PROJECT MANAGEMENT INFORMATION SYSTEM IN CV. AGSA PUTRA CIKITA

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ABSTRACT

CV. Agsa Putra Cikita is an enterprise that engaged in a construction services. Through the history of the previous project there are problems caused by several factors like: the absence of a network diagram makes the critical path of a project cannot be known, ignoring the risk that will appear and bothering the project, lack of human resources to handle projects, and the absence of time and costs controlling system when projects are carried out. That matter makes the project delays and get the loss.

Based on the explained problems, then Project Management Information System is required for handling project planning schedule, controlling time and costs, and for risk management. Critical Path Method (CPM) is used to planning schedule and find the critical path. Earned Value Management (EVM) method is used to control the time and costs of the project. Meanwhile for risk management Probability Impact Matrix (PIM) is used, that later would generate risks that considered high, medium or low. Additionally in the management of human resources the calculation of estimated labor is needed.

Based on the interview and testing, the systems created are quite helpful in optimizing the planning schedule by looking at the critical path, controlling time and costs according to the plan, managing risk before the project is carried out and determine the amount of labor required for the project.

***Keywords** : management, project, critical path method, earned value management, probability impact matrix.*

1. INTRODUCTION

1.1 Background Issues

CV. Agsa Putra Cikita is one company that is engaged in construction services which is located at Bungbulang Street Pasirlangu Village, Pakenjeng, Garut. The companies start operations in 2011 already has experience quite a lot, in the history of this company has been working on various projects such as the construction and rehabilitation of roads, rehabilitation and improvement of irrigation, the construction of rearing ponds, construction of retaining walls, and so forth.

Based on the interview with Mr. Agus Somantri as director of CV. Agsa Putra Cikita, part of the whose handling the project activity is Technical Responsibility and in the implementation of projects undertaken by CV. Agsa Putra Cikita that there are problems caused by several factors, including project planning only to use the budget plan to assess each job and the work breakdown structure to schedule job, it causes less framework for project planning, the absence diagram network project so the dependencies among jobs are not clearly delineated, it causes if a job is delayed then the impact on the entire project can not be assessed quickly so that decision-making will take time and will certainly result in schedule project completion is likely to grow and final cost will grow because it is not in accordance with the budget plan. Lack of human resources to handle projects also stimulate employment is undermined, it results in the time required to complete the project increases. In addition, the neglect of risks that may disturb lead to increased project completion schedule of the project and the costs incurred to be larger because it must cope with those risk. That existing problems resulted in the company's profit is reduced or even doesn't make benefit, other than that the company gets the sanction of the project owner for having violated the deadlines specified.

Based on the interview which has been described by Agus Somantri as director of CV. Agsa Putra Cikita, the problems needed solutions to decreased problems that often occur in the execution of projects in the CV. Agsa Putra Cikita namely the need for the system to handle project planning schedule, cost control and time, risk management and human resource management. On the assumption that it is necessary the implementation of project management, project management is where all the planning, execution, control, and coordination of a project from beginning to end of the project to get the results that had been planned in advance.

Based on the description that has been presented above, the writer intends to make Project Management Information System at CV. Agsa Putra Cikita, through the information system of the

projects undertaken by the CV. Agsa Putra Cikita can be managed properly.

1.2 Purpose and Objectives

The purpose of this research is to build project management information systems at CV. Agsa Putra Cikita.

The objectives to be reached in establishing a project management information systems are:

1. *Help Technical Responsibility for optimizing the schedule that can be known dependencies among jobs that can later be used to see how big the influence of such work towards completion of the project.*
2. *Help Technical Responsibility in controlling costs and time so that the costs and time can be same according to the planned.*
3. *Help Technical Responsibility for manage project risk, so that the problems that arose during the project can be identified before the project is start and the project risks that arise can be handled well by the company.*
4. *Help Technical Responsibility for managing human resources, so that work will not be charged to someone neglected.*

1.3 Project Management

Management is an integrated process where individuals as part of the organizations involved to plan, organize, conduct and control activities, all of which are directed to the targets and continuous over time. Management is a set of responsibilities that are closely linked to one another [2].

Projects can also be interpreted as an attempt or activity that is organized to achieve goals, objectives and expectations are important by using budget funds and resources available which should be completed within a certain period [2].

Project management is all the planning, execution, control, and coordination of a project from the beginning (the idea) to the end of the project to ensure the timely implementation of the project, right cost and right quality [3].

1.4 Critical Path Method (CPM)

Critical Path Method or the critical path method is a method that has a circuit network components with a total activity longest amount of time and shows the fastest project completion period [6].

As for how the calculation in determining the time of completion of the project consists of two phases, namely the calculation of forward and backward calculation. Here's an explanation of these phases.

1. *Forward Pass*
   Forward Pass is calculations determine the slowest time starting and completion of each activity, as well as the latest occurrence of each activity.
   $$EF = ES + D \text{ atau } EF(i\text{-}j) = ES(i\text{-}j) + D(i\text{-}j) \quad (1)$$
2. *Backward Pass*
   Backward Pass meant to know the time or the latest date we can still begin and end activities without delay the timeliness of the overall project.
   $$LS = LF - D \quad (2)$$
3. *Total Float (TF)*
   Total float is the amount of time to delay contained in an activity where such activity can be slowed its implementation without affecting the completion of the overall project.
   $$TF = LF - EF = LS - ES \quad (3)$$

1.5 Earned Value Management (EVM)

Earned Value Management (EVM) is a method to determine the progress of a project is greater or less than the budget should be and sooner or later than scheduled.

There are basic elements and techniques for the calculation of earned value required in the calculation of EVM, namely :

1. *Planned Value (PV)*
   Planned Value (PV) to describe the extent to which the project work should have been, from the beginning up to a certain point in the project schedule.
   $$PV = (\%progres\ rencana) \times BAC \quad (4)$$
2. *Earned Value (EV)*
   Earned Value (EV) is recording the progress of the project from the beginning to the specified point in time.
   $$EV = (\%progres\ aktual) \times BAC \quad (5)$$
3. *Actual Cost (AC)*
   Actual Cost (AC) is an indicator of the level of resources that have been spent to reach the achievement of actual work until at a certain point in time.

The next step in EVM method is to examine the condition of the current project and forecasting by using PV, EV, and AC which had previously been known. To analyze the performance and forecasting required variables which is as follows :

1. *Budget at Completion (BAC), the total project budget.*
2. *Varian (Variances)*
   a. *Schedule Variance (SV)*
      Schedule Variance indicate whether the project is faster or slower than scheduled.
      $$SV = EV - PV \quad (6)$$
   b. *Cost Variance (CV)*
      Cost Variance indicate whether the project spending is smaller or bigger budget than it should.
      $$CV = EV - AC \quad (7)$$
3. *Indeks (Indices)*
   a. *Schedule Performance Index (SPI)*
      Schedule Performance Index identifies how efficiently the project team in the use of time.
      $$SPI = EV / PV \quad (8)$$

b. *Cost Performace Index (CPI)*
Earned Value and Actual Cost can also be used to calculate the cumulative Cost Performance Index (CPI), which is an indicator of the most obvious cost efficiency.
CPI = EV / AC (9)

4. *Peramalan (Forecast)*
   a. *Estimate at Completion (EAC)*
   Estimate at Completion (EAC) is useful to know the final cost if the same trend continues.
   EAC = BAC / CPI (10)
   b. *Estimate Time to Complete (ETC)*
   Estimate Time to Complete shows how much time completion of work.
   ETC = Original Time Estimate / CPI (11)

1.6 Probability Impact Matrix (PIM)

With PIM, the risks can be prioritized for further quantitative analyzed and acted upon based on the value of risk. Assessment conducted on the risk based on the chance / probability and consequences / effects.

The first thing to do to give an assessment of the probability of each risk and impact is to create an index scale beforehand as in Figure 1 [7].

SCALE	PROBABILITY	+/– IMPACT ON PROJECT OBJECTIVES		
		TIME	COST	QUALITY
VHI	>70%	>4 months	>£250K	Very significant impact on overall functionality
HI	51–70%	2–4 months	£101K–£250K	Significant impact on overall functionality
MED	21–50%	1–2 months	£51K–£100K	Some impact in key functional areas
LO	5–20%	1–4 weeks	£10K–£50K	Minor impact on overall functionality
VLO	<5%	<1 week	<£10K	Minor impact on secondary functions

Figure 1. *Indices Scale*

From the picture above can be seen that the scale of the index is divided into five levels, namely VHI (Very High) to very high, HI (High) for the high, Med (Medium) for medium, LO (Low) to low, and VLO (Very Low) to very low.

If the scoring against the likelihood and impact of risks has been completed, then the interest rate risk is then calculated using the this formula.

Risk Score = Probability x Impact (12)

Where :

Risk Score = Interest rate risk

Probability = The probability of the risk occuring

Impact = The impact of the risk occuring

Once the scale of probability, impact and interest rate risks have been known then the next is to map these values into a matrix as in Figure 2.

Probability						
0.9	VHI	0.045	0.09	0.18	0.36	0.72
0.7	HI	0.035	0.07	0.14	0.28	0.56
0.5	MED	0.025	0.05	0.10	0.20	0.40
0.3	LO	0.015	0.03	0.06	0.12	0.24
0.1	VLO	0.005	0.01	0.02	0.04	0.08
		VLO	LO	MED	HI	VHI
		0.05	0.1	0.2	0.4	0.8
		Impact				

Figure 2. *Probability Impact Matrix*

Based on the results of risk grouping by using a matrix, can known which risks are the big possibility appeared, significant impact and requires serious treatment.

Probability	Threats Risk Score = Probability x Impact					Opportunities High (RED) / Med (YEL) / Low (GRN)				
0.90 Very Likely	0.05	0.09	0.18	0.38	0.72	High	High	High	Med	Low
0.70 Likely	0.04	0.07	0.14	0.28	0.56	High	High	Med	Med	Low
0.50 Possible	0.03	0.05	0.10	0.12	0.40	High	High	Med	Low	Low
0.30 Unlikely	0.02	0.03	0.06	0.12	0.24	High	Med	Med	Low	Low
0.10 Very Unlikely	0.01	0.01	0.02	0.04	0.08	Med	Low	Low	Low	Low
	0.05	0.10	0.20	0.40	0.80	Very High	High	Med.	Low	Very Low
	Example Impact Definitions – May Be Tailored to Each Project Objective Impact on an Objective (e.g. Cost, Schedule, Scope, Quality)									

Figure 3. *Map Risk Probability Impact Matrix*

1.7 Human Resources Planning

HR planning aimed at identifying and documenting project roles, responsibilities and how the person reporting relationships with others in the project, as well as making staffing management plan.

There are several formats of delivery in planning technique using the organizational structure and description of each, are as follows :

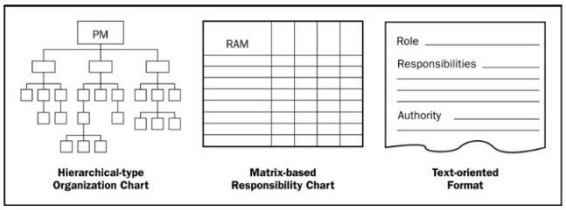


Figure 4. *Roles and Responsibility Formats*

1. *Hierarchy*
   The organization chart which defines the relationship between organizational units that will be responsible for or performing certain work packages is called OBS (Organizational Breakdown Structure).
2. *Matrix*
   Responsibility Assignment Matrix (RAM) is a matrix that maps the projects work against persons responsible for carrying out such work.

RACI Chart	Person				
Activity	Ann	Ben	Carlos	Dina	Ed
Define	A	R	I	I	I
Design	I	A	R	C	C
Develop	I	A	R	C	C
Test	A	I	I	R	I

R = Responsible A = Accountable C = Consult I = Inform

Figure 5. *Rensponsibility Assigment Matrix using RACI formats*

3. *Text Oriented*
   A detailed description of the work and responsibilities of each member of the team with the written text formats such as narrative. Usually therein describes the responsibilities, authority, competence and qualifications

2. CONTENT OF RESEARCH

2.1 Analysis of project scheduling

Analysis of project scheduling is one of the elements of planning which provides information about the schedule and duration of the plan to complete the project. The method used for scheduling analysis in this research is the Critical Path Method (CPM).

2.1.1 Critical Path Method (CPM) Analysis

Based on a series of activities that existed then created a network diagram project, then perform advanced calculations, the countdown and count the float. Here is a recapitulation of the results of analysis using CPM method.

Table 1. *Rekapitulation Analysis using CPM*

Kode Kegiatan	Kegiatan		Durasi (dalam hari)	Paling Awal		Paling Akhir		Total Float (TF)
	i-node	j-node		Mulai (ES)	Akhir (EF)	Mulai (LS)	Akhir (LF)	
A	0	1	1	0	1	0	1	0
B	1	2	3	1	4	1	4	0
F	2	3	3	4	7	4	7	0
C	3	4	6	7	13	7	13	0
D	4	5	5	13	18	13	19	1
E	4	6	6	13	19	13	19	0

From the table information recapitulation of the CPM method of analysis, we can know which activities are included critical path or activities that can not be postponed due to delay would affect the total time of the project. Recapitulation of the table it is known that the activities there is an activity as a whole is on the critical path unless the activity D. If depicted in network diagrams will be generated as Figure 6 below.

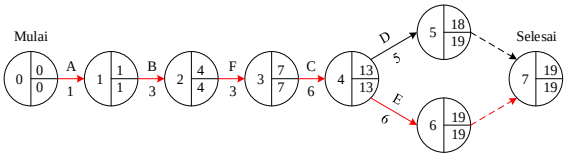


Figure 6. *Diagram Network*

Those result will help the technical responsible for making a decision what to do with the project schedule for the project to be in accordance with a predetermined schedule.

2.2 Analysis of Project Controlling

Analysis of project control contains control analysis of cost and time to the project. The method used in this control is Earned Value Management (EVM).

2.2.1 Analisis Earned Value Management (EVM)

Based on case studies analyzed in the project report Pemb. Rehab Jalan Kp. Cihideung, the project has a total project budget (BAC) of Rp. 171,273,943.00 (excluding VAT) and the processing time for 19 days.

1. Calculation of Planned Value (PV)

PV at week 1 (the day job to 1 - 7 days) :
PV = 8,42% x Rp. 171.273.943,00
= Rp. 14.421.266,00
PV at week 2 (work day 8 - day 14):
PV = 28,72% x Rp. 171.273.943,00
= Rp. 49.189.876,43
PV at week 3 (the work day to 15 - day 21):
PV = 100% x Rp. 171.273.943,00
= Rp. 171.273.943,00

2. Calculation of Earned Value (EV)

EV at week 1 (the day job to 1 - 7 days):
EV = 6,84% x Rp. 171.273.943,00
= Rp. 11.715.137,7
EV at week 2 (work day 8 - day 14):
EV = 28,72% x Rp. 171.273.943,00
= Rp. 49.189.876,43
EV at week 3 (the work day to 15 - day 21):
EV = 91,89% x Rp. 171.273.943,00
= Rp. 157.383.626,22

3. Analysis of Variance

Calculation of the CV and SV in week 1 :
CV = 11.715.137,7 – 11.713.029,94
= 2.107,76
SV = 11.715.137,7 – 14.421.266,00
= -2.706.128,3
Calculation of the CV and SV in week 2 :
CV = 49.189.876,43 – 49.187.068,00
= 2.808,43
SV = 49.189.876,43 – 49.189.876,43
= 0
Calculation of the CV and SV in week 3 :
CV = 157.383.626,22 – 157.388.593,38
= -4.967,16

SV = 157.383.626,22 – 171.273.943,00
= -13.890.316,78

4. Analysis Work Index
Calculation of CPI and SPI in week 1:
CPI = 11.715.137,7 / 11.713.029,94
= 1,00018
SPI = 11.715.137,7 / 14.421.266,00
= 0,81
Calculation of CPI and SPI in week 2 :
CPI = 49.189.876,43 / 49.187.068,00
= 1,00006
SPI = 49.189.876,43 / 49.189.876,43
= 1
Calculation of CPI and SPI in week 3 :
CPI = 157.383.626,22 / 157.388.593,38
= 0,99997
SPI = 157.383.626,22 / 171.273.943,00
= 0,92

From the analysis up to week 3, it can be concluded that the project is expected to experience a delay of a predetermined schedule. Delays and losses to the cost, it is known as the value of the estimated time of completion (ETC) was 21 days, while the estimated completion is 19 days and the cost (EAC) is Rp. 171,279,081.37 while the budget of the fee is Rp. 171,273,943.00.

2.3 Analysis of Risk Management

There are several stages in risk management, ie risk identification, risk measurement, and risk treatment.

1. Identify Risks

The initial process of risk management is to identify risks, namely activities to find any risk that may occur and change into losses. The results of the risk identification can be seen as in Table 2.

***Table 2.** Identify Risk*

Risk Code	Risk Description
R1	Schedule not in accordance with the plan
R2	Cost not in accordance with the plan
R3	Field workers who are sick so that workers will be reduced
R4	Lack of coordination and cooperation
R5	Workers misinterpret the work ordered
R6	Shortage of human resources to do a particular job
R7	Damaged equipment
R8	Stolen equipment
R9	location is hard to reach by machine
R10	Location must be addressed before the project starting
R11	Delay in delivery of goods
R12	Weather (rain, high winds)
R13	Natural disasters (floods, earthquakes, landslides)
R14	Traffic accidents
R15	Accident by working tools
R16	Affected materials

2. Risk Measurement

Risk measurement is performed to determine the relative level of importance of a risk and obtain information to further define a suitable risk management tools to handle it. In this study, risk measurement is done using probability techniques with methods Probability Impact Matrix (PIM).

The first thing to do to give an assessment of the probability of each risk and impact is to create an index scale first.

***Table 3.** Probability Index Scale*

Index	Value	Probability
Very High	0,9	Always happen
High	0,7	Often happen
Average	0,5	Sometimes happen
Low	0,3	Rarely happen
Very Low	0,1	Very rarely happen

***Table 4.** Impact Index Scale*

Index	Value	Impact
Very high	0,8	Very detrimental
High	0,4	Large losses
Average	0,2	Harmful
Low	0,1	Losses small
Very Low	0,05	Losses can be ignored

***Table 5.** Probability and Impact*

Risk Code	Probability	Impact
R1	Always happen	Very detrimental
R2	Always happen	Very detrimental
R3	Very rarely happen	Harmful
R4	Rarely happen	Harmful
R5	Sometimes happen	Harmful
R6	Very rarely happen	Losses small
R7	Rarely happen	Harmful
R8	Sometimes happen	Harmful
R9	Often happen	Harmful
R10	Rarely happen	Harmful
R11	Sometimes happen	Harmful
R12	Sometimes happen	Large losses
R13	Rarely happen	Very detrimental
R14	Sometimes happen	Harmful
R15	Sometimes happen	Harmful
R16	Sometimes happen	Harmful

After scoring the probability and impact of such risks on the table 5, then selanjunya interest rate risk is calculated using the formula 12. Next Table 6 will show the results of calculation of the interest rate risk with a probability value and impact.

Table 6. *Result Risk Score*

Risk Code	Probability	Impact	Risk Score
R1	0,9	0,8	0,72
R2	0,9	0,8	0,72
R3	0,1	0,2	0,02
R4	0,3	0,2	0,06
R5	0,5	0,2	0,1
R6	0,1	0,1	0,01
R7	0,3	0,2	0,06
R8	0,5	0,2	0,1
R9	0,7	0,2	0,14
R10	0,3	0,2	0,06
R11	0,5	0,2	0,1
R12	0,5	0,4	0,2
R13	0,3	0,8	0,24
R14	0,5	0,2	0,1
R15	0,5	0,2	0,1
R16	0,5	0,2	0,1

Once the value of the probability, impact and interest rate risks have been known, we then mapped these values into a matrix based on a picture 3. Based on this matrix can be found anywhere that risks including the risk of high, medium and low index to high red, yellow medium and green for low.

3. Risk Treatment

Having known this level of risk, the technical person in charge can prioritize the handling of high risk. Remedial action against the respective risks can be seen in Table 7.

Table 7. *Risk Treatment*

Risk Code	Risk Level	Risk Treatment
R1	High	Utilizing existing human resources by increasing the hours of work and an understanding of a project
R2	High	Utilizing existing human resources by increasing working hours and reducing costs less necessary
R3	Low	Utilizing the existing human resources by increasing working hours
R4	Medium	Technical Responsibility should continue to monitor the project work and communicate with the Technical Implementation, foreman and workers
R5	Medium	Technical Implementation plans need to explain the project to the foreman and workers to clear before the project is done. If it still happens, technical implementers need more intense communication with mobile workers
R6	Rendah	Increase communication with mobile workers in order to be well targeted
R7	Medium	Seek supporting tools such as the new project to the rental company renting heavy equipment / construction
R8	Medium	Seek supporting tools such as the new project to the rental company renting heavy equipment / construction
		Heightened security at the project site
R9	Medium	Companies need to prepare smaller equipment.
R10	Medium	Use the time float on the critical path planning schedule to cover the lost time due to preparation of project
R11	Medium	Work activities that do not require the materials beforehand
		Search for suppliers that are closer to the location of the project and ensure that the supplier always has the necessary material
R12	High	Project is still have to be done but find good weather conditions, such as if it always rains during the day then do working at night
R13	High	Project is still done because it is already under contract with government tenders but need additional means of supporting the construction or addition of mobile workers
R14	Medium	Use safety devices such work safety helmet, gloves, etc.
		The company always ensures mobile workers in the insurance by paying premiums
R15	Medium	Use safety devices such work safety helmet, gloves, etc.
		The company always ensures mobile workers in the insurance by paying premiums
R16	Medium	Use safety devices such work safety helmet, gloves, etc.
		The company always ensures mobile workers in the insurance by paying premiums

2.4 Analysis of Human Resource Management

Analysis of human resource management in this research is human resources planning.

2.4.1 Human Resource Planning

Human resource planning is to plan the workforce to fit the project's needs and effective and efficient in completing an activity.

Table 8. *Human Resources*

No	SDM	Inisial
1	Penanggungjawab Teknis	PJT
2	Pelaksana Teknis	PT
3	Logistik	Log
4	Penanggungjawab Administrasi	PJA
5	Pelaksana Administrasi	PA
6	Penanggungjawab Keuangan	PJK
7	Mandor	M
8	Pekerja	P
9	Tukang	T

The method used to clarify the roles and responsibilities of existing human resources is a method Responsibility Assignment Matrix (RAM) with RACI format, following detailed explanation:

R : Responsible or person doing an activity or perform any work.

A : Accountable or person who is responsible and has the authority to decide an existing constraints in an activity.

C : Consulted or person required to consult or give advice to an activity.

I : Informed or people who need to know the outcome of a decision or action.

Here are the data of roles and responsibilities in accordance with the activities and the existing human resources in the project.

Table 9. *Peran dan Tanggungjawab SDM*

Kode Kegiatan	Inisial SDM								
	PJT	PT	Log	PJA	PA	PJK	M	P	T
A	A, I	I		C	C			R	R
B	A, I	I	C			C	R	R	
C	A, I	I	C			C	R	R	
D	A, I	I	C			C	R	R	
E	A, I	I	C			C	R	R	
F	A, I	I	C			C	R	R	

3. FINALE

3.1 Conclusion

Based on the results of research and testing has been done on the Project Management Information System at CV. Aqsa Son Cikita, some conclusions can be drawn as follows :

1. *The system has built can help Technical Responsibility for optimizing the schedule that can be known dependencies among jobs that can later be used to see how big the influence of such work towards completion of the project..*
2. *The system has built can help Technical Responsibility in controlling costs and time so that the costs and time can be same according to the planned.*
3. *The system has built can help Technical Responsibility for manage project risk, so that the problems that arose during the project can be identified before the project is start and the project risks that arise can be handled well by the company.*
4. *The system has built can help Technical Responsibility for managing human resources, so that work will not be charged to someone neglected.*

3.2 Suggestion

Based on the results of testing the system, got some suggestions that can be taken into consideration, as follows :

1. *Project Management Information Systems at CV. Agsa Putra Cikita can add some additional features such as notification if a work is not completed on schedule.*
2. *In this study doesn't count loss cost analysis obtained if a risk occurs.*

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