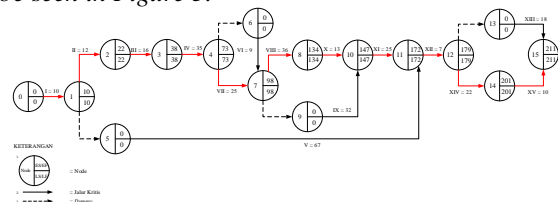
Based on the table above it can be seen the relationship between jobs, then calculated forward,

backward, and total float calculations to produce critical work paths which can be seen in table 4.

**Table 4 Critical Path Calculation**

Kegiatan			Durasi	ES	EF	LS	LF	TF
I	J	Kode						
0	1	I	10	0	10	0	10	0
1	2	II	12	10	22	10	22	0
2	3	III	16	22	38	22	38	0
3	4	IV	35	38	73	38	73	0
5	11	V	67	10	77	105	172	95
6	7	VI	9	73	82	89	98	16
4	7	VII	25	73	98	73	98	0
7	8	VIII	36	98	134	98	134	0
9	10	IX	32	98	130	115	147	17
8	10	X	13	134	147	134	147	0
10	11	XI	25	147	172	147	172	0
11	12	XII	7	172	179	172	179	0
13	15	XIII	18	179	197	193	211	14
12	14	XIV	22	179	201	179	201	0
14	15	XV	10	201	211	201	211	0

For critical paths, the project work network can be seen in Figure 3.



**Figure 3 Critical Pathway to the Project Work Network**

For critical work can be seen in table 5.

**Table 5 Critical Project Work**

No	Nama Pekerjaan	Kode	Status
I	Pekerjaan Persiapan	I	Kritis
II	Pekerjaan Tanah	II	Kritis
III	Pekerjaan Sub Struktur	III	Kritis
IV	Pekerjaan Upper Struktur	IV	Kritis
V	Pekerjaan Luar	V	-
VI	Pekerjaan Atap	VI	-
VII	Pekerjaan Dinding dan Pelapis Dinding	VII	Kritis
VIII	Pekerjaan Kusen, Pintu, dan Jendela	VIII	Kritis
IX	Pekerjaan Pelapis Lantai	IX	-
X	Pekerjaan Plafond	X	Kritis
XI	Pekerjaan Cat	XI	Kritis
XII	Pekerjaan Sanitary	XII	Kritis
XIII	Pekerjaan Mekanikal	XIII	-
XIV	Pekerjaan Elektrikal	XIV	Kritis
XV	Pekerjaan Luar Bangunan	XV	Kritis

Based on the results of the scheduling analysis in table 4, it can be seen that the work is in the critical path. Critical paths or jobs that cannot be delayed are found in the following jobs:

- a. I. Pekerjaan Persiapan
- b. II. Pekerjaan Tanah
- c. III. Pekerjaan Sub Struktur
- d. IV. Pekerjaan Upper Struktur
- e. VII. Pekerjaan Dinding dan Pelapis Dinding
- f. VIII. Pekerjaan Kusen, Pintu, dan Jendela
- g. X. Pekerjaan Plafond

h. XI. Pekerjaan Cat

i. XII. Pekerjaan Sanitary

j. XIV. Pekerjaan Elektrikal

k. XV. Pekerjaan Luar Bangunan

The jobs that can be postponed are as follows:

a. V. Pekerjaan Luar

b. VI. Pekerjaan Atap

c. IX. Pekerjaan Pelapis Lantai

d. XIII. Pekerjaan Mekanikal

Is the longest amount of time that shows the fastest project completion period for 211 weeks, then the path can be a reference for the project manager.

## 2.2. Project Risk Analysis

### 2.2.1. Risk Identification

This risk identification is grouped based on the type of risk and by providing a risk code for each of these risks.

Table 6 Risk Identification

Kode Risiko	Jenis Risiko	Variable Risiko
R1	Personal	Tenaga kerja proyek ada yang berhalangan hadir saat pengerjaan proyek
R2		Tenaga kerja ada yang resign
R3		Tenaga kerja kurang memahami rancangan yang dibuat oleh tenaga ahli
R4		Tenaga kerja kurang memahami jobdesk masing-masing
R5	Keselamatan Tenaga Kerja	Tenaga kerja tertimpa alat berat
R6		Tenaga kerja tertimpa bahan material
R7		Tenaga kerja mengalami kecelakaan lalu lintas
R8	Alat Penunjang	Terlambatnya pengiriman alat penunjang kinerja proyek
R9		Kerusakan dan kehilangan material dan perlengkapan peralatan
R10		Kesulitan penggunaan alat yang tidak dapat diprediksi sebelumnya
R11		Akses pengiriman alat penunjang kinerja proyek yang tidak memadai
R12		Perkiraan jadwal yang tidak sesuai dengan rencana awal
R13	Estimasi	Perkiraan biaya yang tidak sesuai dengan perencanaan awal
R14		Naik turunnya harga bahan baku
R15	Eksternal	Terjadi nya bencana alam dan curah hujan cukup tinggi
R16		Terlambatnya pengiriman bahan baku
R17		Alat atau bahan baku yang hilang atau dicuri

### 2.2.2. Determining the Possible Value and Impact of Risk

The following is the value of the probability and impact of risk which can be seen in table 7.

Table 7 Results of Probability and Impact Risks

Kode Risiko	Jenis Risiko	Variable Risiko	Probabilitas	Dampak
R1	Personal	Tenaga kerja proyek ada yang berhalangan hadir saat pengerjaan proyek	3	2
R2		Tenaga kerja ada yang resign	3	3
R3		Tenaga kerja kurang memahami rancangan yang dibuat oleh tenaga ahli.	1	2
R4		Tenaga kerja kurang memahami jobdesk	2	2

		masing-masing		
R5	Keselamatan Tenaga Kerja	Tenaga kerja tertimpa alat berat	3	5
R6		Tenaga kerja tertimpa bahan material	3	5
R7		Tenaga kerja mengalami kecelakaan lalu lintas	2	3
R8	Alat Penunjang	Terlambatnya pengiriman alat penunjang kinerja proyek	1	3
R9		Kerusakan dan kehilangan material dan perlengkapan peralatan	3	3
R10		Kesulitan penggunaan alat yang tidak dapat diprediksi sebelumnya	1	3
R11		Akses pengiriman alat penunjang kinerja proyek yang tidak memadai	1	1
R12		Perkiraan jadwal yang tidak sesuai dengan rencana awal	2	3
R13	Estimasi	Perkiraan biaya yang tidak sesuai dengan perencanaan awal	1	2
R14		Naik turunnya harga bahan baku	2	3
R15	Eksternal	Terjadi nya bencana alam dan curah hujan cukup tinggi	2	3
R16		Terlambatnya pengiriman bahan baku	2	3
R17		Alat atau bahan baku yang hilang atau di curi	2	3

### 2.2.3. Determining the Risk Level of Interest

Following is the level of risk that can be seen in table 8.

Table 8 level of risk

Kode Risiko	Jenis Risiko	Variable Risiko	Tingkat Risiko
R1	Personal	Tenaga kerja proyek ada yang berhalangan hadir saat pengerjaan proyek	Sedang
R2		Tenaga kerja ada yang resign	Sedang
R3		Tenaga kerja kurang memahami rancangan yang dibuat oleh tenaga ahli.	Rendah
R4		Tenaga kerja kurang memahami jobdesk masing-masing	Rendah
R5	Keselamatan Tenaga Kerja	Tenaga kerja tertimpa alat berat	Tinggi
R6		Tenaga kerja tertimpa bahan material	Tinggi
R7		Tenaga kerja mengalami kecelakaan lalu lintas	Sedang
R8	Alat Penunjang	Terlambatnya pengiriman alat penunjang kinerja proyek	Rendah
R9		Kerusakan dan kehilangan material dan perlengkapan peralatan	Sedang
R10		Kesulitan penggunaan alat yang tidak dapat diprediksi sebelumnya	Rendah
R11		Akses pengiriman alat penunjang kinerja proyek yang tidak memadai	Rendah
R12		Perkiraan jadwal yang tidak sesuai dengan rencana awal	Sedang
R13	Estimasi	Perkiraan biaya yang tidak sesuai dengan perencanaan awal	Rendah
R14		Naik turunnya harga bahan baku	Sedang
R15	Eksternal	Terjadi nya bencana alam dan curah hujan cukup tinggi	Sedang
R16		Terlambatnya pengiriman bahan baku	Sedang
R17		Alat atau bahan baku yang hilang atau di curi	Sedang

### 2.2.4. Risk Management Analysis

Control measures for each risk can be seen in table 9.

**Table 9 Risk Management**

Kode Risiko	Jenis Risiko	Variabel Risiko	Tingkat Risiko	Pengendalian Risiko	Penanganan risiko
R1	Personal	Tenaga kerja proyek yang tidak hadir saat pengerjaan proyek	Sedang	Melakukan negoisasi dengan memanfaatkan SDM yang ada dengan menambah jam kerja dan lakukan komunikasi dengan tim proyek untuk mengaktifkan kinerja proyek	Risiko yang direduksi
R2		Tenaga kerja ada yang resign	Sedang	Memanfaatkan SDM yang tersedia dengan penambahan jam kerja.	Risiko yang direduksi
R3		Tenaga kerja kurang memahami rancangan yang dibuat oleh tenaga ahli.	Rendah	Makukan koordinasi dengan bagian gambar perancangan gambar.	Risiko yang dikurangi
R4		Tenaga kerja kurang memahami masing-masing	Rendah	Memperbanyak komunikasi intensif untuk pengarahan job desk lebih detail dengan tenaga ahli dan tim proyek lain yang terlibat.	Risiko yang dikurangi
R5	Keselamatan Tenaga Kerja	Tenaga kerja tertimpa alat berat	Tinggi	Memberi pengarahan kepada pekerja agar mengutamakan keselamatan kerja	Risiko yang dipindahkan
R6		Tenaga kerja tertimpa bahan material	Tinggi	Memberi pengarahan kepada pekerja agar mengutamakan keselamatan kerja	Risiko yang dipindahkan
R7		Tenaga kerja mengalami kecelakaan lalu lintas	Sedang	Memberikan pengarahan kepada tenaga kerja untuk mengutamakan keselamatan dengan menggunakan helm dijalan raya dan mematuhi rambu-rambu lalu lintas.	Risiko yang dipindahkan
R8		Terlambatnya pengiriman alat penunjang kinerja proyek	Rendah	Melakukan koordinasi dengan bagian logistik untuk menindak lanjuti kepada pihak terkait.	Risiko yang dikurangi
R9	Alat Penunjang	Kerusakan dan kehilangan material dan perlengkapan peralatan	Sedang	Melakukan peningkatan pengawasan dan tanggung jawab pekerjaan.	Risiko yang diterima
R10		Kesulitan penggunaan alat yang tidak dapat diprediksi sebelumnya	Rendah	Mengalihkan ke pekerjaan yang lain yang tidak menggunakan alat tersebut dan terus melakukan komunikasi kepada pihak terkait.	Risiko yang dikurangi
R11		Akses pengiriman alat	Rendah	Mencari jalan alternatif agar alat berat tetap	Risiko yang diterima

		penunjang kinerja proyek yang tidak memadai		mendapat akses, jika tetap tidak memadai segera lakukan komunikasi kepada tim proyek untuk mencari alternatif alat berat lain.	
R12	Estimasi	Perkiraan jadwal yang tidak sesuai dengan rencana awal	Sedang	Menambah jam kerja SDM yang menangani proyek dan melakukan percepatan pekerjaan dengan koordinasi tim proyek mengenai pemahaman tindak lanjut kinerja proyek.	Risiko yang direduksi
R13		Perkiraan biaya yang tidak sesuai dengan perencanaan awal	Rendah	Maintenance biaya dengan melakukan Pengurangan jumlah biaya yang kurang diperlukan atau bisa diminimalisir	Risiko yang dikurangi
R14		Naik turunnya harga bahan baku	Sedang	Menanyakan dan terus berkomunikasi dengan pihak supplier dan terus mencari informasi	Risiko yang dikurangi
R15	Eksternal	Terjadinya bencana alam dan curah hujan cukup tinggi	Sedang	Kinerja proyek harus tetap berjalan dengan syarat pengerjaan dimulai dari tempat yang memiliki ketinggian air lebih rendah dan menggunakan helm keselamatan, jas hujan, dsb.	Risiko yang direduksi
R16		Terlambatnya pengiriman bahan baku	Sedang	Melakukan negoisasi dan melakukan komunikasi dengan pihak supplier untuk segera melakukan tindak lanjut dan menemukan jalan keluar pengiriman material.	Risiko yang diterima
R17		Alat atau bahan baku yang hilang atau di curi	Sedang	Melakukan komunikasi dengan tim keamanan untuk menginstruksikan bagian security secara bergantian menjaga lingkungan dan aset proyek.	Risiko yang diterima

### 2.2.5. Risk Cost Analysis

The calculation of the cost that must be incurred by the company to handle a risk that appears can be seen in table 10.

**Table 10 Risk Costs**

No	Kode Risiko	Probabilitas (%)	Konsekuensi	EMV
1	R1	25	- Rp 5,000,000	- Rp 1,250,000
2	R2	25	- Rp 31,500,000	- Rp 7,875,000
3	R3	5	- Rp 12,000,000	- Rp 600,000
4	R4	5	- Rp 9,000,000	- Rp 450,000

5	R5	50	- Rp 21,000,000	- Rp 10,500,000
6	R6	50	- Rp 13,000,000	- Rp 6,500,000
7	R7	5	- Rp 10,000,000	- Rp 500,000
8	R8	30	- Rp 8,500,000	- Rp 2,550,000
9	R9	10	- Rp 6,000,000	- Rp 600,000
10	R10	10	- Rp 4,500,000	- Rp 450,000
11	R11	5	- Rp 4,000,000	- Rp 200,000
12	R12	15	- Rp 12,000,000	- Rp 1,800,000
13	R13	10	- Rp 17,000,000	- Rp 1,700,000
14	R14	20	- Rp 12,000,000	- Rp 2,400,000
15	R15	10	- Rp 7,500,000	- Rp 750,000
16	R16	10	- Rp 6,000,000	- Rp 600,000
17	R17	15	- Rp 3,000,000	- Rp 450,000

### 2.3. User Analysis

Analysis of functional requirements in the form of use case diagrams can be seen in Figure 4.

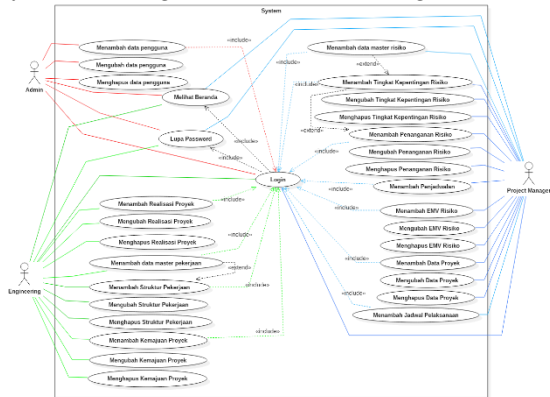


Figure 4 Use Case Diagram

For class diagrams can be seen in Figure 5.

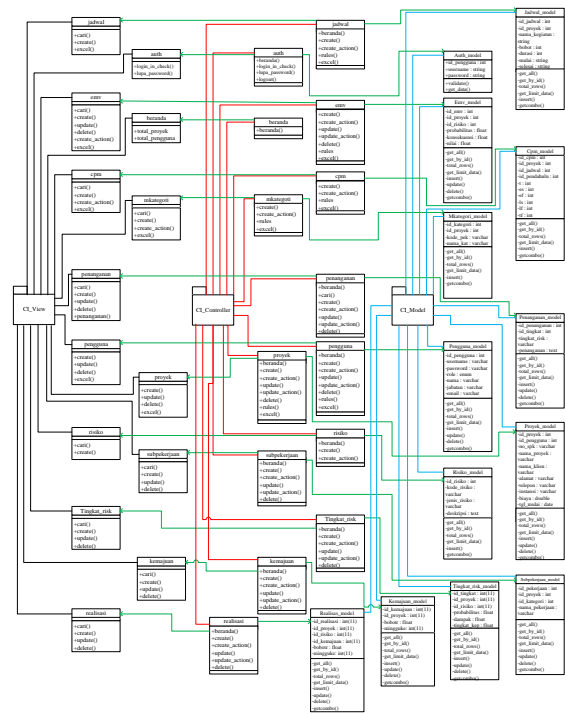


Figure 5 Class Diagram

### 2.4. Data Design

Data design in the form of a relation scheme can be seen in Figure 6.

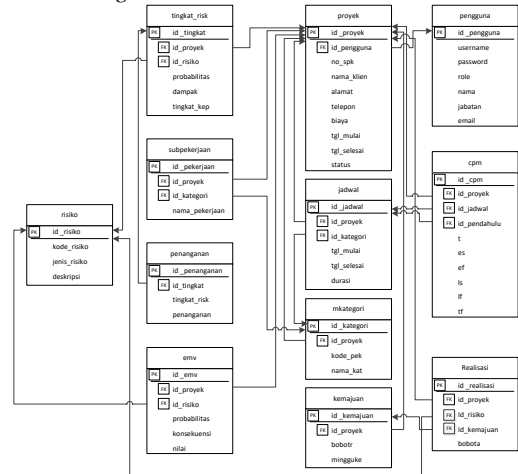


Figure 6 Relationship Scheme

### 2.5. Interface Design

Designing the admin home interface can be seen in Figure 7.

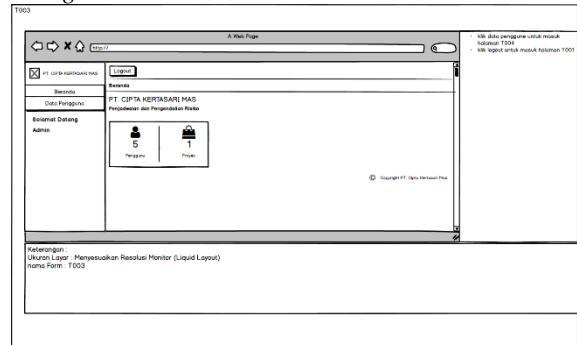


Figure 7 Admin Interface



Designing the project manager home page interface can be seen in Figure 8.

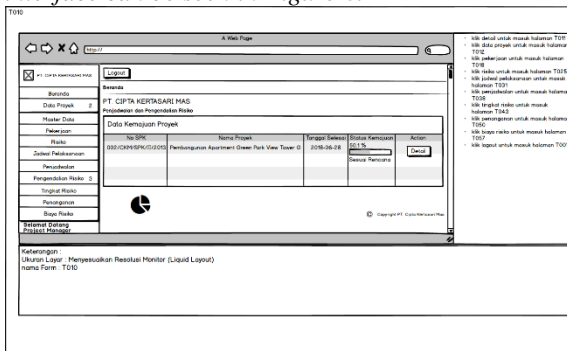


Figure 8 Project Manager Interface

Designing an engineering homepage interface can be seen in Figure 9.

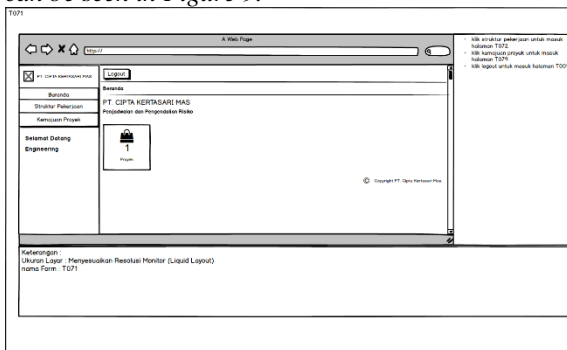


Figure 9 Engineering Interface

## 2.6. Conclusion of Blackbox Testing

Based on the results of the system blackbox testing that has been carried out as a whole, it can be concluded that the information system scheduling and risk control application process at PT. Cipta Kertasari Mas in the system functionality is correct and as expected. Display error messages, warnings are maximal and functionally the system built can produce an expected output.

## 2.7. Conclusion of Beta Testing

Based on the results of beta testing, it can be concluded that the construction project management information system at PT. Cipta Kertasari Mas is in accordance with the expected goals.

- The risk scheduling and control information system that has been built can facilitate the project manager's part in monitoring project activities, managing project data, job data, project scheduling, and project risk control as well as making information on project progress and interface system display quite neat and good.
- The information system for scheduling and risk control that has been built can facilitate the engineering part in the management of work structure data, and make project progress, as well as the system interface is good enough, but for job structure data it is better to be separated per category to make it easier to read the work structure data.

- The risk scheduling and control information system built has made it easier for the admin in managing user data easily, and the system interface is very attractive and easy to use.

## 3. CLOSING

Based on the results obtained in this final project research, it can be concluded as follows.

- The information system built can help the project manager in scheduling projects to determine the focus of work and critical paths so that they know which work can be delayed and cannot be delayed to minimize the occurrence.
- The information system built can help the project manager's part in controlling project risk by recording risks so that adverse impacts can be immediately addressed.

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