PROJECT MANAGEMENT INFORMATION SYSTEM

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ABSTRACT

Project Management is an application of science skills, tools, and techniques to project to meet the requirements that have been determined, including scope, time, cost, risk and quality. The project management system discusses, among other things, project scheduling management, cost and time management, project risk management.

Some of the methods applied to this project management information system are PERT, EVM, PIM, and EMV. PERT is a network analysis technique used to know the critical path as well as predict the total duration of the project. EVM is a method that combines the relationship between cost and time and also provides an overview of all the project cost requirements. PIM is a method for risk management that uses two parameters namely the probability of occurrence of risk and impact. EMV is an analytical method that has a statistical concept that counts from the future average future expenditures that may occur.

The conclusion to be gained is that project management information systems built on can help to solve problems that occur in the project management process such as project scheduling, time and cost control, and project risk management.

Keywords: *project management, PERT, EVM, PIM, EMV.*

1. INTRODUCTION

The case study on this project management information system is taken from a manufacturing company engaged in the trade in goods and services that has completed a blade-making project for steam or gas turbines, pump psrt, impeller, wearing ring, sleeve bearing, and thrust or tilting pad. In previous research has been built project management system in manufacturing companies, [1] but in this study added risk calculation or decision-making calculation that is expected to help the project manager know the cost of consequences at each risk that arise during project work is underway.

The problem raised in this research is that the project that has been done many obstacles that occurred during the project so that the project experienced delays. The delay is due to a problem in the scheduling of project work, as happened in the work of this research on the scheduling of the 11th week of project implementation is delayed from the weight of the planning schedule by 0.1%, because the scheduling only calculates the start and finish date and the lack of job focus determination which can be delayed or can not be postponed. In addition, the availability of the fastest time indicator, the most likely time, and the longest time and the absence of a presentation of possible project completion. This results in a negative impact on project execution in the event of problems that result in the project being less than optimal and make the project manager difficult to determine the work that should be prioritized in case of constraints in the process of project work.

Furthermore, the project manager in charge of project oversight that impacts the chance of cost swelling occurring can not be known at the time of the project and often the cost swelling is known at the end of the project due to delays in reports from each section.

Less attention to the project risk factors that can actually hamper the project performance process so that the project experience constraints. Risk factors that constrain project delays and disrupt the project performance process such as delay factor delivery of goods to be installed, damage to project performance support tools.

Solutions to overcome the problem of lack of supervision of deviations of time and costs resulting in swelling costs, and the need to apply time and cost control by evaluating the week so that the control of project work can be done better.

The next solution is to address the risk issues that often arise in the project need to be implemented risk management so that risks that arise during project work can be minimized and the project manager can prepare handling to overcome any risks that appear

in the project every week and also calculate the cost consequences of each risk that arise in when project work is in progress.

2. RESEARCH CONTENTS

2.1 Research Methodology

The research method used in this research is descriptive research methodology, namely research method that aims to create a description, a description of the facts and information in situations that conducted research systematically. Here is a research method that will be done in the development of Management Information System stages as follows:

1. *Identification of Problems*
   Stage finds problems in place of research
2. *Data Collection*
   Conducted to obtain information needed to achieve research objectives, among others:
   1) *Interview*
   2) *Observation*
   3) *Library Studies*
3. *Problem Analysis*
   Stage clarify the problem and look for the causes of the problem and to find a problem solving.
4. *Analysis Procedure in Progress*
   Stage of analysis of procedures concerning features of research that will become a reference research on the company.
5. *Business Rules Analysis*
   Stage analysis of the business rules of the company.
6. *Project Scheduling Anlysis*
   Stage find problem and look for problem solving in scheduling using PERT method.
7. *Project Control Analysis*
   Stage find problem and look for problem solving in cost and time control using EVM method.
8. *Risk Handling Analysis*
   Step find the problem and look for problem solving in risk management using PIM and EMV methods.
9. *Data Planning*
   Data planning stage required by system
10. *Interface Planning*
    Stage planning interface or user interface system
11. *System Implementation*
12. *System Testing*
    Stage pengujijan by the user by doing black box testing to find out the research objectives have been met or not.
13. *Conclusion and Sugestion*
    The stage draws conclusions and suggestions about the results of the research.

2.2. Analysis Result

In the analysis process is needed to identify a problem of a system and to determine the needs of a system to be built. Where in this research there are three analysis that is project scheduling using PERT method, evaluation of cost and time using EVM method and project risk using PIM and EMV method.

2.2.1. Project Scheduling

Project scheduling is a tool to determine the time required for an activity to complete a project, in addition to scheduling also serves as to determine when to begin and completion of the project activity. In general, project scheduling consists of scheduling time, labor, equipment, materials, and finance. The timeliness of scheduling in project implementation is very influential in the avoidance of losses due to cost swelling, delays in project submission, and disputes or claims. [2]

2.2.1.1. Job Activity

Job activity is the determination of the activation of a job to break down the whole scope of the project work into smaller activities aimed at each job can be well controlled by the project manager, as in the table 1.

Table 1 Job Activity

No	*Job descryption*
I	*Preperation*
II	*Cleaning / sand blasting / brushing / painting*
III	*Investigasi, reverses engineering*
IV	*Fabrication, replace / supply , repair and recondition*
V	*Electrical Work (exciter)*
VI	*Electrical Work (generator)*
VII	*Elektrical test*
VIII	*Instrument*
IX	*Centering Preparation*
X	*Release of a series of centering and painting*

Table 2 Job Activity

XI	*Stage of turbine and mechanical installation*
XII	*Installation stage generator / mechanic*
XIII	*Measurement and mechanical testing*

2.2.1.2. Determining Inter-Employment Relationships

Making network work among others is to organize all the work into a performance on the project that can later be presented logically. The logical relationship between jobs can be determined by determining the relationship of previous work, where the previous relationship occurs when an activity must first be completed before afterwards activity can begin. Next is to determine the subsequent employment relationship, where the aftermath can occur after the previous activity, as in Table 2.

Table 3 Inter-Employment Relationship

No	***Type of Work***	***Activity Code***	***Predecessor***	***Durtion (Week)***
I	*Preperation*	I	-	1
II	*Cleaning / sand blasting / brushing / painting*	II	I	4
III	*Investigasi, reverses engineering*	III	II	11
IV	*Fabrication, replace / supply , repair and recondition*	IV	III	24
V	*Electrical Work (exciter)*	V	IV	2
VI	*Electrical Work (generator)*	VI	V	19
VII	*Elektrical test*	VII	VI	1
VIII	*Instrument*	VIII	VI	3
IX	*Centering Preparation*	IX	VII , VII	2
X	*Release of a series of centering and painting*	X	IX	1
XI	*Stage of turbine and mechanical installation*	XI	X	4
XII	*Installation stage generator / mechanic*	XII	X	4
XIII	*Measurement and mechanical testing*	XIII	XI , XII	2

Based on table 3, it is known that the relationship between project work and duration on each work will become a reference for doing calculations in the network so that the logical connection of one job will be illustrated to find out the critical path.

2.2.1.3. Advanced and Countdown Calculations at PERT

After knowing the relationship between jobs, the next step is to calculate the total project completion time, forward calculation (fordward pass), backward pass and slack calculation.

1. *Advanced Accounting at Work I*
   Es : 0
   Te : 7
   EF = Es + Te = 0 + 7 = 7
   From the calculation that has been done with the code of work I then get the value of its earliest finish is 7, the next step is to continue the calculation up to the work XIII.
2. *Countdown on Work XIII*
   LF : 371
   Te : 7
   LS = LF – Te = 371 – 7 = 364
   From the calculation that has been done with the code of work XIII is then get its Lastest Start value is 364. the next step is to continue the calculation up to the job I.
3. *Advanced Accounting at Work I*
   LS : 0
   ES : 0
   Slack = LS – ES = 0 – 0 = 0

From the calculation that has been done with the job code I then got the value of his Slack is 0.

Recapitulation of Network Calculations can be seen in table 3.

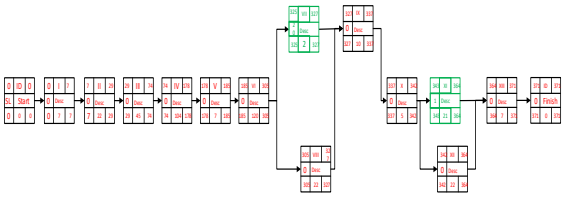
Table 4 Recapitulation of Network Calculations

Code	*Predecessor*	Te	ES	EF	LF	LS
I	0	7	0	7	7	0
II	I	22	7	29	29	7
III	II	45	29	74	74	29
IV	II	104	74	178	178	74
V	IV	7	178	185	185	178
VI	V	120	185	305	305	185
VII	VI	2	305	307	327	325
VIII	VI	22	305	327	327	305
IX	VII,VII	10	327	337	337	327
X	VII	5	337	342	342	337
XI	X	21	342	363	364	343
XII	X	22	342	364	364	342
XIII	XI,XII	7	364	371	371	364

From the calculation and scheduling analysis using Program Evaluation and Review Technique (PERT) method, it can be concluded that the work activities of I, II, III, IV, V, VI, VIII, IX, X, XII, and XIII are passed by critical path which is the job is a critical job and should not be postponed because if there is a delay in work it will have a negative impact on the next job.

2.2.1.4. Networking

After completing the above calculation can be described network work can be seen in Figure 1.



Gambar.1 Networking

2.2.2. Cost Control and Time

Project control is a particular effort or endeavor that is used to determine a job in accordance with the planning targets, design an information system, compare implementation to standards by analyzing the possibility of a deviation between execution and standards, then taking a step towards achieving that goal.[3]

2.2.2.1. Weight Calculation

How to know the calculation of the weight of work is by calculating based on the unit price of work in accordance with the value of the contract and not including the 10% VAT. Calculation of weights can be seen in table 3.

1. *Weight Calculation at Week 1*
   Total Price of work : Rp.8.982.715.400
   Price Of Job : Rp.2.844.736.140
   *Weight = (2.844.736.140/8.982.715.400)*100%*
   = 31,669

Table 4 Weight of Job

No	*Type of Work*	*The Price of Job (Rp)*	*Weight (%)*
I	*Preperation*	2.844.767.500	31,669
II	*Cleaning / sand blasting / brushing / painting*	251.890.400	2,804
III	*Investigasi, reverses engineering*	277.597.000	3,090
IV	*Fabrication, replace / supply , repair and recondition*	583.514.000	6,496
V	*Electrical Work (exciter)*	146.525.000	1,631

Table 4 Weight of Job

VI	*Electrical Work (generator)*	269.120.000	2,996
VII	*Elektrical test*	170.890.000	1,902
VIII	*Instrument*	221.400.000	2,465
IX	*Centering Preparation*	422.508.000	4,704
X	*Release of a series of centering and painting*	99.900.000	1,112
XI	*Stage of turbine and mechanical installation*	380.721.500	4,238
XII	*Installation stage generator / mechanic*	2.819.326.000	31,386
XIII	*Measurement and mechanical testing*	494.556.000	5,506
Total		8.982.715.400	100,000

Based on table 3 we get the value of work weight which will be used to calculate Planned Value and Earned Value.

2.2.2.2. *PV Calculation (Planned Value)*

Analysis of planned value (PV) or often also called BCWS is the cost value allocated to race against the schedule that has been prepared. Here is the calculation of the planned value (PV) on the 1st week of work:

1. *PV Calculation*
   Total Price : Rp. 8.982.715.400
   Weight : 31,669 %
   *PV = Rp. 8.982.715.400 * 31,669 %*
   = Rp. 2.844.736.140

If the calculation of the planned value (PV) is completed until the last work, the calculation of the planned value (PV) is obtained from the results of the cumulative cost of week 1 to the 34th week, seen from the calculation of the planned value (PV) which have been prepared according to the implementation schedule.

2.2.2.3. EV Calculation (Earned Value)

Analysis of earned value (EV) or also called BCWP is a sum of costs incurred in accordance with work completed in the field. Here is an example of earned value (EV) calculation at week 1:

1. *EV Calculation*
   Total Price : Rp. 8.982.715.400
   Weight : 31,669 %
   *PV = Rp. 8.982.715.400 * 31,669 %*
   = Rp. 2.844.736.140

2.2.2.4. AC Calculation (Actual Cost)

Analysis of actual cost (AC) or so-called ACWP is a sum of the actual cost of a work that has been done. Looking for AC value is obtained from the weighted progress report with the actual cost of expenditure in the field.

1. *Actual Cost*
   Actual cost week 1= Rp.2.609.434.000

2.2.2.5. Calculation of Variance Analysis

Analysis of the variance in which there is a variant of cost or so-called cost variance (CV) and time variance or schedule variance. Which is where the value of cost variance (CV) is the comparative value obtained after successfully completing the part of the job by looking at the actual value of project implementation. While the schedule variance (SV) is a different part of the work that can be done with part of the work that has been planned previously. Here are the calculations to get the value of cost variance (CV) and schedule variance (SV) at week 1.

1. *CV Calculation*
   CV= EV - AC
   CV= Rp. 2.844.736.140- Rp. 2.609.434.000
   = Rp. 235.302.140
2. *SV Calculation*
   SV=EV – PV
   SV= Rp. 2.844.736.140 - Rp. 2.609.434.000
   = Rp. 0

2.2.2.6. Calculation of Analysis Working Index

In the performance index analysis or so-called cost performance index (CPI) and time performance index (SPI). Which is where the CPI is a comparative value diteia and work completion with the actual cost that dikerluarkan to complete a job, while the SPI is a comparison between the completion of the field in the work plan at a certain period. Here is the calculation of CPI and SPI at week 1.

1. *CPI Calculation*
   CPI= EV / AC
   CPI= Rp. 2.844.736.140 - Rp. 2.609.434.000
   = 1,090

2. *SPI Calculation*
   SPI= EV / PV
   SPI= Rp. 2.844.736.140 - Rp. 2.844.736.140 = 1

The results of the calculations of CPI and SPI can be concluded, among others:

1. *The number index shows the number> 1 on the CPI in the 1st week until the 34th week shows the physical progress being worked out as planned at the beginning at a lower cost.*
2. *SPI indexes generated at week 1 to week 10 and week 12 to week 34 of SPI = 1, indicating that the work on which the course has been scheduled is scheduled, but at week 11 the SPI index < 1 which indicates that the progress of fiisk is slower than planned.*

2.2.2.7. Calculation of Cost Analysis

The EAC value is calculated from the estimated difference between the cost of the project completion plan or the actual cost (BAC) cost. Where the value of Estimate at Completion (EAC) is used to predict the cost of completion of the final project dnegan calculation per week. While Estimate to Completion (ETC) to predict the estimated cost of the remaining, Here is the calculation of EAC and ETC at week 1.

1. *ETC calculation*
   ETC =((BAC-EV)/CPI)
   ETC =((8.982.715.400-2.844.736.140)/1.090 = Rp5.630.276.758
2. *EAC calculation*
   EAC= AC + ETC
   EAC= Rp2.609.434.000 + Rp5.630.276.758 = Rp8.239.710.758

Then the next step is to do the calculation up to the last job. By knowing the value of ETC and EAC will be a reference by the project manager to control the time and cost of each week to stay in accordance with the planned.

2.1.3. Project Risk Management

Project risk management also includes several processes in performing a planning, identification, analysis, response planning, and risk control that occurs within a project. The objective of project risk management is to increase the likelihood and impact of positive events, and may earlier reduce the likelihood and impact of negative project events.[2]

2.2.3.1. Risk identification

In the risk management process can be initiated by identifying the risks involved in knowing and creating a list of possible risks that may interfere with project implementation. In the process of identification of this incident is done with a discussion approach and interview with the company. This risk identification is grouped according to the type of risk and by assigning risk codes to each risk, it can be seen in table 5.

Table 5 Risk Identifitacion

Risk Code	***Type of Risk***	***Risk Variables***
R1	*Personal*	*There are no project workers available*
R2		*There are workers who resign*
R3		*Manpower does not understand the design drawings done by the company's experts*
R4		*Manpower lacks understanding of their respective jobdesk*
R5	*Labor Safety*	*Labor fell on heavy equipment*
R6		*Workforce exposed to materials*
R7		*Workers have traffic accidents*
R8	*Supporting tools*	*Delay in delivery of supporting equipment*
R9		*Supporting tools are damaged*
R10		*The difficulty of using a tool that can not be predicted by the operator*
R11		*Inadequate access of heavy equipment delivery*
R12	*Estimation*	*Estimated schedule that is not in accordance with the initial planning*
R13		*The estimated cost is not tidal according to the initial planning*
R14		*The rise and fall of the Rupiah against the US Dollar*

Table 5 Risk Identifitacion

R15		*Import permit constraints from customs*
R16	*External*	*The occurrence of natural disasters*
R17		*Late delivery of raw materials*
R18		*Error delivery of raw materials*
R19		*Tools or supporting materials lost or stolen*
R18		*Error delivery of raw materials*
R19		*Tools or supporting materials lost or stolen*

2.2.3.2. Determining Probability and Impact

The purpose of the risk assessment is to obtain a list of assessed risks based on the level of impact and the likelihood of the risk that will occur. Then the results of the risk assessment are mapped to make it easier to know the risk-ratios that should be the main priority that must be addressed. The parameters of risk probability can be seen in table 6.

Table 6 Parameter Value probability Risk

Probability	***Value***	***Information***
Very Low	1	*Rarely occurs, only under certain conditions*
Low	2	*Sometimes it happens in certain conditions*
Moderate	3	*Occurs under certain conditions*
High	4	*Often occurs under certain conditions*
Very High	5	*It always happens under certain conditions*

2.2.3.3. Determining the Level of Risk Interest

After obtaining the value of the probability outcome and the impact of risk, the next is to determine the value and importance of risk by using the risk matrix.

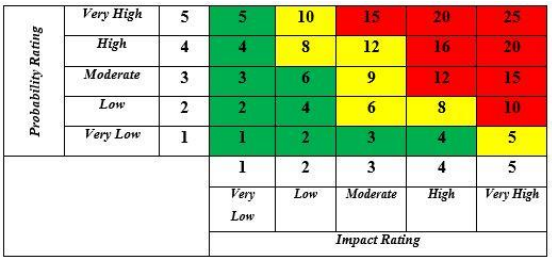


Figure .2 Qualitative Risk Analysis Matrix

Here is the calculation of the importance level of risk as shown in the table with the following formula:

Risk Exposure = Probability x Impact
Information :
Risk Exposure = Level of risk importance
Probability = Risk probability value
Impact = Value of impact of risk

2.2.3.4. Determining Project Cost

At this stage will be calculated the cost to be incurred by the company to deal with an emerging risk which is where to the determination of the risk costs using the method of Expected Monetary Value (EMV) which for which the value of the consequences of each risk arising is taken from the results discussion with project manager. The value of these consequences is an estimate of the most numbers to be spent for each of these risks. [2]

Table 7 Consequences

No	***Risk Code***	***Consequences***
1	R1	Rp. 4.650.000
2	R2	Rp. 59.100.000
3	R3	Rp. 10.000.000
4	R4	Rp. 10.000.000
5	R5	Rp. 15.000.000
6	R6	Rp. 10.000.000
7	R7	Rp. 7.500.000
8	R8	Rp. 9.000.000
9	R9	Rp. 5.000.000

Table 7 Consequences

10	R10	Rp. 3.500.000
11	R11	Rp. 2.000.000
12	R12	Rp. 10.000.000
13	R13	Rp. 15.000.000
14	R14	Rp. 10.000.000
15	R15	Rp. 10.000.000
16	R16	Rp. 8.000.000
17	R17	Rp. 4.500.000
18	R18	Rp. 7.000.000
19	R19	Rp. 5.000.000

The next stage is to find the probability value of the percentage of the possibility of a risk will arise where the value of probability or percentage is the result of discussion with the project manager.

The next step after obtaining the result of the value of consequence and probability is to calculate from each risk using Expected Monetary Value (EMV) method.

EMV = Probabilitas x Konsekuensi

Where :
Probability : The frequency of occurrence of risks
Consequences : The cost or compensation is which must be removed

Table 8 EMV Calculation

No	Risk Code	Presentage (%)	Consequences	EMV
1	R1	25	Rp. 4.650.000	Rp. 1.162.500
2	R2	25	Rp. 59.100.000	Rp. 14.775.000
3	R3	5	Rp. 10.000.000	Rp. 500.000
4	R4	5	Rp. 10.000.000	Rp. 500.000
5	R5	50	Rp. 15.000.000	Rp. 7.500.000
6	R6	50	Rp. 10.000.000	Rp. 5.000.000
7	R7	5	Rp. 7.500.000	Rp. 375.000
8	R8	30	Rp. 9.000.000	Rp. 2.700.000
9	R9	10	Rp. 5.000.000	Rp. 500.000
10	R10	10	Rp. 3.500.000	Rp. 350.000
11	R11	5	Rp. 2.000.000	Rp. 100.000
12	R12	15	Rp. 10.000.000	Rp. 1.500.000
13	R13	10	Rp. 15.000.000	Rp. 1.500.000
14	R14	20	Rp. 10.000.000	Rp. 2.000.000
15	R15	25	Rp. 10.000.000	Rp. 2.500.000
16	R16	10	Rp. 8.000.000	Rp. 800.000
17	R17	10	Rp. 4.500.000	Rp. 450.000
18	R18	5	Rp. 7.000.000	Rp. 350.000
19	R19	15	Rp. 5.000.000	Rp. 750.000

3. Cover

3.1. Conclusions and recomendations

Based on the results that have been obtained in the final project research that has been done, it can be concluded that the project management information system that has been built to assist the project manager in determining the work of the project is on the critical line and can facilitate the project responsible for determining the priority of each work. Furthermore, the project management information system that has been built can assist the project manager in controlling the time and cost of

the planned project can be in accordance with the project work to completion. Then the project management information system that has been built can assist the person in charge of managing the project risk so that the risks that emerge can be well identified and can know the cost of risk if there are risks that arise when the project is in progress.

Based on the results of the test on the project management system in PT.Safta Ferti obtained suggestions that can be considered for future system development, for example for the development of information systems furthermore it is expected this application can calculate the estimated amount of workers needed in each project and for the development of the next information system the need for additional systems for the management of project finances.

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