CONSTRUCTION PROJECT MANAGEMENT INFORMATION SYSTEMS AT PT. TUJUH PILAR SARANA

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ABSTRACT

PT. Tujuh Pilar Sarana is a company engaged in construction. In implementation of company's projects are often constrained by problems of some factors that often happens so that implementation project being late of schedule as well as lack of analysis of critical job managing difficult part so specify focus job. Part of difficulty in project manager monitoring and controling because latest report from each section as well as difficulty in managing possible risk badly project implementation.

Based on existing problems current required construction project management information system at PT. Tujuh Pilar Sarana. purpose is to facilitate in determining critical paths with method of critical path method so as to facilitate project implementer in determining focus of work when is delay, to facilitate project manager in monitoring and controlling project using earned value management to see how big cost and time comparisons that have been incurred during implementation of plan and assist in managing and measuring risk level with probability impact matrix method so that emerging risk can be handled immediately.

Based on test results it can be concluded that system is already helping with critical job of showing scheduling for easy commissioning in determining focus of work, assist in supervision and controlling project and help in managing risk of appearing along with how to handle.

Keywords: Project Management, Critical Path Method, Earned Value Management, Probability Impact Matrix.

1. INTRODUCTION

PT. Tujuh Pilar Sarana is one of the companies engaged in construction. As a company engaged in the field of developers and contractors in the management of project activities both in the planning and implementation must be implemented properly in order to achieve company objectives. But now the process of project activities that exist in the company is still done in a simple and still difficulties in the implementation and processing of data as a whole.

Based on interview with Mr. Dany Juanda as project manager stated that in one of PT. Tujuh Pilar Sarana is a Multifunction Building Bandung Independent School located at Jalan Surya Sumantri No.61 Bandung, in a written contract the project commences on 1 January 2017 and is completed on 29 June 2017 with a duration of 180 days. Based on project progress data in March at week 10, the project implementation had a delay of 2.70% of the planned schedule. Delay occurs due to several factors, namely bad weather, delay in the process of purchasing and shipping of materials, and sometimes there is a change in the drawing in the field so that the implementation of the project is not in accordance with the planning schedule. From the delay of implementer difficulties in determining which work focus should be done in order to have an impact on overall project delays.

Furthermore, in an interview with Mr. Dany Juanda as project manager, he also stated that from the delay it can also impact on the cost. The longer the delay time then the cost to be incurred can be getting bigger. Evaluation of project progress is very important because in addition to viewing and assessing the progress of a project can also assess in terms of cost and time has been spent. Currently in the Multifunction Building Bandung Independent School Project , process of evaluating progress of the project conducted once a month based on the data cost of work and project expenditure data, in addition to the slow delivery of reports from each section can also affect the evaluation activities. From the evaluation of the progress made once a month

then the supervision of the project becomes less supervised so that deviations on the cost and time spent on the project become less controlled and cause the cost incurred to become larger. Therefore, for the implementation of the project can run in accordance with the plan it is necessary to supervise and evaluate good control in the implementation of the project. In addition, project manager also need to know the factors causing the risk of project delays along with how to deal so that if there is a bad risk can be handled and minimized so that the implementation of the project can go according to plan.

Based on existing problems, then requird construction project management information system at PT. The Tujuh Pilar Sarana in order to ma easier project scheduling in determining the focus of the project work, helping in the process of evaluation of the control of the project, and assist in managing risk with how to handle.

The objectives of this research are:

1. Assist the Site Manager in order to ma easier project scheduling implementers in determining focus of work until the time execution of each project work can be known when to begin and end the settlement as well as work which should not be time-delayed its implementation.
2. Assisting the Project Manager in overseeing the progress of the project from each part of the report and assisting in the evaluation of project cost control so that project implementation can proceed according to plan.
3. Assisting the Project Manager in managing the risks that adversely affect the project implementation so that the bad risks that arise can be addressed and minimized.

1.1. Stages of Research

Stages of research conducted in building the Construction Project Management Information System at PT. The Tujuh Pilar Sarana can be seen in the picture 1.

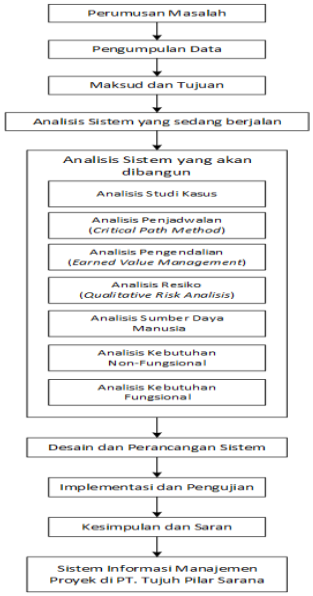


Figure 1 Stages of Research

1.2. Project Management

Project Management is application of science, expertise, and technical means by managing limited resources to achieve predetermined goals and objectives to achieve optimal results in terms of cost, quality and time and work safety performance [1].

The components of science knowledge area in project management in figure 2.

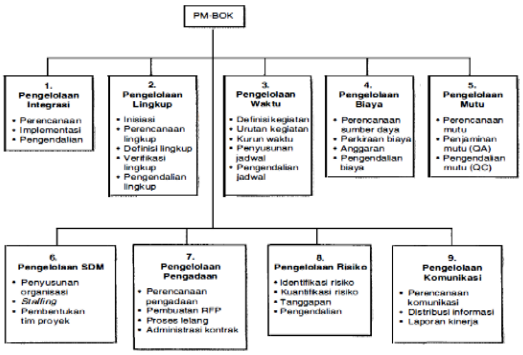


Figure 2
Components of Science Knowledge Area In Project Management

1.3. Critical Path Method

Critical Path Method (CPM) is method of analyzing the path of activity by showing the longest total time and the fastest project completion time by predicting the total duration of the project time [2].

The terms in CPM are as follows.

a. E (earliest event occurence time) is the earliest time of an event.

b. L (latest event occurence time) is the last time that is still allowed for an event to occur.
c. ES (earliest activity start time) is the earliest time to start an activity.
d. EF (earliest activity finish time) is the earliest time of completion of an activity.
e. LS (latest activity start time) is the last time the start of an activity.
f. LF (latest activity finish activity) is: the last time the completion of an activity.
g. D (activity duration time) is the time required for an activity.

Technique to calculate critical path method [5], that is:

1. Forward Pass
   Calculates the fastest completion time of an activity (EF), the fastest time of activity (ES).
   The calculation formula, namely:
   EF (i-j) = ES (i-j) + D (i-j) .... (1)
2. Backward Pass
   Calculate the slowest time of an activity (LF), the slowest time of an activity (LS).
   The calculation formula, namely:
   LS (i-j) = LF (i-j) - D (i-j) .... (2)
3. Total Float
   Calculates the time of an activity that may be delayed, without affecting the overall project completion schedule.
   The calculation formula of Total float, namely:
   TF = LF (i-j) - EF (i-j) .... (3)

1.4. Earned Value Management

Earned Value Management is a project performance control method that provides project progress information within a certain time period and can estimate the progress of the project over the next period in terms of both cost and project completion time [1].

The basic elements that become the reference in analyzing project performance with Earned Value Management method are as follows [6].

a. BCWS (budgeted cost of work schedule)
   Costs allocated based on the work plan prepared against time.
   The formula for BCWS is
   BCWS = % progress plan x BAC ..... (4)
b. BCWP (budgeted cost of work performed)
   Costs received from completion of work over a specified period of time.
   The formula for BCWP is
   BCWP =% actual progress x BAC ..... (5)
c. ACWP (actual cost of work performed)
   Actual cost of expenditure used to carry out work over a period of time.

For calculations on Earned Value Management (EVM), namely

a. Schedule Variance (SV)
   Value of deviation or difference between BCWS and BCWP. The formula for Schedule Variance is
   SV = BCWP – BCWS ……...(6)
b. Cost variance (CV)
   Value of deviation or difference between BCWP value and ACWP. The formula for Cost Variance is
   CV = BCWP – ACWP ……...(7)
c. Schedule Performance Index (SPI)
   The value of performance efficiency by comparing the value of completed work implementation (BCWP) with planning (BCWS)
   The formula for SPI is.
   SPI = BCWP / BCWS ……...(8)
d. Cost Performance Index (CPI)
   The value of cost efficiency by comparing the value of the completed work implementation (BCWP) with the costs incurred in the same period (ACWP). The formula for CPI is.
   CPI = BCWP / ACWP ……...(9)
e. Estimate To Complete (ETC)
   Predicted residual costs for project work. The formula for Estimate To Complete is.
   ETC = BCWS – BCWP / CPI ……...(7)
f. Estimate At Completion (EAC)
   Predicted cost of final project completion. The formula for Estimate At Completion is.
   EAC = ACWP + ETC……...(10)

1.5. Risk Management

Project risk in risk management is the cumulative opportunity of uncertain possibility, which may affect the project objectives and objectives. Risk management is the prevention of loss. Here are the steps tan in risk management, namely:

1. Risk Identification
2. Probability and Impact Analysis of Risk
3. Risk Handling

1.6. Probability Impact Matrix

Probability Impact Matrix (PIM) is a risk approach that uses two criteria to measure risk:

1. Probability is the possibility that risk will occur.
2. Impact is the impact on the project in case of risk.

Probability Impact Matrix is a matrix that provides a value of risk (very low, low, medium, high, and very high) as measured by probability

and impact scale [4]. To measure the risk can use the formula:

$$R = P \times I \text{ .....(11)}$$

Information :
R = Level of risk importance.
P = Probability of risk will occur.
I = Impact (if impact) occurs.

The probability and impact matrix used is boston square matrix as shown in Figure 3.

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

Figure 3 Probability and Impact Matrix (Boston Square Matrix)

2. CONTENT OF RESEARCH

2.1. Analysis of Project Scheduling

Scheduling analysis is the analysis of the activity of the work required to complete the project in a certain sequence and timing. For the connections between the work project on the development multifunction building Bandung Independent School can be seen in table 1.

Table 1 Connection Between The Work of Project

No	Work of Project	Code	Duration (Week)	Predecessor's Work
A	Preparatory work	A	5	Start
B	Structural Work			
I	Basement Floor Work	B.I	4	Start
II	Ground Floor Work	B.II	4	A, B.I
III	Upper Floor Work	B.III	4	B.II
IV	Roof Floor Work	B.IV	3	B.III
V	Roof Work	B.V	3	B.IV, C.III
C	Architectural Work			
I	Wall Plastering Work	C.I	7	A, B.I
II	Frame, Door And Window Works	C.II	5	A, B.I
III	Ceiling Work	C.III	3	C.I, C.II
IV	Floor And Ceramic Wal Works	C.IV	5	C.I, C.II
V	Painting Works	C.V	3	C.I, C.II
VI	Sanitation Work	C.VI	3	C.IV, C.V
VII	Views And Railing Work	C.VII	5	C.IV, CV
D	Electrical Mechanical Work			
I	Plumbing Work	D.I	4	C.IV, CV
II	Electrical And Electronic Works	D.II	2	B.IV, C.III
E	Building Outside Work			
I	Roadworks	E.I	2	B.V, D.II
II	Landscape Work	E.II	2	E.I
III	Front Fence Works	E.III	2	C.VI, C.VII, D.I
IV	Side Fence Work	E.IV	3	E.II
V	Rear Fence Work	E.V	2	E.III

Based on the table above can be known connection between works of project. After that calculated using forward pass, backward pass, and total float to generate critical path works which can be seen in table 2.

Table 2 Calculation of Critical Path

No	Activity			Duration	ES	EF	LS	LF	TF
	Code	i	j						
1	A	1	3	5	0	5	0	5	0
2	B.I	2	3	4	0	4	1	5	1
3	B.II	3	4	4	5	9	5	9	0
4	B.III	4	7	4	9	13	9	13	0
5	B.IV	7	10	3	13	16	13	16	0
6	B.V	10	15	3	16	19	16	19	0
7	C.I	3	6	7	5	12	5	12	0
8	C.II	5	6	5	5	10	7	12	2
9	C.III	8	10	3	12	15	13	16	1
10	C.IV	6	12	5	12	17	12	17	0
11	C.V	9	12	3	12	15	14	17	2
12	C.VI	12	16	3	17	20	19	22	2
13	C.VII	13	16	5	17	22	17	22	0
14	D.I	14	16	4	17	21	18	22	1
15	D.II	11	15	2	16	18	17	19	1
16	E.I	15	17	2	19	21	19	21	0
17	E.II	17	19	2	21	23	21	23	0
18	E.III	16	18	2	22	24	22	24	0
19	E.IV	19	20	3	23	26	23	26	0
20	E.V	18	20	2	24	26	24	26	0

The critical path network project can be seen in Figure 7.

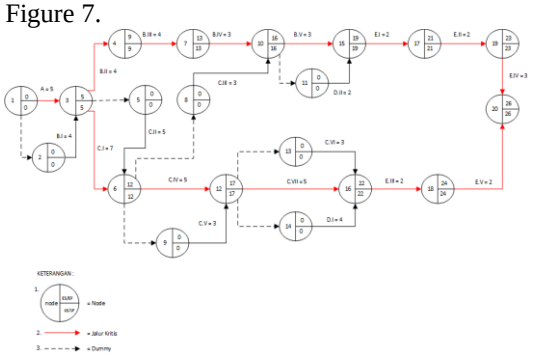


Figure 7 Critical Path Network Project

2.2. Analysis of Project Control

Analysis of project control was the analysis of how big the budget costs incurred with respect to time period based on the project's progress. For project budgets of each works can be seen in table 3.

Table 3 Project Budget

No	Work of Project	Budget (Rp)	Percentage (%)
A	Preparatory work	231.668.325,00	2,08
B	Structural Work		
I	Basement Floor Work	2.687.254.811,12	24,18
II	Ground Floor Work	1.145.354.586,44	10,30
III	Upper Floor Work	1.904.162.151,21	17,13
IV	Roof Floor Work	798.468.460,10	7,18
V	Roof Work	703.904.734,34	6,33
C	Architectural Work		
I	Wall Plastering Work	376.164.402,30	3,38
II	Frame, Door And Window Works	656.615.662,80	5,91

No	Work of Project	Budget (Rp)	Percentage (%)
III	Ceiling Work	324.255.585,25	2,92
IV	Floor And Ceramic Wal Works	619.697.373,00	5,57
V	Painting Works	113.361.410,60	1,02
VI	Sanitation Work	185.096.000,00	1,67
VII	Views And Railing Work	442.917.812,00	3,98
D	Electrical Mechanical Work		
I	Plumbing Work	108.225.000,00	0,97
II	Electrical And Electronic Works	193.925.000,00	1,74
E	Building Outside Work		
I	Roadworks	69.180.950,00	0,62
II	Landscape Work	31.306.200,00	0,28
III	Front Fence Works	111.302.659,35	1,00
IV	Side Fence Work	237.636.884,00	2,14
V	Rear Fence Work	175.276.017,00	1,58
Total		**11.115.774.024,50**	**100.00**

Recapitulation of BCWS, BCWP and ACWP calculation results can be seen in table 4.

Table 4 Recapitulation of Calculation BCWP, BCWS dan ACWP

Weeks	BCWS	BCWP	ACWP
Week -1	Rp. 46.686.250,90	Rp. 373.490.007,22	Rp. 373.400.200
Week -2	Rp. 570.239.207,46	Rp. 769.211.562,50	Rp. 769.050.700
Week -3	Rp. 1.507.298.957,72	Rp. 1.654.027.174,85	Rp. 1.653.616.200
Week -4	Rp. 2.452.139.749,80	Rp. 2.524.392.280,96	Rp. 2.523.821.200
Week -5	Rp. 2.921.225.413,64	Rp. 2.946.791.693,89	Rp. 2.945.476.700
Week -6	Rp. 3.325.839.588,13	Rp. 3.325.839.588,13	Rp. 3.323.881.700
Week -7	Rp. 3.867.177.783,12	Rp. 3.867.177.783,12	Rp. 3.865.182.000
Week -8	Rp. 4.203.985.736,07	Rp. 4.203.985.736,07	Rp. 4.201.882.000
Week -9	Rp. 4.540.793.689,01	Rp. 4.540.793.689,01	Rp. 4.538.632.700
Week - 10	Rp. 5.236.641.142,94	Rp. 4.936.515.244,28	Rp. 4.934.352.700
Week - 11	Rp. 6.051.427.378,94	Rp. 5.747.966.748,07	Rp. 5.745.752.700
Week - 12	Rp. 6.866.213.614,93	Rp. 6.568.310.871,08	Rp. 6.565.952.900
Week - 13	Rp. 7.094.086.982,44	Rp. 6.838.424.179,87	Rp. 6.835.953.400
Week - 14	Rp. 7.559.837.914,06	Rp. 7.299.728.801,89	Rp. 7.297.257.700
Week - 15	Rp. 8.094.506.644,64	Rp. 7.866.633.277,14	Rp. 7.863.490.000
Week - 16	Rp. 8.650.295.345,87	Rp. 8.453.546.145,63	Rp. 8.450.318.700
Week - 17	Rp. 9.146.058.867,36	Rp. 8.975.987.524,78	Rp. 8.972.636.700
Week - 18	Rp. 9.666.277.091,71	Rp. 9.505.098.368,35	Rp. 9.501.387.200
Week - 19	Rp. 10.039.767.098,93	Rp. 9.927.497.781,28	Rp. 9.923.423.000
Week - 20	Rp. 10.273.198.353,44	Rp. 10.206.503.709,30	Rp. 10.202.317.700
Week - 21	Rp. 10.473.282.285,88	Rp. 10.463.278.089,26	Rp. 10.458.905.200

Recapitulation of SV, CV, SPI and CPI calculation results can be seen in table 5.

Table 5 Recapitulation of Calculation SV, CV, SPI dan CPI

Weeks	SV	CV	SPI	CPI
Week - 1	Rp. 326.803.756,32	Rp. 89.807,22	8,00	1,0002
Week - 2	Rp. 198.972.355,04	Rp. 160.862,50	1,35	1,0002
Week - 3	Rp. 146.728.217,12	Rp. 410.974,85	1,10	1,0002
Week - 4	Rp. 72.252.531,16	Rp. 571.080,96	1,03	1,0002
Week - 5	Rp. 25.566.280,26	Rp. 1.314.993,89	1,01	1,0004
Week - 6	Rp. 0,00	Rp. 1.957.888,13	1,00	1,0005
Week - 7	Rp. 0,00	Rp. 1.995.783,12	1,00	1,0005
Week - 8	Rp. 0,00	Rp. 2.103.736,07	1,00	1,0005
Week - 9	Rp. 0,00	Rp. 2.160.989,01	1,00	1,0004
Week - 10	Rp. -300.125.898,66	Rp. 2.162.544,28	0,94	1,0004
Week - 11	Rp. -303.460.630,87	Rp. 2.214.048,07	0,95	1,0003
Week - 12	Rp. -297.902.743,86	Rp. 2.357.971,08	0,96	1,0004
Week - 13	Rp. -255.662.802,56	Rp. 2.470.779,87	0,96	1,0004
Week - 14	Rp. -260.109.112,17	Rp. 2.471.101,89	0,97	1,0003
Week - 15	Rp. -227.873.367,50	Rp. 3.143.277,14	0,97	1,0004
Week - 16	Rp. -196.749.200,23	Rp. 3.227.445,63	0,98	1,0004
Week - 17	Rp. -170.071.342,57	Rp. 3.350.824,78	0,98	1,0004
Week - 18	Rp. -161.178.723,36	Rp. 3.711.168,35	0,98	1,0004
Week - 19	Rp. -112.269.317,65	Rp. 4.074.781,28	0,99	1,0004
Week - 20	Rp. -66.694.644,15	Rp. 4.186.009,30	0,99	1,0004
Week - 21	Rp. -10.004.196,62	Rp. 4.372.889,26	0,99	1,0005

Determine the estimated cost of work left or Estimate to Completion (ETC) is as follows.

ETC = (BAC – BCWP) / CPI
= (11.115.774.024,50 - 10.463.278.089,26) / 1,00
= Rp. 652.223.239,40

Determine the estimated final cost of the project or Estimate at Completion (EAC) is as follows.

EAC = ACWP + ETC
= 10.458.905.200 + 652.223.239,40
= Rp. 11.111.128.439,39

Based on the results of the calculation of the estimated final cost of mobilising project (EAC) was Rp. 11,110,801,135.24. Then the budget needed to complete construction of Multifunction Building Bandung Independent School until week 21 is still less than the cost of the planned budget, with a difference:

Difference Budget = Rp. 11.115.774.024,50 - Rp. 11.111.128.439,39
= Rp. 4.465.585,11

Based on the results of the above calculation, then when the implementation for the job the rest of the project did not experience the delay until the end of project the company had a profit of Rp. 4,465,585.11 from the project budget.

2.3. Risk Analysis Project

Risk analysis used in this study is a qualitative risk analysis. The stages are performed on a risk analysis, namely:

1. Risk Identification

Risk identification is the stage of identifying risks that may interfere with the activity of project implementation as in Figure 6.

Table 6 Risk Identification

No	Code	Type Risk	Variable Risk	Responsible Person
1	R1	External Risk	Bad weather factor	Project Manager
2	R2		Increase in material prices	Project Manager
3	R3		Security disturbance at the project site	Site Manager
4	R4	Supporting Equipment Construction Risk	Damage and loss of materials and equipment	Logistic
5	R5		The equipment does not match the working conditions	Logistic
6	R6	Needs Risk	Incomplete image / design specifications	Site Manager
7	R7		The existence of changes and errors images / design buildings	Project Manager
8	R8	Estimates Risk	Material delivery delay	Logistic
9	R9	Personal Risk	Labor Accidents	Impelementer
10	R10		There are sick field worrs	Impelementer
11	R11		Low field labor productivity	Impelementer
12	R12	Operational Risk	The quality of quality is less	Impelementer
13	R13		Repetition of work	Impelementer

2. Value of Probability and impact of Risks

After the stage of identification of risks that may occur on the project of building a versatile Bandung Independent School, further risks-the risk is assessed by project manager at PT. Tujuh Pilar Sarana on a questionnaire by providing a scale value of 1 to 5, which is given as in table 7.

Table 7 Value of Probability and impact Risks

No	Type Risk	Variable Risk	Code	Probability	Impact
1	External Risk	Bad weather factor	R1	4	4
2		Increase in material prices	R2	5	5
3		Security disturbance at the project site	R3	3	3
4	Supporting Equipment Constructio n Risk	Damage and loss of materials and equipment	R4	3	3
5		The equipment does not match the working conditions	R5	4	4
6	Needs Risk	Incomplete image / design specifications	R6	3	3
7		The existence of changes and errors images / design buildings	R7	2	2
8	Estimates Risk	Material delivery delay	R8	3	3
9	Personal Risk	Labor Accidents	R9	4	4
10		There are sick field worrs	R10	3	4
11		Low field labor productivity	R11	3	4
12	Operational Risk	The quality of quality is less	R12	3	4
13		Repetition of work	R13	5	5

3. Level of Risk

After determining the value of the probability and impact of risks, then determine the value of the level of risk using risk matrix in Figure 3 can be seen in table 8.

Table 8 Value Level of Risk

Code	Probability	Impact	Value Level	Risk Level
R1	4	4	16	High
R2	5	5	25	High
R3	3	3	9	Moderate
R4	3	3	9	Moderate
R5	4	4	16	High
R6	3	3	9	Moderate
R7	2	2	4	Low
R8	3	3	9	Moderate
R9	4	4	16	High
R10	3	4	12	Moderate
R11	3	4	12	Moderate
R12	3	4	12	Moderate
R13	5	5	25	High

4. Risk Handling

Based on the results of the above risk assessment, then the next preparing action against the risk of handling. The handling of risks derived from the results of the discussion with project manager at PT. Tujuh Pilar Sarana. As for handling actions against each of those risks can be seen in table 9.

Table 9 Risk Handling

No	Code	Level Risk	Handling	Responsible Person
1	R1	High	Maintain the continuity of the project and if it is not possible to ma additional hours for work.	Project Manager
2	R2	High	Conducting price agreement to owner or supplier.	Project Manager
3	R3	Moderate	Perform security protection during the project.	Site Manager
4	R4	Moderate	Improved oversight and job responsibilities.	Logistic
5	R5	High	Performing identified equipment work first.	Logistic
6	R6	Moderate	Checking or requesting completeness of the drawing / design first.	Site Manager

No	Code	Level Risk	Handling	Responsible Person
7	R7	Low	Ma a clear initial agreement, when contract.	Project Manager
8	R8	Moderate	Coordinate with Supplier.	Logistic
9	R9	High	Provide guidance to worrs to prioritize safety	Impelementer
10	R10	Moderate	Utilizing the existing tbsp with the addition of working hours.	Impelementer
11	R11	Moderate	Conduct clear supervision and direction on the workforce	Impelementer
12	R12	Moderate	Checking the quality of the project thoroughly.	Impelementer
13	R13	High	Checking for completed work.	Impelementer

2.4. Analysis of Human Resource Project

Human resources project is an employee of staholders who have an interest and become involved in the project. Multifunction Building Project for Bandung Independent School implementation time starts from 1 January 2017 until 29 June 2017. Below is a diagram of the RACI human resources project involved in the multifunction building project for Bandung Independent School obtained from the project's organizational structure and human resources projects such as in Figure 6.

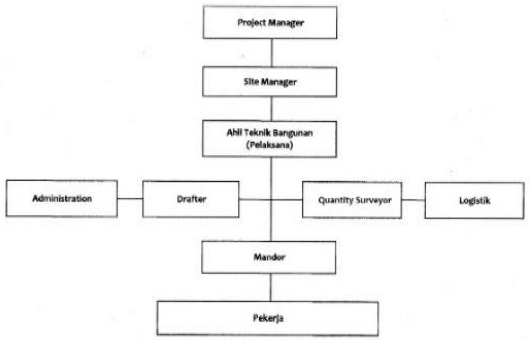


Figure 6 Organizational Structure Project

For human resources project can be seen in table 10.

Table 10 Human Resource Project

No	Employee Name	Potition
1	Dany	Project Manager
2	Nuslih	Site Manager
3	Ceisar	Implementer
4	Ade S.	Logistic
5	Ane	Administration
6	Yunanti	Drafter
7	Budin	Quantity Surveyor

RACI diagram for human resources project can be seen in table 11.

Tabel 11 RACI Diagram for Human Resources Project

No	Work of Project	Human Resources Project						
		Dany	Nuslih	Ceisar	Ade	Ane	Yunanti	Budin
A	Preparatory work	I, C, A	I, C, A	R	R	R	C	C
B	Structural Work							
I	Basement Floor Work	I, C, A	I, C, A	R	R	R	C	C
II	Ground Floor Work	I, C, A	I, C, A	R	R	R	C	C
III	Upper Floor Work	I, C, A	I, C, A	R	R	R	C	C
IV	Roof Floor Work	I, C, A	I, C, A	R	R	R	C	C
V	Roof Work	I, C, A	I, C, A	R	R	R	C	C
C	Architectural Work							
I	Wall Plastering Work	I, C, A	I, C, A	R	R	R	C	C
II	Frame, Door And Window Works	I, C, A	I, C, A	R	R	R	C	C
III	Ceiling Work	I, C, A	I, C, A	R	R	R	C	C
IV	Floor And Ceramic Wal Works	I, C, A	I, C, A	R	R	R	C	C
V	Painting Works	I, C, A	I, C, A	R	R	R	C	C
VI	Sanitation Work	I, C, A	I, C, A	R	R	R	C	C
VII	Views And Railing Work	I, C, A	I, C, A	R	R	R	C	C
D	Electrical Mechanical Work							
I	Plumbing Work	I, C, A	I, C, A	R	R	R	C	C
II	Electrical And Electronic Works	I, C, A	I, C, A	R	R	R	C	C
E	Building Outside Work							
I	Roadworks	I, C, A	I, C, A	R	R	R	C	C
II	Landscape Work	I, C, A	I, C, A	R	R	R	C	C
III	Front Fence Works	I, C, A	I, C, A	R	R	R	C	C
IV	Side Fence Work	I, C, A	I, C, A	R	R	R	C	C
V	Rear Fence Work	I, C, A	I, C, A	R	R	R	C	C

At the time of implementation the multifunction building project of Bandung Independent School. Company gets new projects such as Project X with a time of execution of the project in conjunction with the construction of the Multipurpose Building at Bandung Independent School.

Based on the above table, then when the company has a new project, such as Project X, the company should hire employees as part of the site manager, implementer, drafter, and so that quantity surveryor focus for the completion of the project work can be more under control so as not to interfere with the implementation of the work in other projects.

2.5. User Analysis

Analysis of the characteristics of the user is a user that will be using the construction project management information system in PT. Tujuh Pilar Sarana. As contained in table 12.

Table 12 User Analysis

User	Responsible	Level of Education	Experience
Project Manager	Open projects, create project budgets and manage project risks.	Min. S1	Must be able to operate computer and can use browser.
Site Manager	Ma details of project cost budget, project schedule and project progress evaluation report.	Min. S1	Must be able to operate computer.
Implementer	Create daily reports and Weak project.	Min. D3	Minimal must be able to operate computer.
Logistic	Processing material order data.	Min. D3	Minimal must be able to operate computer.
Administration	Create a project expenditure report.	Min. D3	Minimal must be able to operate computer.

2.6. Functional Analysis

A functional analysis is an analysis of the needs in the data or information.
For use case diagram can be seen in Figure 7.

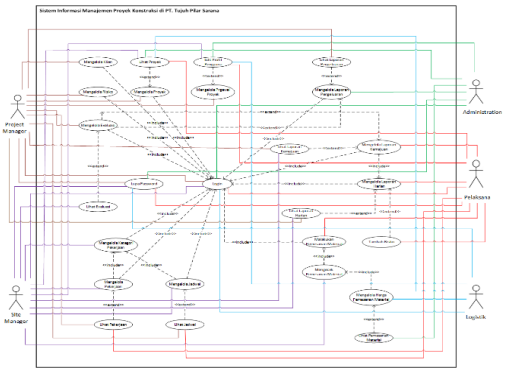


Figure 7 Use Case Diagram

For class diagrams can be seen in figure 8.

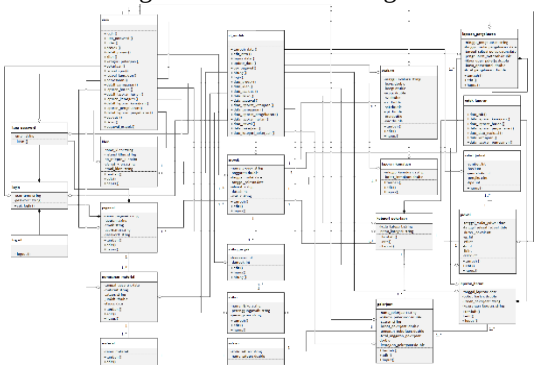


Figure 8 Class Diagram

2.7. Design of data

Design of data is application of conceptual models into the model database will be used in construction project management information systems at PT. Tujuh Pilar Sarana. For the design of data, namely scheme relations can be seen in Figure 9.

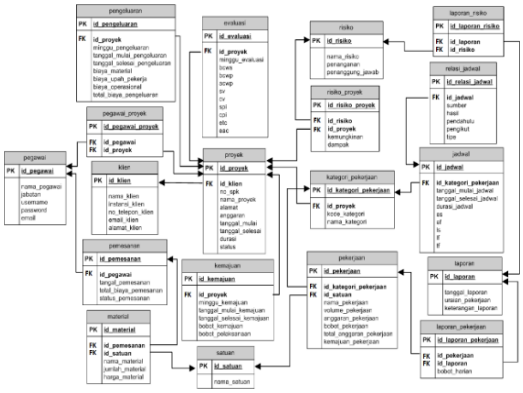


Figure 9 Scheme Relation

2.8. Design Interface

The design of the interface is a picture of the interface that will be used by users to interact with the construction project management information system at PT. Tujuh Pilar Sarana.

For the design of project manager interface can be seen in figure 10.

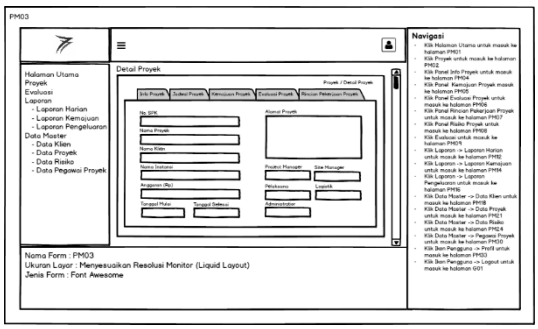


Figure 10 Interface Project Manager

For the design of site manager interface can be seen in figure 11.

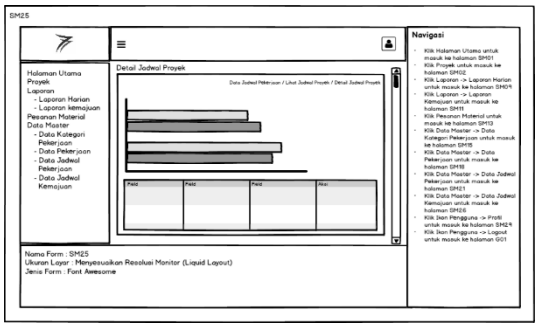


Figure 11 Interface Site Manager

For the design of implementer interface can be seen in figure 12.

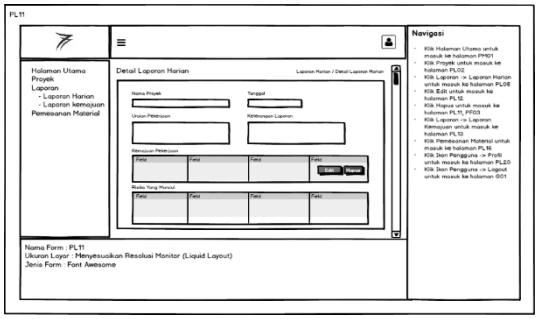


Figure 12 Interface Implementer

For the design of logistic interface can be seen in figure 13..

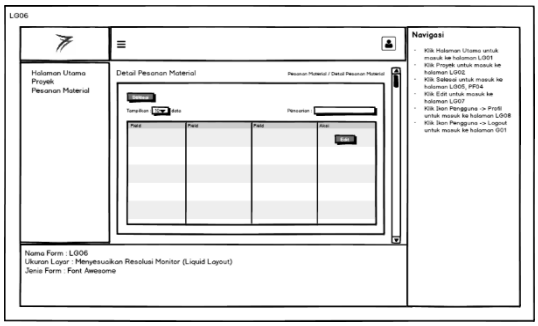


Figure 13 Interface Logistic

For the design of administration interface can be seen in figure 14.

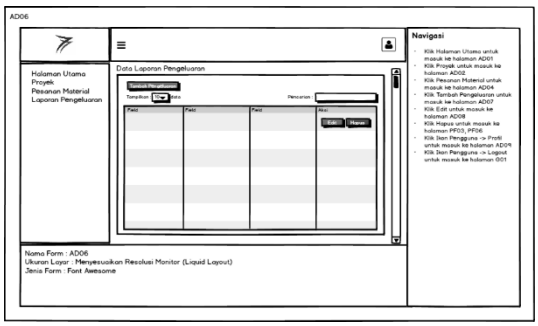


Figure 14 Interface Administration

2.9. Black Box Testing Conclusions

Based on the results of testing the system black box has done overall conclusion that obtained in the process of application of construction project management information system in PT. Tujuh Pilar Sarana in the functionality of the system can already produce the expected output as the overall data management process is already good, print process daily reports, weekly progress reports, expense reports, data, details of the work and budget data and processes of delivery schedule error information in the form of the error message on the display interface system already as expected.

2.10. Beta Testing Conclusions

Based on the results of beta testing, then it can be inferred that the construction project management information system in PT. Tujuh Pilar Sarana can already simplify part project manager, site manager, implementer, logistics and administration in the management of project data overall, the management of scheduling, supervision of project progress on performance reports daily, weekly and the expenditure of the project, the process of evaluation and control of the project, the process of ordering materials already processed by the logistics section become easier and faster as well as the look of the interface system is already good.

3. CLOSING

Based on the results obtained in this study, it can be concluded as follows.

1. The built information system has been able can assist the site manager in performing project scheduling by displaying the schedule of gantt chart and critical path method (CPM) method to get critical job to assist in determining job focus and job recommendation which should not be postponed when project implementation tas place.
2. The built information system has been able to assist the project manager in project supervision of reports received from each part involved in the project and in the process of evaluating project control using earned value management (EVM) method to see how much high of progress and expenses incurred during implementation with project planning.
3. The information system built has been able to assist the project manager in managing the risk and can show the level of each risk has been identified with the method of probability impact matrix (PIM) so that it can be used as a reference when project implementation tas place.

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