DEVELOPMENT PROJECT MANAGEMENT INFORMATION SYSTEM AT PT. SAEKAN BUMI PERSADA

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ABSTRACT

Project Management has become a fundamental way for a company to optimize project time, cost and risk. Based on the analysis that has been done and supported by the results of interviews conducted with Mr. Fitra K. Rahmawan, ST, MT as Chief of Geotechnical Associations PT.Saekan Bumi Persada explained that the Project for Dining Room and Hall Building which started on July 11, 2011 and is scheduled to finish on March 12, 2012 This project is already running, but it has been delayed in the 4th week from the original work plan of 10.69%, only realized 6,971% and experiencing delays of 3,718%. The project is delayed due to several factors such as ordering goods that are not in accordance with the specifications, late material coming, missing material, less material, defective material, human error, miscalculation, mismanagement, installation error, access to non-support project environment, overload, broken wires, labor accidents. Based on the problems presented, the solution to assist the Chief of Geotechnical Guard in controlling project implementation time, using Precedence Diagramming Method (PDM) method, and estimating and controlling cost and time of project using Earned Value Management (EVM) method, and for project risk risk using method of Failure Mode Effect Analysis (FMEA).

Based on the explanation that has been presented then the need for the system to handle the project planning schedule, cost control and time, risk management.

Keywords: Project Management, PDM, EVM, FMEA

1. INTRODUCTION

Project Management has become a fundamental way for a company to optimize project time, cost and risk. Project management software has the capacity to help plan, organize and manage resources. The process of planning, implementing and managing the project will take time because it has to map out all the important steps to be understood by all the teams involved in the project, especially when it comes to large projects that take a lot of time to complete, project management roles will be helpful as having access to data and following who is responsible so as to provide information and determine the important task for each project team and the performance that has been done.

Based on the analysis that has been done and supported by the results of interviews conducted with Mr. Fitra K. Rahmawan, S. T., M. M. as Chief of Geotechnical Associations PT.Saekan Bumi Persada explained that, in the implementation of project projects often occur delays. The Project for the Construction of the Dining Room and Hall which started on July 11, 2011 and is scheduled for completion on March 12, 2012 The project is already underway but has been delayed by the 4th week from the previous work plan of 10.69%, 6.971% realization and 3.718% delay. The project is delayed due to several factors such as ordering goods that are not in accordance with the specifications, late material coming, missing material, less material, defective material, human error, miscalculation, mismanagement, installation error, access to non-support project environment, overload, broken wires, labor accidents. The delay of the project will have a direct impact on the company's operations, cost control, and time of the project so that the company suffers a loss or gets sanctioned from the project owner for violating the specified time limit.

The purpose of this research, to build a project management information system at PT. Saekan Bumi Persada. While the objectives in the study, are as follows:

1. Assisting the Chief of Geotechnical Guard as the project responsible for handling project scheduling so that the process of work in accordance with what has been scheduled.
2. Assisting the Chief of Geotechnical Guard as the project manager in charge of the project performance control so that the funds issued in accordance with what has been done.
3. Assisting the Chief of Geotechnical Guard as the project responsible for analyzing the opportunity of emergence of field risks that are often ignored to be factors that greatly affect the project delay, and prepare for mitigation.

2 RESEARCH CONTENT

2.1 Project

The project is a combination of resources such as human, material and equipment and capital/costs gathered in a temporary organization vessel to achieve goals and objectives [1]. the project can be assumed as something big to determine how to complete a job. Some project characteristics can be summed up among others [1]:

1. Work is not routinely involved.
2. Planning is required.
3. Specific objectives can be viewed or specific products to be made.
4. Work completed by several people.
5. Work completed in several phases.
6. Resources that can be used in projects are limited.
7. The project is large and complex.

Project Management is the application of science, skills, and skills, the best technical means and with limited resources, to achieve the goals and objectives that have been determined in order to obtain optimal results in terms of performance, cost and quality and time and safety. 2].

2.2. Method Precedence Diagramming Methode (PDM)

PDM was developed in the 1960s by the United States navy in collaboration with Professor Dr. John Fondahl from Stanford University to develop a CPM calculation method that will also solve the use of "Dummy" dependencies. Professor Dr. John Fondahl reversed the AOA diagram method to the traditional AON method known as the Precedence Method. At first there was only FS relationship. Dr. Proposal Fondahl was published around 1977 in Western Construction. Precedence diagram is actually a relic / development of the bar chart. In the PDM method the activity time scale and calendar are placed at the top, this of course shows the schedule instead of logic diagrams that are not time scale or have calendar lines. In the 1980-2000 period the capabilities of the computer expanded so that many additional attributes were added to the basic PDM network of program analysis, such as some relationship types, lag and lead time values on dependencies, multiple calendars, and some resources on the activities. The use of these functions really requires a high level of training and experience in construction scheduling. Excess Precedence Diagram Method (PDM) compared to CPM is PDM does not require fictitious / dummy activity so networking becomes simpler. This is because different overlapping relationships can be created without increasing the number of activities. The purpose of advanced calculations on PDM is to determine the earliest start time (Early Start) that occurred. the provisions in advanced calculations are as follows [3]:

1. Looking for value of Earliest Finish Time (EF)
   EF = ES + d
2. Looking for slack value (SL)
   SL = ES (next node) –EF
3. Looking for value Latest Start Time (LS)
   LS = SL + ES
4. Looking for value Latest Finish Time (LF)
   LF = LS + d

Where a case of work is solved using only one way of forward direction calculation only if the case has only one path is the critical path, which where each initial work must be completed before continuing the next job and the next job can not start before the previous work is completed.

2.3. Earned Value Management Method

This method uses the S curve as the information display with the X axis indicating the project duration and Y axis to express the cumulative cost. Where the advantages of this method are as follows: Display information methods earned value is more progressive than the conventional S curve. This method can predict cost and time losses based on slowly progressing work, so that additional project duration and final cost can be calculated by systematic approach [3].

There are 3 indicators in informing the progress of the project:

1. BCWS (Budgeted Cost of Work Shedule), describes the budget plan up to a certain period of volume of the project plan to be done.
2. BCWP (Budgeted Cost of Work Performed), describes the project plan budget for a certain period of what has been done on the actual volume of work.
3. ACWP (Actual Cost of Work Performed), describes actual budget spent on job execution on the actual job volume.

The formula to find the weight value of a job is as follows:

Weight =
(Employment Price) / (Total work price) X 100%

When viewed from the amount of work completed it means that this method measures the size of the completed work unit, at a time when judged by the amount of budget provided it is known the relationship between what has actually been achieved physically to the amount of budget that has been issued [3]. To find out the value of Budget Cost of Work Schedule (BCWS) is as follows:

BCWS = (% Completion) × (Budget)

The formula used to determine the deviation schedule or time is as follows:

SV = BCWP – BCWS

If the value of SV> 0, the actual progress> plan: acceleration of the project to the plan (chedule underrun). If the value of 2.7 SV <0, the actual progress <plan: there is a delay in the project to the plan (chedule overrun).

SPI = BCWP / BCWS

If the value of SPI> 1, the actual progress> plan: the project acceleration occurs against the plan (Schedule underrun). If the SPI value <1, the actual progress <plan: there is a delay in the project against the plan (Schedule overrun).

The formula used to determine the cost is as follows:

CV = BCWP-ACWP

If the value is CV> 0, the actual volume cost> actual cost (Cost Underrun). If nil ai CV <0, actual cost of volume <actual cost (Cost Overrun).

Variable that can be used to estimate cost at project time completed based on project performance until a certain time.

CPI = BCWP / ACWP

If the CPI value is> 1, the actual progress> plan: the project accelerates to the plan (Schedule underrun). If the CPI value <1, the actual progress <plan: there is a delay in the project against the plan (Schedule overrun).

The Estimated Completion Date estimation formula can be calculated in the following way:

ECD = ((Time remaining) / SPI) + Used Time

Where :
ECD = Estimated Completion Date
SPI = Schedule Performance Index

The formula of acceleration calculation or project delays can be calculated using the following formula:

Percentage of acceleration or delay
= 100% - (ECD / SchedulePlan) * 100%

The Estimated at Completion cost estimation formula can be calculated in the following way:

EAC = Time Budget / CPI + ACW
Or
EAC = ((Total Cost-BCWP)) / (CPI + ACWP)

The Percentage Actual Increase Cost / Actual Cost can be calculated using the following formula:

Percentage of additional or decrease cost = 100% - (EAC / Total Cost) * 100%
EV = BCWP

2.4. Method FMEA (Failure Mode and Effects Analysis)

FMEA was inaugurated in 1949 by the US armed forces with the introduction of MIL-P 1629 Procedures to effect the failure mode and criticality analysis. The objective is to classify the failure of "In accordance with its impact on the mission of success and security of personnel / equipment. Later in adoption in the Apollo space program to reduce the risk due to the small sample size being too small the use of FMEA gained momentum during the 1960s. FMEA can identify and address security concerns prior to any potential catastrophe [4].

FMEA is a method designed to:

1. Identify and fully understand the potential failure modes and their causes, and the impact of failures on the system or end users, for certain products or processes.
2. Assess risks associated with identified failure modes, effects and causes, and prioritizes corrective action issues.
3. Identify and take corrective action to address the most serious concerns

2.5. Project Management Flow Analysis PT. Saekan Bumi Persada.

Analysis of project management at PT.Saekan Bumi Persada takes data on the construction of the dining room and hall located at Jl. Tanjung Kayu Batu No.06 Tanjung Ria Jayapura in 2011 with project implementation time 22 weeks with a time delay of 3 weeks from the scheduled schedule with total budget cost Rp. 5,341,238,000 (Five Billion Three Hundred Forty One Million Two Hundred and Three Thousands of Rupiah Thousand Rupiah).

NO.	URAIAN PEKERJAAN	KONTRAK
I	PEKERJAAN PERSIAPAN	110.528.957,15
II	PEKERJAAN PENYIAPAN LAHAN	244.566.833,50
III	PEKERJAAN STRUKTUR	2.787.373.172,49
IV	PEKERJAAN ARSITEKTUR	1.455.082.974,21
V	PEKERJAAN MEKANIKAL & ELEKTRIKAL	218.907.144,35
VI	PEKERJAAN LAIN-LAIN	14.774.727,56
VII	PEKERJAAN SALURAN BEL/SAMP.BANGUNAN	24.437.212,80
	REAL COST	4.855.671.022,06
	PPN 10 %	485.567.102,21
	TOTAL COST FISIK	5.341.238.124,26
	PEMBULATAN	5.341.238.000,00

Figure 1. The Cost of the Dining Room and AULA Development Project

Analysis of project management at PT. Saekan Bumi Persada is to provide a picture of project management analysis flow which can be seen as follows:

2.6. Analysis of Earned Value Management (EVM)

Analysis of time and cost of the project used a method of Earned Value Management (EVM). This method is used to measure against time and cost in the construction of dining room and hall located at Jl. Tanjung Kayu Batu No.06 Tanjung Ria Jayapura in 2011 with the project implementation time of 25 weeks with total budget cost Rp. 5,341,238,000 (Five Billion Three Hundred Forty One Million Two Hundred and Three Thousands of Rupiah Thousand Rupiah).
The Budget Cost For Work Schedule (BCWS) is derived from the workload carried out in the project execution schedule multiplied by the cost budget plan (RAB) then accumulated on a weekly basis.

Table 1. BCWS first week

Total Anggaran proyek (BAC)	Rp. 5.341.238.000
% Penyelesaian minggu pertama	4.875 %
BCWS	4.875% x Rp. 5.341.238.000
Total	**Rp. 260.385.353**

Budget cost for work performed (BCWP) is a calculation of the cost used for a certain period and set in the budget an actual volume of work. The calculation of BCWP is derived from the actual weight of all work multiplied by the amount of contract value. Then accumulated every week. The actual weight of all work is obtained from the project progress report.

Table 2. First week BCWP

Total Anggaran proyek (BAC)	Rp. 5.341.238.000
% Penyelesaian minggu pertama	4.875 %
BCWP	4.875% x Rp. 5.341.238.000
Total	**Rp. 260.385.353**

Actual cost of work performed (ACWP) is a representation of the total expenditure incurred to complete the work within a certain period. ACWP value is obtained based on expenditure data from work that has been carried out the construction of dining room and hall located at Jl. Tanjung Kayu Batu No.06 Tanjung Ria Jayapura in 2011.

Table 3. ACWP Calculation Analysis

Analisis Perhitungan ACWP				
Minggu ke	Bobot Prestasi %	Bobot Prestasi Kumulatif	Laporan Keuangan Mingguan	ACWP
Minggu 1	4,875	4,875	Rp132.909.345	Rp132.909.345
Minggu 2	0,11	4,886	Rp120.362.787	Rp253.272.132
Minggu 3	0,621	5,507	Rp40.321.352	Rp293.593.484
Minggu 4	0,772	6,279	Rp32.343.778	Rp325.937.262
Minggu 5	0,693	6,971	Rp120.322.877	Rp446.260.139
Minggu 6	3,496	10,467	Rp210.220.345	Rp656.480.484
Minggu 7	8,49	18,957	Rp13.900.234	Rp670.380.718

Scheduling Variance (SV) is used to calculate the deviations between BCWS and BCWP. A positive score indicates that the project work packages that are executed outweigh the plans. Conversely, negative values indicate poor job performance because the work packets that are accomplished are less than the planned schedule.
BCWP = Rp. 260.385.353
BCWS = Rp. 260.385.353
SV = Rp. 260.385.353 - Rp. 260.385.353 = Rp.0

Table 4. Anilisis deviation Schedule time (SV)

No	Minggu ke-	BCWS	BCWP	SV
1	Minggu ke-1	Rp260.385.353	Rp260.385.353	Rp. 0
2	Minggu ke-2	Rp260.972.889	Rp260.972.889	Rp. 0
3	Minggu ke-3	Rp294.141.977	Rp294.141.977	Rp. 0
4	Minggu ke-4	Rp335.429.746	Rp335.429.746	Rp. 0
5	Minggu ke-5	Rp370.978.342	Rp372.337.701	**- Rp. 198.640.641**
6	Minggu ke-6	Rp851.393.337	Rp559.227.619	**- Rp. 292.165.718**

Cost Variance (CV) is the difference between the value obtained after the package work package with the actual cost that occurred during the implementation of the project. The negative number in the cost variance indicates that the higher cost of the budget is called cost overrun. A zero indicates that the work is performed at a cost. While the positive number means the work is done at a cost less than the budget, called cost underrun.

CV = BCWP – ACWP

Table 5. Anilisis calculation CV (Cost Variance)

No	Minggu ke-	BCWP	ACWP	CV
1	Minggu ke-1	Rp260.385.353	Rp132.909.345	Rp127.476.008
2	Minggu ke-2	Rp260.972.889	Rp253.272.132	Rp7.700.757
3	Minggu ke-3	Rp294.141.977	Rp293.593.484	Rp548.493
4	Minggu ke-4	Rp335.429.746	Rp325.937.262	Rp9.492.484
5	Minggu ke-5	Rp372.337.701	Rp446.260.139	**-Rp73.922.438**
6	Minggu ke-6	Rp559.227.619	Rp656.480.484	**-Rp97.252.865**

The schedule performance index (SPI) is to determine a time performance index value calculated using the equation of the formula.

BCWP = Rp. 260.385.353

BCWS = Rp. 260.385.353

SPI = Rp. 260.385.353 ÷ Rp. 260.385.353 = 1

Tabel 6. Anilisis perhitungan Schedule performance index (SPI)

No	Minggu ke-	BCWP	BCWS	SPI
1	Minggu ke-1	Rp260.385.353	Rp260.385.353	1
2	Minggu ke-2	Rp260.972.889	Rp260.972.889	1
3	Minggu ke-3	Rp294.141.977	Rp294.141.977	1
4	Minggu ke-4	Rp335.429.746	Rp335.429.746	1
5	Minggu ke-5	Rp372.337.701	Rp570.978.342	**0,65**
6	Minggu ke-6	Rp559.227.619	Rp851.393.337	**0,65**

To determine the value of the cost performance index or the so-called Cost Performance Index (CPI) can be calculated using the equation of formula 2.11. As for example calculation Cost Performance Index (CPI) is as follows.

BCWP = Rp. 260.385.353
ACWP = Rp132.909.345
CPI = Rp. 260.385.353 ÷ Rp132.909.345 = 1.95912

Based on the calculation analysis that has been done, can be seen that the project completion time will be late or faster and the cost incurred will be excessive or less than budgeted. In addition, project progress for the foreseeable future also needs to estimate the time and cost of completion.

ECD (Estimate to Complete Date) is an estimated project completion time. ECD formula = (Time Time / SPI) + Time has passed.
ECD (Estimate to Complete Date) at week 1
Remaining Time = 24 Weeks
SPI = 1
Time has passed = 1 Week
ECD = (24/1) + 1
= 25 weeks

Table 7. Anilisis calculation Schedule performance index (SPI)

No	Minggu ke-	Sisa Waktu (Minggu)	SPI	Waktu telah dilalui	ECD (Minggu)
1	Minggu ke-1	24	1	1	25
2	Minggu ke-2	23	1	2	25
3	Minggu ke-3	22	1	3	25
4	Minggu ke-4	21	1	4	25
5	Minggu ke-5	20	**0,65**	5	35,769 ≈ 36
6	Minggu ke-6	19	**0,65**	6	35,230 ≈ 35

To find out the estimated cost required to complete the project, can be done by looking for the value of EAC (Estimate at Completion) by using equation of formula 2.13. The example calculation is as follows

EAC (Estimate at Complete) Week 1
BAC = Rp. 5.341.238.000
CPI = 1.96
EAC = Rp. 5.341.238.000 ÷ 1.96
= Rp 102.998.200,952

Table 8. Estimated Project Completion Costs

No	Minggu ke-	BAC	CPI	EAC
1	Minggu ke-1	Rp. 5.341.238.000	1,96	Rp. 2.725.121.429
2	Minggu ke-2	Rp. 5.341.238.000	1,03	Rp. 5.185.667.961
3	Minggu ke-3	Rp. 5.341.238.000	1,00	Rp. 5.341.238.000
4	Minggu ke-4	Rp. 5.341.238.000	1,03	Rp. 5.185.667.961
5	Minggu ke-5	Rp. 5.341.238.000	**0,83**	Rp. 6.435.226.506
6	Minggu ke-6	Rp. 5.341.238.000	**0,85**	Rp. 6.283.809.412

From the above calculation it can be concluded that the estimated cost required to complete the project starting from week 1 to week 4 does not exceed the total project cost budget. While the estimated cost of project completion starting from week 5 then experiencing excess project cost from the budgeted Rp. 5,341,238,000. This is because during the 5th week the project experienced time delays and project cost overruns.

Calculation Result of Earned Value Management Method.

Minggu	Analisis Varian		Analisis Kinerja		Analisis Estimasi	
	Waktu SV	Biaya CV	Waktu SPI	Biaya CPI	Waktu ECD (minggu)	Biaya EAC
Minggu ke-1	Rp. 0	Rp127.476.008	1	1,96	25	Rp. 2.725.121.429
Minggu ke-2	Rp. 0	Rp7.700.757	1	1,03	25	Rp. 5.185.667.961
Minggu ke-3	Rp. 0	Rp548.493	1	1,00	25	Rp. 5.341.238.000
Minggu ke-4	Rp. 0	Rp9.492.484	1	1,03	25	Rp. 5.185.667.961
Minggu ke-5	- Rp. 198.640.641	-Rp73.922.438	0,65	0,83	35,769 ≈ 36	Rp. 6.435.226.506
Minggu ke-6	- Rp. 292.165.718	-Rp97.252.865	0,65	0,85	35,230 ≈ 35	Rp. 6.283.809.412

the results of the above calculation analysis can be concluded that in the first week until the 4th week the project has been running in accordance with the plan, both in terms of project implementation schedule and project cost. However, at the 5th week the project is experiencing delays from the

planned schedule and experiencing budgeted excess cost. This project should be completed by the 25th week but due to the delay in the project is estimated to be completed by 35 weeks, it means the project is delayed for 10 weeks. In addition, this project should cost Rp. 5,341,238,000 but due to the delay of this project is estimated to cost Rp. 6,283,809,412. So it can be concluded that the project menglami loss of Rp. 942.571.412.

2.7. Analysis of Failure Mode Effect Analysis (FMEA).

Failure Mode Effect Analysis (FMEA) is a method used to identify and eliminate errors or deviations in a project. This is a qualitative method and the results are displayed in a table. The result may be the cause of the failure, effect, frequency, severity, probability and recommended countermeasures.

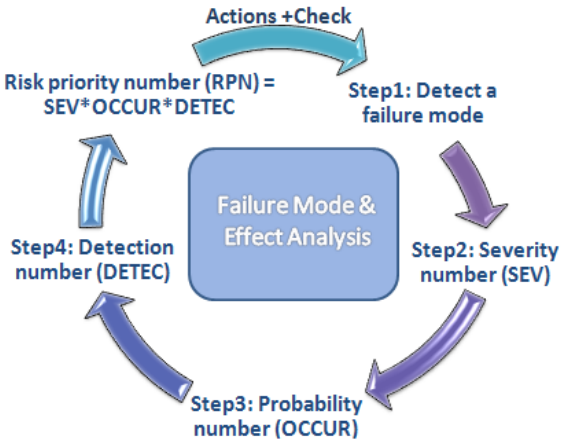


Figure 1. FMEA Cycle

Based on FMEA analysis and interview result with Mr. Fitra K. Rahmawan, S.T., M.T explained the severity for risk risk that happened as follows:

Severity Scale

Effect	Kriteria Kejadian	Skala
Sangat Tinggi	Efek kegagalan yang sangat parah	5
Tinggi	Efek kegagalan yang parah	4
Sedang	Efek kegagalan yang jarang parah	3
Kecil	Efek kegagalan yang sedikit parah	2
Sangat Kecil	Efek kegagalan yang tidak parah	1

Based on FMEA analysis and interview result with Mr. Fitra K. Rahmawan, S.T., M.T explain the incidence rate for the risks that occur as follows:

Scale of Occurrence (Occurance)

Effect	Kriteria Kejadian	Skala
Sangat sering terjadi	Kegagalan yang tidak dapat dihindarkan	5
Sering terjadi	Kegagalan yang sering terjadi berulang-ulang	4
Biasa terjadi	Kegagalan yang biasa terjadi	3
Jarang terjadi	Kegagalan yang terjadi beberapa kali saja	2
Sangat jarang terjadi	Kegagalan yang sangat jarang terjadi	1

Based on FMEA analysis and interview result with Mr. Fitra K. Rahmawan, S.T., M.T explained the detection rate for risk risk that occurred as follows:

Scale Detection (Detection)

Effect	Kriteria Kejadian	Skala
Tidak terdeteksi	Kemungkinan kegagalan terdeteksi lebih awal : tidak terdeteksi	5
Jarang terdeteksi	Kemungkinan kegagalan terdeteksi lebih awal : sangat rendah	4
Biasa terdeteksi	Kemungkinan kegagalan terdeteksi lebih awal : rendah	3
Terdeteksi	Kemungkinan kegagalan terdeteksi lebih awal : tinggi	2
Sangat terdeteksi	Kemungkinan kegagalan terdeteksi lebih awal : sangat tinggi	1

RPN calculation:
RPN = Severity x Occurance x Detection

No	Risiko	Kode Risiko	*Severity*	*Occurance*	*Detection*	RPN
1.	Cuaca yang tidak dapat diprediksi	R1	4	4	4	64
2.	Material bahan yang tidak sesuai dengan spesifikasi	R2	3	3	3	27
3.	Material terlambat datang	R3	3	4	3	36
4.	Material hilang	R4	4	4	4	64
5.	Material kurang	R5	4	4	3	48
6.	Material rusak	R6	4	5	3	60
7.	*Human Error*	R7	4	4	3	48
8.	Salah perhitungan	R8	5	4	4	**80**
9.	Kesalahan pelaksanaan	R9	5	4	3	60
10.	Kesalahan instalasi	R10	5	4	4	**80**
11.	Akses menuju lingkungan proyek yang tidak mendukung	R11	3	3	3	27
12.	Macet	R12	3	4	3	36
13.	Kelebihan muatan	R13	3	3	3	27
14.	Kabel putus	R14	3	3	3	27

Based on the above calculation obtained RPN value to determine the level of risk priority. The total RPN value is aggregated to get the value

Total RPN = 684
Average = 684/14 = 48.86

After getting the total value of RPN, then get the average RPN as above calculation. The average RPN score is 48.86. Then the information obtained is the risks that produce values above the average value of 48.86 is a list of risks that have a high priority level is a risk that has a risk code R1, R4, R6, R8, R9, and R10, so that required mitigation or appropriate handling to reduce high risk priority levels.

Table 9. Risk Handling

No	Risiko	Kode Risiko	Level Risiko	Penanganan Risiko
1.	Cuaca yang tidak dapat diprediksi	R1	Tinggi	Berdasarkan monitoring perkiraan cuaca dari BMKG sehingga bisa didapatkan dua proses yaitu menghentikan pekerjaan yang terpengaruh cuaca dan mengerjakan pekerjaan lain yang tidak terpengaruh dengan cuaca. Apabila kondisinya sedang hujan maka menyewa pawang hujan.
4.	Material hilang	R4	Tinggi	1. Melakukan *stock opname* apabila telah selesai melakukan suatu pekerjaan 2. Material bahan yang hilang akan dibebankan kepada petugas yang melakukan penjagaan barang
6.	Material rusak	R6	Tinggi	1. Apabila kondisi rusak saat di proses pengiriman, maka akan dibebankan kepada *supplier* material 2. Apabila kerusakan terjadi pada saat penyimpanan, maka kerugian dibebankan kepada perusahaan
8.	Salah perhitungan	R8	Tinggi	Melakukan pengecekan ulang agar meminimalisir kesalahan dalam perhitungan
9.	Kesalahan pelaksanaan	R9	Tinggi	Memberikan laporan pekerjaan proyek agar terawasi dengan baik dalam pelaksanaan pekerjaan yang akan meminimalisir kesalahan pelaksanaan pekerjaan
10.	Kesalahan instalasi	R10	Tinggi	Melakukan pengawasan pada karyawan agar meminimalisir kesalahan instalasi

2.8. Analysis of Precedence Diagramming Method (PDM).

Precedence Diagraming Method (PDM) is one of the scheduling techniques that belong to the network planning scheduling technique or network plan. In the PDM network this activity focuses on using nodes so often called activity on node (AON).

No	Deskripsi Pekerjaan	Kode Kegiatan	Kegiatan Pendahulu	Durasi kerja (hari)
1	PEKERJAAN PERSIAPAN	A	-	23
2	PEKERJAAN PERSIAPAN LAHAN	B	A	13
3	PEKERJAAN STRUKTUR	C	B	31
4	PEKERJAAN ARSITEKTUR	D	B	40
5	PEKERJAAN MEKANIKAL DAN ELEKTRIKAL	E	C,D	14
6	PEKERJAAN LAIN-LAIN	F	E	42
7	PEKERJAAN SALURAN	G	F	12
			Jumlah Hari :	175

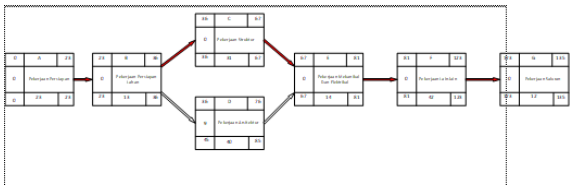


Figure 2. PDM Network

1. Forward pass calculation on the activity or node to find the value of EF (Earlier Finish) is to use equation of formula (2.1).
   Calculation of node A
   $ESA = 0\ dA = 23$
   $EFA = (0 + 23) = 23$
   Calculation of node B
   $ESB = 23\ dB = 13$
   $EFB = (23 + 13) = 36$
2. The calculation of the backward pass on the activity or node to find the SL value (Slack lag) using equation of formula (2.2), LS (Lates Start) using equation of formula (2.3) and LF (Lates Finish) using equation of formula (2.4).
   Calculation of node C
   $ESE = 67\ EFC = 67$
   Looking for SL value (Slack Lag)
   $SLC = (ESE - EFC)$
   $SLEC = (67 - 67) = 0$
   Looking for LS value (Lates Start)
   $LSC = (SLC + ESC)$
   $LSC = (0 + 36) = 36$
   Looking for LF (Lates Finish)
   $LFC = (LSC + dC)$
   $LFC = (36 + 31) = 85$
   Based on the above calculation can be seen the value of the ES (Earlier Start), EF (Earlier Finish), SL (Slack Lag), LS (Lates Start), LF (Lates Finish), it can be concluded from the recapitulation of the final PDM calculation on home construction projects dining and hall.

No	Kode Kegiatan	Rekapitulasi Perhitungan					
		d (Durasi)	ES	EF	SL	LS	LF
1	A	23 hari	0	23	0	0	23
2	B	13 hari	23	36	0	23	36
3	C	31 hari	36	67	0	36	67
4	D	40 hari	36	76	9	45	85
5	E	14 hari	67	81	0	67	81
6	F	42 hari	81	123	0	81	123
7	G	12 hari	123	135	0	123	135

Figure 3. Project Coordination Calculation

2.10 Functional Needs Analysis

Functional needs analysis is a functional requirement analysis in both data and information flow. Analysis of functional requirements described in structured analysis which will be discussed as follows.

2.10.1 Database Analysis

Data analysis can be seen from the data that will be used in the process of development of project management information system in PT.Saekan Bumi Persada then the data has been obtained built a data design by using entity relationship diagram (ERD) which can be seen on:

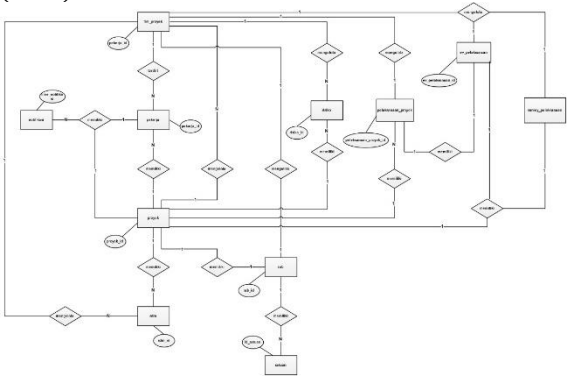


Figure 4. Entity Relationship Diagram

2.10.2 Context Diagram

The Context Diagram is a simple diagram illustrating the relationship between the outer entity, the input and output of the system, the context diagram represented by a single circle representing the whole system.

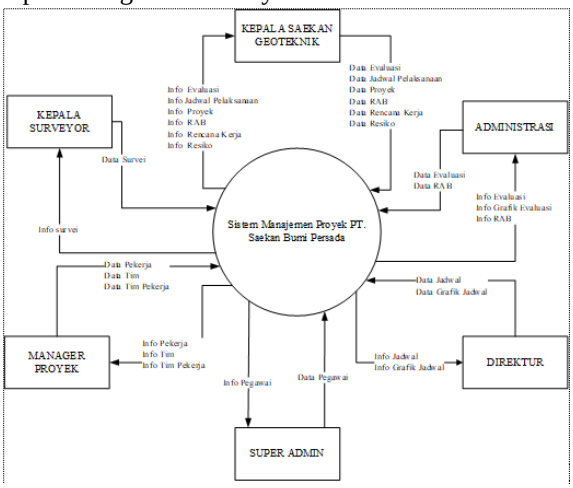


Figure 5. Context Diagram

2.10.3 System Interface

The project management information system interface at PT. Saekan Bumi Persada is as follows:

Work Plan Interface

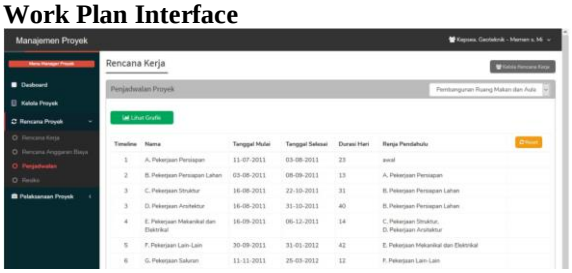


Figure 6. Interface work plan

Working Risk Interface

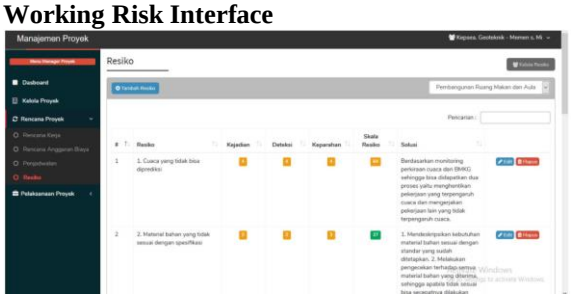


Figure 7. Working Risk Interface

Project Implementation Interface

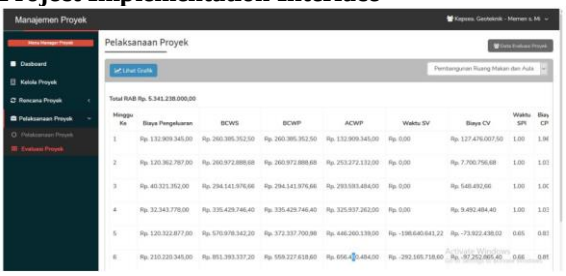


Figure 8. Project Implementation Interface

Graph Schedule Interface

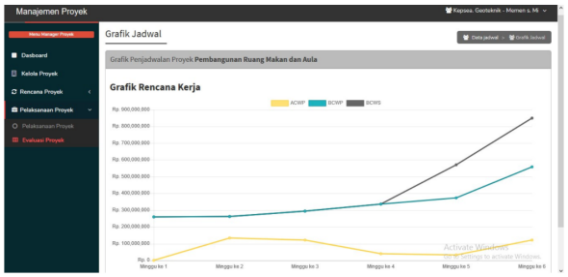


Figure 9. The Schedule Chart Interface

2.11 Implementation and Testing

Testing the system is an important thing that aims to find errors or shortcomings in the project management information system PT.Saekan Bumi Persada to be tested. Testing intends to know the project management information system created has met the criteria in accordance with the design objectives.

2.11.1 Functional Testing

Functional testing is focused on the basic functionality of built software. Based on the test results with cases of test samples that have been done to get a conclusion that process process in construction of project management information system at PT. Saekan Bumi persada is correct. Functionally the system is able to produce the expected output.

2.11.2 Results of End User Acceptance Testing

Based on the results of interviews conducted to directors, managers, heads of geotechnical, administrative and surveyors, it can be concluded that the construction of project management information system at PT.Saekan Bumi Persada can help companies to know the project performance and classify risk and risk mitigation , can help the project team in making decisions in the project and estimate project time, project cost control and system has been running well when used.

3. CLOSING

In this section, explain the conclusions and suggestions that contain the results obtained after

the research so that further development can be done related to the research that has been done.

3.1 Conclusions

Based on the research and test results that have been done on the project management information system at PT.Saekan Bumi Persada, it can be concluded as follows:

1. Project management information system at PT.Saekan Bumi Persada can assist the Chief of Geotechnical Guard in knowing and estimating project execution time in accordance with pre-determined project time planning so as to reduce the risk of delay of PT project. Saekan Bumi Persada.
2. Project management information system at PT.Saekan Bumi Persada can help control project costs so as to reduce the risk of project cost swelling.
3. Project management information system at PT.Saekan Bumi Persada can help identify opportunities for project risk risks occurring in the field to prepare risk mitigation and improve project success.

3.2 Suggestions

Based on the research and test results that have been done to the project management information system at PT.Saekan Bumi Persada, it can be proposed suggestions for improvement of project management information system PT.Saekan Bumi Persada is as follows:

1. Development to implement financial information system covering cost fix cost, variable cost, and operational cost PT.Saekan Bumi Persada
2. Development of the interface so it is more user friendly.

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