SCHEDULING AND RISK MANAGEMENT INFORMATION SYSTEM FOR MANUFACTURING PROJECT AT PT PADINA BARAYA JAYA

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ABSTRACT

PT. Padina Baraya Jaya is one of the companies engaged in manufacturing services. In the implementation of manufacturing projects there are obstacles due to several factors that cause delays in the project implementation schedule, so that PPIC has difficulty in planning project schedules and difficulties in determining the focus of work that must be done first. The less optimal risk management that arises, especially in handling risks because the implementation of the project so far has not known how much impact it has, so that project leaders have difficulty dealing with risk. Based on current problems, scheduling and risk management systems for manufacturing projects at PT. Padina Baraya Jaya. The aim is to help schedule planning and determine critical paths and help in determining the focus of work using the Critical Path Method (CPM) method, then to identify risks along with the level of risk that arises by using the Probability Impact Matrix (PIM) method and to calculate the cost of each risk using the method of Earn Value Management (EMV). Based on the test results it can be concluded that this system has helped scheduling by displaying important work to facilitate in determining the focus of work and project control as well as helping in managing the risks that arise along with how to handle it.

Keywords: *Scheduling, Risk, Critical Path Method, Expected Monetary Value, Probabbility Impact Matrix*

1. INTRODUCTION

PT. Padina Baraya Jaya is one of the companies engaged in manufacturing. PT. Padina Baraya Jaya was established in 2015 which was founded by Mr. Bernadi Narada Hadiwijaya. Projects or jobs that are usually handled by PT. Padina Baraya Jaya covers the making of JIG, making DIES, manufacturing Base Frames and other manufacturing projects

Based on the results of the interview with Pak Asep Ened as PPIC stated that from one of the projects carried out, namely the creation of the N-100 JIG project there was a delay of 0.6% of the weight of the planning schedule. This happened, because in the 4th week there were delays in ordering materials due to lack of material, so the company had to order openly so that additional time was needed in the execution of work in the 4th week, so the implementation of the project had to be completed based on the required planning schedule days but because of obstacles in project implementation so the implementation time is 12 days. In addition, delays occur because of scheduling planning so far by estimating and seeing from previous project experience and lack of a complete framework, this results in errors in calculating project scheduling, which means that in the implementation of similar projects there are jobs that require the same tools there is confusion in determining the focus of work that must be done first, if any of the pending jobs can have an impact on the overall project delay.

Next, based on an interview with Mr. Amir Hamza as Project Leader. Currently PT. Padina Baraya Jaya in project risk management, especially in terms of risk management that arises during project implementation. In the work report data, in the 4th week, that is in the work of regulators, there are several risks that arise such as lack of material that interferes with work, where with the emergence of risks arising during the execution of work, actions taken by the company handle the risks that arise without knowing how impact of the project. So this causes the project implementation process to experience delays due to the emergence of risk in the next work which has a higher impact than the previous risk.

Based on the results of interviews that have been submitted by Mr. Amir Hamzah as Project Leader and Mr. Asep Ened as PPIC. A solution is needed to answer the problems that occur in the implementation of the project, which is an information system scheduling project using the Critical Path Method (CPM) method to optimize the project schedule by looking for critical paths of a job so that it can help determine which work can be done during a delay. This cannot have an impact on other work, Probability and Impact Matrix (PIM) as a method for analyzing risks that arise along with the impacts and how to overcome them against the project, the method of Expected Monetary Value

(EMV) as a method used to help calculate the costs used for manage risk.

The objectives to be achieved in developing a management information system for scheduling and controlling the risk of this project are as follows :

1. *Help PPIC as the person responsible for project scheduling planning to determine which work can be done first when there is a delay, so that it does not affect other work.*
2. *Assisting the Project Leader in controlling project risks so that the risks that occur can be identified based on the extent of the impact and help in monitoring risks arising from the same type of project, so the company can find out the possible impacts. because of the emergence of risk during project work so that the risks that arise can be immediately addressed.*

2. RESEARCH METHODS

The research method used in developing Manufacturing Project Risk Management and Information System Scheduling at PT. Padina Baraya Jaya can be seen in Figure 1.

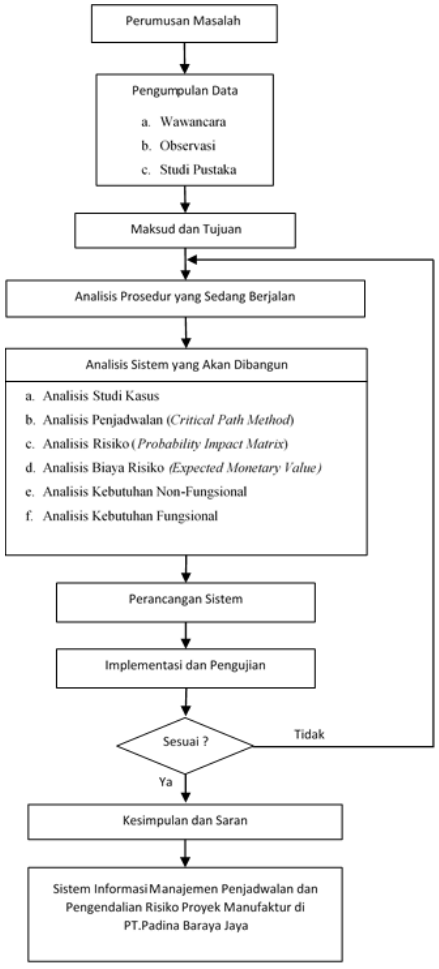


Figure 1 Research methodology

3. CONTENTS OF RESEARCH

3.1 Project Scheduling Analysis

Scheduling is part of the application of project management science by doing the best technical in managing the available power sunver to achieve a planned goal so that it is expected to get maximum results. [1]

Scheduling analysis is an analysis of the work activities needed to complete the JIG project making the N-100 project of PT. Setia Guna Selaras Cikarang in a certain order and time. In this study scheduling uses the Critical Path Method (CPM) method to optimize the project schedule by looking for critical paths of a job. The following are the steps taken in the project scheduling analysis using the Critical Path Method (CPM) method. [2]

The term in the Critical Path Method (CPM) method includes:

a. *E (Earlist) is the earliest time of an activity.*
b. *L (latest event) is the last time allowed for an activity.*
c. *ES (earliest start) is the earliest start time of an activity.*
d. *EF (earliest finish) is the earliest time to finish the activity.*
e. *LS (latest start) is the time the activity starts at the latest.*
f. *LF (latest finish) is the time to finish the activity.*
g. *D (activity duration) is the time needed to carry out an activity.*

2.2.1 Planning Schedule Analysis

The first step in scheduling analysis is to determine the project work activities, the data used in this scheduling analysis is the project schedule for making the JIG project N-100 PT. Setia Guna Selaras Cikarang.

Table 1 Project Planning Schedule

No	Pekerjaan	Kode	Start	Finish
1	Review Design	1	16-Jan-18	23-Jan-18
2	Trial Hasil Review	2	24-Jan-18	06-Feb-18
3	Persiapan	3	01-Feb-18	13-Feb-18
4	Pekerjaan Regulator Mtg Brkt	4	14-Feb-18	24-Feb-18
5	Pekerjaan Floor Board Mtg Front	5	24-Feb-18	28-Feb-18
6	Pekerjaan Tube Floor Board L	6	01-Mar-18	20-Mar-18
7	Pekerjaan Tube Floor Board R	7	01-Mar-18	23-Mar-18
8	Pekerjaan Cross Member Suspension	8	24-Mar-18	31-Mar-18
9	Pekerjaan Brkt. cover Main Pipe FR	9	01-Apr-18	06-Apr-18
10	Pekerjaan Brkt Toggle Link L	10	08-Apr-18	27-Apr-18
11	Pekerjaan Brkt Toggle Link R	11	09-Apr-18	27-Apr-18
12	Pekerjaan Brkt Holder Front	12	17-Apr-18	15-May-18

No	Pekerjaan	Kode	Start	Finish
13	Pekerjaan Brkt Comp Lgn Coil	13	16-May-18	20-May-18
14	Trial Implementasi di PT. SGS	14	21-May-18	28-May-18

2.2.2 Determining Job Description

To determine the job description, the activity code is first made to facilitate the reading of the schedule. Job description on the JIG project making project N-100 PT. Setia Guna Selaras Cikarang.

Table 2 Job description

No	Kode	Durasi	Start	Finish
1	1	7	16-Jan-18	23-Jan-18
2	2	13	24-Jan-18	06-Feb-18
3	3	12	01-Feb-18	13-Feb-18
4	4	10	14-Feb-18	24-Feb-18
5	5	4	24-Feb-18	28-Feb-18
6	6	19	01-Mar-18	20-Mar-18
7	7	22	01-Mar-18	23-Mar-18
8	8	7	24-Mar-18	31-Mar-18
9	9	5	01-Apr-18	06-Apr-18
10	10	19	08-Apr-18	27-Apr-18
11	11	18	09-Apr-18	27-Apr-18
12	12	28	17-Apr-18	15-May-18
13	13	4	16-May-18	20-May-18
14	14	7	21-May-18	28-May-18

2.2.3 Determining Between Relations

The following is the relationship between work on the JIG project making project N-100 PT. Setia Guna Selaras Cikarang.

Table 3 Determining Between Relations

No	Pekerjaan	Kode	Durasi	Pekerjaan Pendahulu
1	Review Design	1	7	Start
2	Trial Hasil Review	2	13	1
3	Persiapan	3	12	2
4	Pekerjaan Regulator Mtg Brkt	4	10	3
5	Pekerjaan Floor Board Mtg Front	5	4	4
6	Pekerjaan Tube Floor Board L	6	19	5
7	Pekerjaan Tube Floor Board R	7	22	5
8	Pekerjaan Cross Member Suspension	8	7	6,7
9	Pekerjaan Brkt. cover Main Pipe FR	9	5	8
10	Pekerjaan Brkt Toggle Link L	10	19	9
11	Pekerjaan Brkt Toggle Link R	11	18	9
12	Pekerjaan Brkt Holder Front	12	28	10,11
13	Pekerjaan Brkt Comp Lgn Coil	13	4	12
14	Trial Implementasi di PT. SGS	14	7	13

2.2.4 Critical Path Analysis

After determining the relationship between project work, then the critical path analysis uses the Critical Path Merthod (CPM) method to calculate the total project completion time with forward pass, backward pass, and calculate the total float.

Job network paths are a way of connecting nodes from each job. Where the connected node consists of arrows, the arrow in question is a work activity and the node represents the event. [3]

2.2.4.1 Forward Pass

In the advanced calculation there is an ES which is the earliest time an activity can begin after the previous activity is completed. Furthermore, EF is the earliest time an activity can be completed, while EF is the sum of ES plus activity. then obtained the advanced calculation formula as follows. [4]

$$EF_{(i-j)} = ES_{(i-j)} + D_{(i-j)} \quad \text{.....(1)}$$

Here is a picture of a network of advanced job calculations.

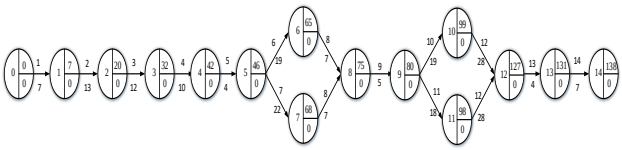


Figure 2 Advanced Job Network

2.2.4.2 Backward Pass

In the backward calculation there is an LF that is the last time it finishes, the LS is the last time minus the duration.

$$LS(i\text{-}j) = LF(i\text{-}j) - D(i\text{-}j) \text{ ……...(2)}$$

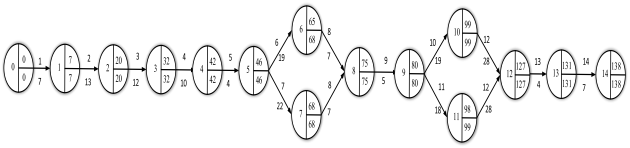


Figure 3 Job Reverse Network

2.2.4.3 Calculation Total Float

Float is a vulnerable time delay that is allowed in an activity, which does not affect the schedule of activities, the following are TF.

$$TF = LF(i\text{-}j) - EF(i\text{-}j)\ D(i\text{-}j) \text{ ……... (3)}$$

Calculation of the total float and the critical path for the JIG-making project can be seen in Table 4.

Tabel 4 Calculation of Total Float

No	Kode Pekerjaan	Kegiatan		D	Paling Awal		Paling Akhir		TF
		i-node	j-node		(ES)	(EF)	(LS)	(LF)	
1	1	0	1	7	0	7	0	7	0

No	Kode Pekerjaan	Kegiatan		D	Paling Awal		Paling Akhir		TF
		i-node	j-node		(ES)	(EF)	(LS)	(LF)	
2	2	1	2	13	7	20	7	20	0
3	3	2	3	12	20	32	20	32	0
4	4	3	4	10	32	42	32	42	0
5	5	4	5	4	42	46	42	46	0
6	6	5	6	19	46	65	49	68	3
7	7	5	7	22	46	68	46	68	0
8	8	7	8	7	68	75	68	75	0
9	9	8	9	5	75	80	75	80	0
10	10	9	10	19	80	99	80	99	0
11	11	9	11	18	80	98	81	99	1
12	12	10	12	28	99	127	99	127	0
13	13	12	13	4	127	131	127	131	0
14	14	13	14	7	131	138	131	138	0

Based on the results of CPM calculations it is known that there are two jobs that have a float value of more than zero, which means that the two jobs are not critical jobs with a maximum of 3 days of work. The critical path can be seen in Figure 4.

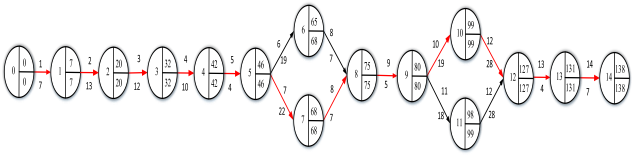


Figure 4 Critical Job Network

3.3 Project Risk Analysis

Project risk analysis is an activity carried out prior to project implementation. The steps taken in the risk analysis are as follows.

3.3.1 Risk Identification

The process of risk identification in this study was conducted by discussing with Mr. Amir Hamza as Project Leader. The results of risk identification can be seen in table 5. [6]

Tabel 5 Risk Identification

Kode Risiko	Jenis Risiko	Risiko
R1	*Estimasi*	Jadwal tidak sesuai dengan rencana
R2	*Personal*	*Approval design* mengalami keterlambatan
R3		Kurang memahami *design* yang telah ditetapkan
R4		Tenaga kerja ada yang berhalangan hadir
R5		Kurang memahami dengan spesial tools yang teresedia
R6	*Material*	Kurangnya *part*/*material*
R7		Rusaknya *part*/*material* saat ingin digunakan
R8		Terdapat spesial tools yang tidak tersedia di dalam negri
R9	*Eksternal*	Hilangnya bahan baku
R10		Terjadinya bencana alam
R11	Keselamatan Tenaga Kerja	Tenaga kerja terkena (tertiban/terpecik/terjepit) alat/material
R12		Rusaknya pelindung (Helm/Sepatu)

3.3.2 Determine the Risk Level

At this stage the risk that arises will be given a value based on the measurement value of the likelihood and value of the impact that has been discussed with Bapak Amir Hamzah selaku *Project Leader* dan Bapak Asep Ened selaku *PPIC*. The results of this level of risk aim to provide an estimate of possible risks that will occur.

After determining the value of possible risks and impacts. Furthermore, calculating the importance of risk by the formula. [6]

$$Risk\ Score = Probability * Impact \quad (4)$$

Information :
Risk Score = *Risk Level of Interest*
Probability = *Possible Value*
Impact = *Impact Value*

Tabel 6 Risk Level of Interest

No	Kode Risiko	Kemungkinan	Dampak	Tingkat Kepetingan Risiko
1	R1	4	4	16
2	R2	3	3	9
3	R3	2	3	6
4	R4	2	2	4
5	R5	2	2	4
6	R6	3	3	9
7	R7	3	2	6
8	R8	3	4	12
9	R9	1	2	2
10	R10	1	2	2
11	R11	1	2	2
12	R12	1	1	1

Based on the results of the calculation of interests, then do the risk groupings that appear including low, medium or high risk levels.

Tabel 7 Risk Level

No	Kode Risiko	Risiko	Tingkat Kepetingan Risiko	Tingkat Risiko
1	R1	Jadwal tidak sesuai dengan rencana	16	Tinggi
2	R2	Approval design mengalami keterlambatan	9	Sedang
3	R3	Kurang memahami design yang telah ditetapkan	6	Sedang
4	R4	Tenaga kerja ada yang berhalangan hadir	4	Rendah
5	R5	Kurang memahami dengan spesial tools yang teresedia	4	Rendah
6	R6	Kurangnya part/material	9	Sedang
7	R7	Rusaknya part/material saat ingin digunakan	6	Sedang
8	R8	Terdapat spesial tools yang tidak tersedia di dalam negri	12	Sedang
9	R9	Hilangnya bahan baku	2	Rendah
10	R10	Terjadinya bencana alam	2	Rendah
11	R11	Tenaga kerja terkena (tertiban/terpecik/terjepit) alat/material	2	Rendah
12	R12	Rusaknya pelindung (Helm/Sepatu)	1	Rendah

3.3.3 Determining Risk Costs

At this stage, the cost of risk is calculated using the EMV method, the EMV calculation is used to provide information in the form of risk costs that arise, the consequences and probability values are obtained based on the results of discussions with Mr. Amir Hamzah as Project Leader.

EMV can be calculated with a probability multiplied by the value of the possibility that the company expends when there is a risk. [5]

EMV = Probability * Consequences ..... (5)

Information :
Probability = value of risk probability
Consequences = Value from impact

The results of the EMV calculation can be *seen in the table.*

Table 8 EMV Calculations

No	Risiko	Probabilitas (%)	Konsekuensi (Rp)	EMV (Rp)
1	Jadwal tidak sesuai dengan rencana	50	- 1.250.000	- 625.000
2	Approval design mengalami keterlambatan	30	- 2.500.000	- 750.000
3	Kurang memahami design yang telah ditetapkan	30	- 2.500.000	- 750.000
4	Tenaga kerja ada yang berhalangan hadir	15	- 1.000.000	- 150.000
5	Kurang memahami dengan spesial tools yang teresedia	5	- 1.000.000	- 50.000
6	Kurangnya part/material	25	- 2.500.000	- 625.000
7	Rusaknya part/material saat ingin digunakan	5	- 2.500.000	- 125.000
8	Terdapat spesial tools yang tidak tersedia di dalam negri	30	- 2.500.000	- 750.000
9	Hilangnya bahan baku	15	- 1.000.000	- 150.000
10	Terjadinya bencana alam	15	- 1.000.000	- 150.000
11	Tenaga kerja terkena (tertiban/terpecik/terjepit) alat/material	10	- 1.000.000	- 100.000
12	Rusaknya pelindung (Helm/Sepatu)	5	- 1.000.000	- 50.000
			TOTAL	- 4.275.000

3.4 Analysis of Project Implementation

At this stage, the project work report is filled out, an assessment of the risks that arise as well as the handling carried out when the risk occurs. So that it can know the right handling to handle the risks that arise.

Before filling out a job report, first calculate the weight of each job.

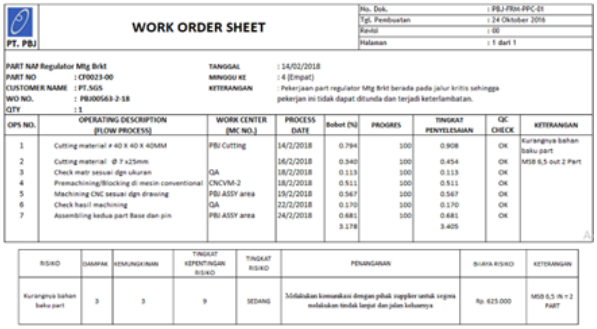
$$\textbf{Bobot} = \left(\frac{\textbf{Anggaran Pekerjaan}}{\textbf{Anggaran Total Pekerjaan}}\right) \times \textbf{100}\ \% \ldots\ldots (3.1)$$

Table 9 Calculation of Weight

No	Pekerjaan	Total Harga	Bobot (%)
1	Review Design	Rp. 2,000,000	4.539
2	Trial Hasil Review	Rp. 2,550,000	5.788
3	Persiapan	Rp. 7,383,570	16.759
4	Pekerjaan Regulator Mtg Brkt	Rp. 1,400,000	3.178
5	Pekerjaan Floor Board Mtg Front	Rp. 1,450,000	3.291
6	Pekerjaan Tube Floor Board L	Rp. 2,750,000	6.242
7	Pekerjaan Tube Floor Board R	Rp. 2,650,000	6.015
8	Pekerjaan Cross Member Suspension	Rp. 2,500,000	5.674
9	Pekerjaan Brkt. cover Main Pipe FR	Rp. 1,450,000	3.291
10	Pekerjaan Brkt Toggle Link L	Rp. 3,000,000	6.809
11	Pekerjaan Brkt Toggle Link R	Rp. 3,000,000	6.809

No	Pekerjaan	Total Harga	Bobot (%)
12	Pekerjaan Brkt Holder Front	Rp. 1,425,000	3.234
13	Pekerjaan Brkt Comp Lgn Coil	Rp. 2,500,000	5.674
14	Trial Implementasi di PT. SGS	Rp. 10,000,000	22.697

After determining the work weight, then fill out a work report consisting of risks and studies on the effects and possibilities of risioko. The results of the work report can be seen in Figure 5.



WORK ORDER SHEET

PT. PBJ

No. Dok.	: PBJ-FRM-PPC-01		
Tgl. Pembuatan	: 24 Oktober 2016		
Revisi	: 00		
Halaman	: 1 dari 1		

PART NAP Regulator Mtg Brkt — TANGGAL : 14/02/2018
PART NO : CF0023-00 — MINGGU KE : 4 (Empat)
CUSTOMER NAME : PT.SGS — KETERANGAN : Pekerjaan part regulator Mtg Brkt berada pada jalur kritis sehingga pekerjan ini tidak dapat ditunda dan terjadi keterlambatan.
WO NO. : PBJ00563-2-18
QTY : 1

OPS NO.	OPERATING DESCRIPTION (FLOW PROCESS)	WORK CENTER (MC NO.)	PROCESS DATE	Bobot (%)	PROGRES	TINGKAT PENYELESAIAN	QC CHECK	KETERANGAN
1	Cutting material # 40 X 40 X 40MM	PBJ Cutting	14/2/2018	0.794	100	0.908	OK	Kurangnya bahan baku part MSB 6,5 out 2 Part
2	Cutting material Ø 7 x25mm		16/2/2018	0.340	100	0.454	OK	
3	Check matr sesuai dgn ukuran	QA	18/2/2018	0.113	100	0.113	OK	
4	Premachining/Blocking di mesin conventional	CNCVM-2	18/2/2018	0.511	100	0.511	OK	
5	Machining CNC sesuai dgn drawing	PBJ ASSY area	19/2/2018	0.567	100	0.567	OK	
6	Check hasil machining	QA	22/2/2018	0.170	100	0.170	OK	
7	Assembling kedua part Base dan pin	PBJ ASSY area	24/2/2018	0.681	100	0.681	OK	
				3.178		3.405		

RISIKO	DAMPAK	KEMUNGKINAN	TINGKAT KEPENTINGAN RISIKO	TINGKAT RISIKO	PENANGANAN	BIAYA RISIKO	KETERANGAN
Kurangnya bahan baku part	3	3	9	SEDANG	Melakukan komunikasi dengan pihak supplier untuk segera melakukan tindak lanjut dan jalan keluarnya	Rp. 625.000	MSB 6,5 IN = 2 PART

Figure 5 Job Report

3.5 System Analysis

System analysis is an elaboration of an interaction consisting of a system, actors and information that is intended to identify and evaluate problems that arise. The steps taken in the system analysis include problem analysis, ongoing system analysis, functional analysis and non-functional analysis.

3.5.1 Use Case Diagram

Use case diagram is a diagram that shows the functionality of a system in the form of an interaction picture between the user and the system to be built.

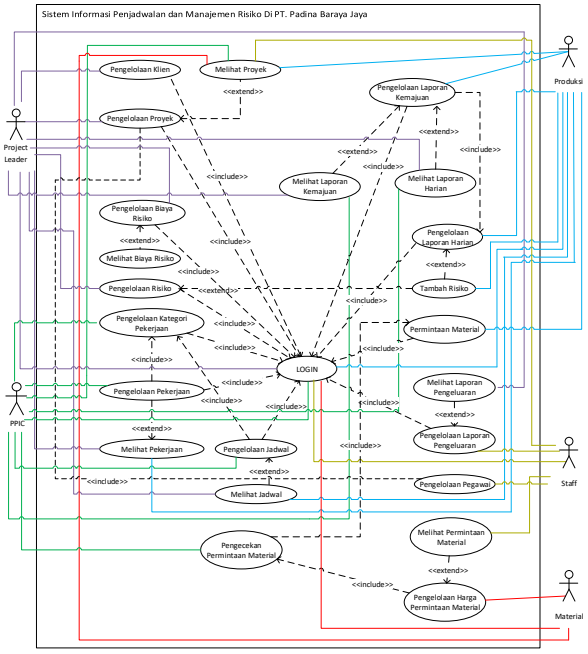


Figure 2 Use Case Diagram

3.5.2 Class Diagram

Class Diagrams are an overview of the system structure in defining classes that will be created on the system. The following is a class diagram of the risk scheduling and management information system at PT. Padina Baraya Jaya. [7]

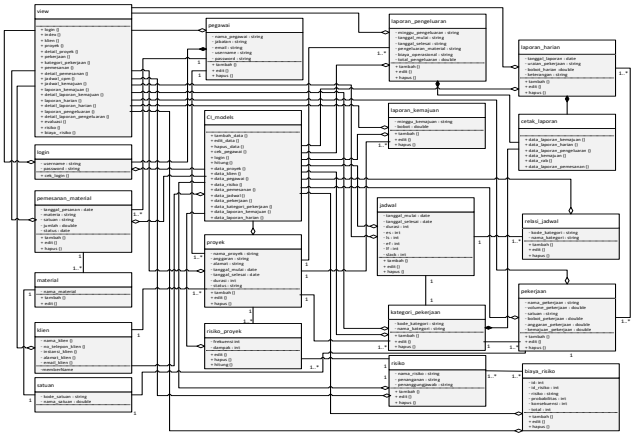


Figure 3 *Class Diagram*

3.6 Designing Data

At this stage the conceptual model is carried out into the database model used in making risk scheduling and management information systems at PT. Padina Baraya Jaya. Designing data in the form of relation schemes can be seen in the figure. [7]

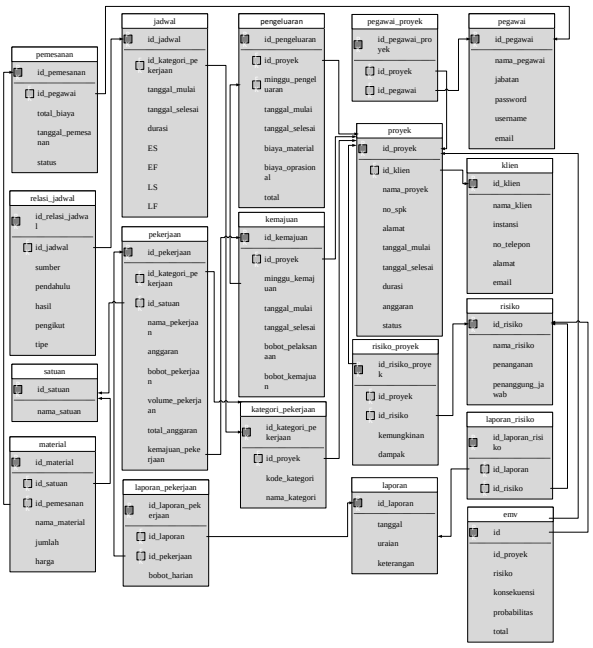


Figure 8 Relationship Scheme

3.7 *Interface Design*

This stage is an illustration of the interaction between users with the scheduling and risk management information system to be built.

The following is the design of the project schedule interface to determine the relationship between jobs and find out the path of job criticism can be seen in Figure 9.

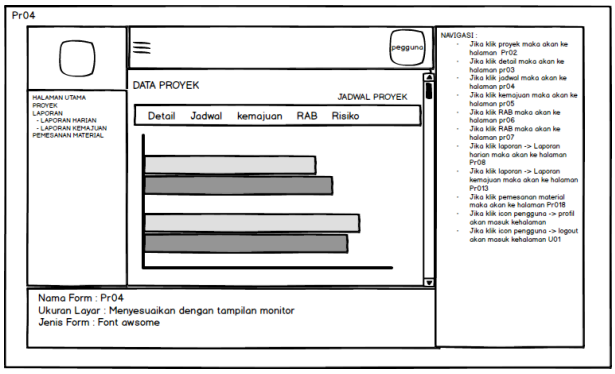


Figure 9 Designing Project Schedule Interfaces

Furthermore, to design the project progress interface to show progress progress of each spelling can be seen in Figure 10.

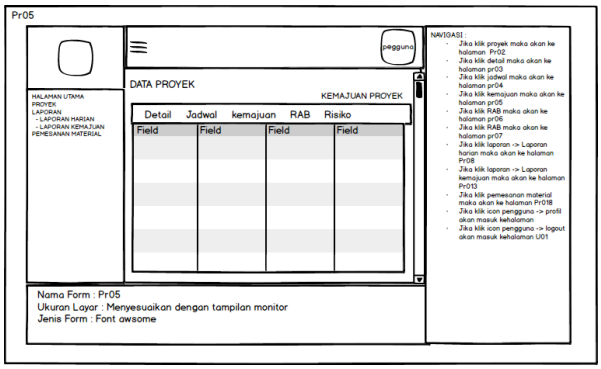


Figure 10 Project Progress

Furthermore, to design the project risk interface to display the risk of each spelling can be seen in Figure 11.

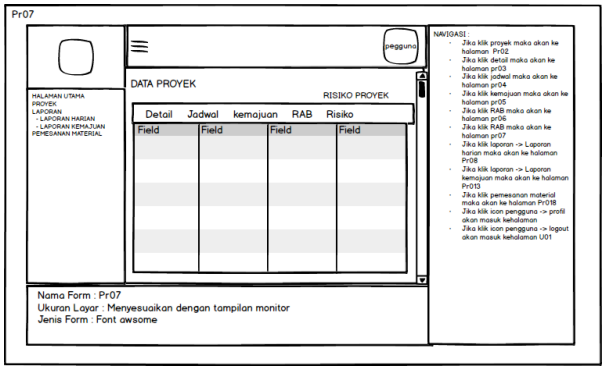


Figure 11 Project Risk

3.8 *Conclusion Black Box Testing*

Based on the results of the black box testing system that has been carried out as a whole, it can be concluded that the application project scheduling and risk management information system application processes at PT. Padina Baraya Jaya system functionality has been able to assist PPIC as the person in charge in planning the project schedule to determine the focus of the work if there is a problem, which means it can determine which work can be done first if a problem occurs. Furthermore, the system can assist the Project Leader in risk management so that the risks that arise can be identified and can be handled according to how much the impact is tied to.

3.9 *Conclusion of Beta Testing*

Based on the results of beta testing, it can be concluded that the project information system at PT. Padina Baraya Jaya is in line with the expected goals. The system that has been built can facilitate the management of project data, client data, project risk data, project schedule data, material ordering data and project employee data as well as receipt of daily, weekly and expenditure reports and in project risk management and interface system display is sufficient good.

3. CLOSING

Based on the results of the research obtained, it was concluded as follows.

1. The system that is built can already help the PPIC section in scheduling settings by displaying work and determining the processes that help allow efforts to be delayed or not.
2. The system can already help in the management that is really needed. Can be used during project implementation.

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