PROJECT MANAGEMENT INFORMATION SYSTEM AT PT. ADHYAKSA PERSADA INDONESIA

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ABSTRACT

PT. Adhyaksa Persada Indonesia is a General Contractor, Interior and Exterior which engages in the field of construction services and structure sub-areas. On implementations in the field, contractors oftentimes encounter project delays. These project delays are caused by several factors, namely late shipment of materials caused by uncertain weathers, resulting in project execution does not fit with planned schedule. Lack of supervision by the project manager towards time and cost deviations caused by evaluations only carried out once a month, so that projects handled by the project manager often experience difficulties in managing risks which detrimentally affects project execution and difficulties in executing controlling measures so that projects still run as planned.

Seeing these problems, it is necessary to have a web-based Management Information System, to facilitate management process at PT. Adhyaksa Persada Indonesia in project planning, execution, and control by conducting schedule planning analysis using Critical Path Method (CPM); controlling time and cost using Earned Value Method (EVM); risk analysis using Qualitative Risk Analysis; and preparing controlling measures using Time Cost Trade Off (TCTO).

The Project Management Information System has been quite helpful in assisting the site manager in schedule planning for searching critical tasks and controlling projects' time and cost, and also helps the project manager in project evaluation by identifying risks and providing project controlling alternative measures.

Keywords: *Project, Critical Path Method, Earned Value Method, Risk, Time Cost Trade Off, MIS, Web.*

1. INTRODUCTION

In a construction project needed a good cooperation relationship between the owner of the project and implementing contractors. Project owners certainly wanted the project implementation went smoothly in accordance with the times and costs have been determined.

As was the case in one of the projects of PT Adhyaksa Persada Indonesia bridge construction project musi II stage IV which is located in the District of Kapahiang, province of Bengkulu are having problems, these problems are caused by several factors, namely the delivery of materials that are late because of erratic weather factors result in project implementation schedule is not in accordance with the planned schedule for the beginning of the project, the delay affects to the job because every job linked dependency so it is difficult to determine the focus of the work against the overall project schedule.

Another factor that is less supervision by project manager against the diversion of time and costs because the evaluation of the progress of the project was only carried out once a month by site manager, because in one month project manager does not handle one project but some of the projects that must be completed so that the number of such project lead project manager have difficulty to perform control measures in order to keep the project according to plan.

From the large number of projects handled by the project manager the project manager often have difficulty in risk due to qualify in the process of being done with the drawing up of risk based on impact against the purpose of the project that forms the image of risk less got special attention and how to respond to the risk in the case, so that risks impacting negatively on the implementation of the project languished.

Planning and cost control and time is part of the overall construction project management. Planning and control is performed by the project manager and site manager, in addition to that by identifying the risk of adverse impact on the implementation of the project and can prepare action plan the handling of risks, so as to make it easier to focus the work and became the basis of control. From this information a project manager can estimate within a certain period on a certain reporting period anyway and can overcome the delay by doing control measures in the form of an alternative add work hours or overtime.

1.1 Management Information Systems (MIS)

Management Information Systems (MIS) can be measured by a decision of the organization or group. SIM has been around since the sixties, but because of the development of science pengentahuan, then there is a development of the information system manajamen definition is as follows [3]:

Understanding which refers to the '60s, namely Opera-Management System is a system as a service provider information that is useful in providing support through pengorperasian scope, the scope of management, and the scope of certain organizational decisions.

Understanding which refers to 1993, namely Information Management System is a combination of a set of software and hardware to design the transformation of some of the data collected, later dihadikan one as an important source of information to find a solution or settlement.

1.2 Project Scheduling

Scheduling planning project is the elaboration of the project into a sequence of steps that have included work execution time factor to achieve the target. In general it can be said that scheduling is the calculation of the allocation of the available time to the execution of each piece of work or activities, in the context of the completion of such projects, in order to achieve optimal results, taking into account the limitations - limitations that exist [8].

1.2.1 Critical Path Method (CPM)

Critical Path Method or the method of the critical path is the path that has circuit components of activities, with the total amount of time shows the longest and fastest period remerdy project. Thus, the critical path consists of a series of critical activities, starting from the first event until the last activities of the project [1]. The critical path is very important for the contractor because this path is that implementation activities should start on time and finish on time as well.

There are two calculations used in the critical path method, namely calculation of forward and backward calculation. There are some important things that must be considered in the calculation sehubung forward and backward calculation as follows:

1. *Forward Pass*
   Advanced calculations in determining the slowest time starting and completion of each activity, as well as the latest occurrence of each activity..

$$EF = ES + D$$

$$EF(i\text{-}j) = ES(i\text{-}j) + D(i\text{-}j)$$

2. *Backward Pass*
   Countdown is the slowest time of starting and completion of each activity, as well as the latest occurrence of each activity.

$$LS = LF - D$$

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

3. *Total Float (TF)*
   Total float is the amount of time allowed for an activity can be delayed without affecting the overall project schedule. Total float an activity together with the latest finish time minus the earliest completion time, or the latest start time minus the earliest start time.

$$TF = LS - ES$$

1.3 Project Controling

Project Controling is a systematic effort to define a standard that is in accordance with the objectives of planning, designing information systems, compares the implementation and standards, then take the necessary corrective action so that resources are used effectively and fuel-efficient in order to achieve the objectives [1]. The benefits of a control function is to reduce the possibility of errors occurring in terms of quality, quantity, cost and time. In construction projects, control is needed to keep the implementation does not deviate from the plan.

1.3.1 Earned Value Method (EVM)

Earned Value Method is a method of calculating the fees according to the budget in accordance with the work that has been completed or implemented Budget Cost Work Performance (BCWP). While the weight of the work is calculated based on the unit price corresponding to the contract value (excluding VAT 10%). The formula used is as follows:

$$\text{Bobot} = \left(\frac{\text{Harga Pekerjaan}}{\text{Harga Total Pekerjaan}} \right) \text{x } 100\%$$

When viewed from the amount of work completed then it means this method to measure the amount of units of work completed, at a time when judged by the amount of the budget provided is unknown relationship between what has been achieved physically to the amount of the budget that have been issued.

$$\text{BCWP} = (\%\text{Penyelesaian}) \text{ x } (\text{Anggaran})$$

Earned value method results can be used to analyze performance and make forecasts the achievement of targets. So we use three indicators, namely:

1. *ACWP (Actual Cost of Work Performed)*
   ACWP is the amount of the actual cost of the work that has been used to carry out the work at a certain time. These costs derived from the data accounting or finance projects at the reporting date, the annals of all actual expenses.
2. *BCWP (Budget Cost of Work Performed)*
   BWCP is an indicator that shows the value of the results from the point of view of the value of the work completed on the budget provided for the job.

3. *BCWS (Budget Cost of Work Schedule)*
   BWCS is a budget for a work package, but compiled and linked with the implementation schedule. To ensure a mix between cost, schedule and scope of work and in each element of the work has been given the allocation of costs and schedules can become benchmarks in project implementation.

Merging the two performance schedule and cost in a single graph makes it easier to analyze the measurement of the performance of a job. Two pieces of analysis that can be used in measuring the performance of a work that is the variance that aims to measure the performance of a job up to the reporting date. The variants analyzed are the schedule (schedule) and cost (cost).

Varians biaya, CV (Cost Varians) :

$$CV = BCWP - ACWP$$

Varian jadwal, SV (Schedule Varians) :

$$SV = BCWP - BCWS$$

CPI (Cost Performance Index) :

$$CPI = BCWP/ACWP$$

SPI (Schedule Performance Index) :

$$SPI = BCWP/BCWS$$

To calculating the CPI and SPI is to statistically predict the time and cost needed to complete the project. There are many methods in predicting the time (EAS) and the cost of project completion (EAC). However, the calculation of the value of EAS and EAC with SPI and CPI easier and faster use. There are several calculation formula EAS and EAC, are as follows. Untuk menentukan perkiraan biaya untuk pekerjaan tersisa atau Estimate to Completion (ETC), digunakan sebagai berikut :

$$ETC = (BAC- BCWP)/CPI$$

To calculate cost estimates for remaining work or Estimate to Completion (ETC), is used as follows:

$$EAC = ACWP + ETC$$

To calculate the approximate time for completion of the remaining work or Temporary Estimate Schedule (ETS), used the following formula :

$$ETS = (Total\ waktu - Waktu\ pakai)/SPI$$

To calculate the estimated time of completion of the final project or Estimate All Schedule (EAS), use the following formula :

$$EAS = Waktu\ selesai + ETS$$

1.3.2 Risk Management

Risks are events or factors that the event will increase the likelihood of not achieving the project objectives are in accordance with the time, cost and performance [5]. Risk management is a process that simantik of identification, analysis, response and control of project risks. The purpose of risk management is to maximize the opportunities and consequences of positive events and minimize the scope and consequences of negative events to project objectives [4].

1.3.3 Probability and Impact Matrix

Risks can be prioritized for further quantitative analysis and action (response) based on size (rating) risks. Measurement is performed on the risk based on the likelihood and impact. Evaluation of risk to the level of interest and priority to note is that with the help of tables [7], as in Figure 1:

Tabel 1 Boston Square Qualitative Risk Assessment Matrix

Probability Factory						
	Very Likely	5	10	15	20	25
	Likely	4	9	12	16	20
	Possible	3	6	8	12	15
	Unlekely	2	4	6	9	10
	Very Unlikely	1	2	3	4	5
		Slight	Minor	Significant	Severe	Major
		Impact Factory				

Table 2 Qualitative Impact Assessment

Nilai	Deskripsi	Dampak
1	Sangat Rendah	Tidak Berdampak
2	Rendah	Terjadi Keterlambatan jadwal < 5%
3	Sedang	Terjadi Keterlambatan jadwal 5% - 10%
4	Tinggi	Terjadi Keterlambatan jadwal 10% - 20%
5	Sangat Tinggi	Terjadi Keterlambatan jadwal > 20%

Table 3 Probability Qualitative Assessment

Nilai	Deskripsi	Kemungkinan
1	Sangat Rendah	Jarang terjadi, hanya kondisi tertentu
2	Rendah	Kadang terjadi pada kondisi tertentu
3	Sedang	Terjadi pada kondisi tertentu
4	Tinggi	Sering terjadi pada tiap kondisi
5	Sangat Tinggi	Selalu terjadi pada setiap kondisi

1.3.4 Project Accelerating

Acceleration of the project is an attempt to finish the construction project with a duration of time which is faster than a predetermined schedule. Duration of acceleration (crashing duration) is the shortest time to complete the project activity is still technically possible, assuming the resources are not impediments [1].

There are several alternatives that can be used to accelerate the completion of the duration of the project, namely the addition of working hours, turn the division of labor, more labor, additional tools and replacement method of execution. Any alternative used to perform the acceleration will lead to changes in costs, both total costs, direct costs and indirect costs.

$$Dc = \frac{Dn \times h}{h + (h0 \times e)}$$

Note :

Dc = Accelerate Duration
Dn = Normal Duration
H = Normal Work Hour per-day
h0 = Normal Extra Work Hour per-day
e = Effectiveness of overtime, with the provision that if h0 is 1 hour, 2 hours, 3 hours, 4 hours, then the values are respectively 0.9, 0.8, 0.7, 0.6.

Extra working hours or overtime decreased productivity due to worker fatigue or limited vision, decreased productivity, overtime can be seen in Figure 1:

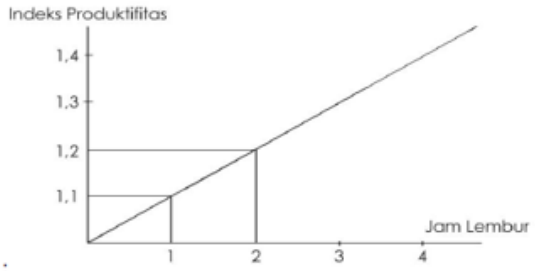


Figure 1. Decreased Productivity Overtime Graph

1.3.5 Time Cost Trade Off (TCTO)

Analysis and calculations used to determine changes in the duration of the project costs is by using Time Cost Trade Off (TCTO). This method is used to analyze how far the schedule or the duration of the work can be speeded up economically. Acceleration is only done on critical jobs that are still likely to be accelerated so as to produce a new shorter duration.

With the accelerated long a job will inevitably lead to changes in cost and time, which includes:

1. *Time Normal (Normal Duration) is the time required to conduct complete with a normal level of productivity.*
2. *Acceleration Time (Crash Duration) is the shortest time to complete an activity which is technically still possible.*
3. *Cost of Normal (Normal Cost) are direct costs required to complete a period of normal activities.*
4. *Cost Acceleration (Crash Cost) is the amount of direct costs to complete the activities with the shortest period of time.*
5. *dditional Charges (Cost Slope) is the amount of direct costs per-unit time.*

The equation used to calculate Cost Slope is as follows:

$$\mathbf{Ri} = \frac{\mathbf{Cc - Cn}}{\mathbf{Dn - Dc}}$$

Note :

Ri = Cost Slope
Dc = Accelerate Duration
Dn = Normal Duration
Cc = Accelerate Cost
Cn = Normal Cost

2. THE CONTENT OF RESEARCH

2.1 Analysis of Critical Path Method CPM

Based on the network that has been created, the next step is to calculate the total project completion time, advanced computation (forward pass), countdown (backward pass), and calculate the float. Critical path: A1-A2-B2-C1-D1-D2-E1-E3-F1-F3.

Table 4 Critical Task

Task	*Code*	*Duration (week)*	*Status*
PEKERJAAN MUTU	*A*		
Mobilisasi	*A1*	*8*	*Critis*
Manajemen Mutu	*A2*	*8*	*Critis*
PEKERJAAN BETON	*B*		
Beton mutu sedang fc'=30 Mpa atau K-350	*B1*	*6*	*-------*
Beton mutu sedang fc'=20 Mpa atau K-250	*B2*	*4*	*Critis*
Beton mutu rendah fc'=10 Mpa	*B3*	*3*	*-------*
PEKERJAAN BAJA	*C*		
Baja tulang U 39 Ulir	*C1*	*5*	*Critis*
PEKERJAAN BAJA STRUKTUR	*D*		
Penyediaan baja struktur BJ 34 (titik leleh 210 Mpa)(Deckplat)	*D1*	*2*	*Critis*
Pemasangan baja struktur BJ 34 (titik leleh 210 Mpa)(Deckplat)	*D2*	*2*	*Critis*
PEKERJAAN RANGKA BAJA	*E*		
Pengadaan struktur jembatan rangka baja tipe I	*E1*	*4*	*Critis*
Pengangkutan bahan jembatan baja	*E2*	*3*	*--------*
Pemasangan jembatan rangka baja tipe I	*E3*	*3*	*Critis*
Expansion joint tipe baja I	*E4*	*2*	*--------*
PEKERJAAN PEMASANGAN	*F*		
Perletakan elastomerik alam ukuran 350mm x 350mm x 50mm	*F1*	*5*	*Critis*
Sandaran (railing)	*F2*	*4*	*--------*
Pipa drainase baja diameter 75mm	*F3*	*3*	*Critis*

2.2 Project Evaluation With EVM

Analysis contains project control analysis, evaluation and analysis of the project budget equalization of resources on the Project is done by PT. Adhyaksa Persada Indonesia. In this case the evaluation analysis project using Earned Value Method (EVM).

Table 5 Analysis BCWS, BCWP and ACWP

No	*Week*	*BCWS*	*BCWP*	*ACWP*
1	*Week -1*	*Rp 225.908.663*	*Rp 225.908.663*	*Rp 183.221.910*
2	*Week -2*	*Rp 451.817.326*	*Rp 451.817.326*	*Rp 366.443.821*
3	*Week -3*	*Rp 677.725.989*	*Rp 677.725.989*	*Rp 549.665.731*
4	*Week -4*	*Rp 903.634.652*	*Rp 903.634.652*	*Rp 732.887.641*
5	*Week -5*	*Rp 1.129.543.314*	*Rp 1.129.543.314*	*Rp 916.109.552*

Based on Table 5 in the previous analysis, the data obtained as follows:

a. Total Duration = 34 week
b. Total Work Duration = 29 week
c. Total Budgeted (BAC) = Rp. 17.788.083.692
d. BCWS = Rp. 17.732.940.633
e. BCWP = Rp. 17.732.940.633
f. ACWP = Rp. 14.382.198.613
g. SV = Rp. 0

h. CV = Rp. 3.350.742.020
i. SPI = 1,00
j. CPI = 1,23

2.3 Risk Analysis

Qualitative Risk Analysis by identifying the risks resulting from secondary data (literature and journals) and then developed with field observations with the PT. Adhyaksa Persada Indonesia. Further interviews with the help of a questionnaire regarding the possibility of the risk and impact of these risks to the scale of values. Furthermore, the resulting value will be determined based on the level of risk level matrix. Respondents were drawn from the PT. Adhayaksa Persada Indonesia is Project Manager, Site Manager, Accounting Manager and Project Supervisor at Musi II.

Table 6 Risk Assessment

Risk Variable	Probability	Impact	Total	Level
Spesifikasi gambar tidak lengkap	3	1	3	L
Perubahan pemilik	1	2	2	L
Data geoteknik dan tanah tidak lengkap	1	3	3	L
Tidak sesuai standar	1	1	1	L
Cacat desain	1	1	1	L
Ketersediaan material	2	4	8	M
Keselamatan atau kecelakaan	1	1	1	L
Alam / Cuaca	4	5	20	H
Permasalahan pekerjaan tanah	3	4	12	M
Pengulangan pekerjaan (rework)	1	2	2	L
Keterlambatan pengiriman material	2	3	6	M
Tenaga kerja	2	5	10	M
Masalah konstruksi jembatan	1	2	2	L
Mutu	2	2	4	L
Kenaikan harga material	3	2	6	M
Kenaikan BBM	3	3	9	M
Kekurangan dana	1	3	3	L
Kerusakan dan kehilangan properti	2	3	6	M
Perubahan peraturan	1	1	1	L
Protes dari organisasi tertentu	3	2	6	M
Pembebasan lahan	1	1	1	L
Kontaminasi lingkungan	1	2	2	L
Spesies terancam punah	1	1	1	L

2.4 Percepatan Metode TCTO

Accelerate project completion and the estimated time and cost on the Project Home Store (office) using Time Cost Trade Off. Acceleration time and costs are calculated based on the alternative Extra working hours centered on the work that is on the critical path.

Calculation of duration crash, crash costs, and costs slope at Work The provision of the steel structure of the BJ 34 (melting point 210 Mpa)(Deckplat) :

a. Volume = 19.080 Kg
b. Normal Duration = 2 week → 14 day
c. Normal Cost = Rp. 532.952.672 Kg
d. The unit cost of wages = Rp. 36.978 Kg
e. The unit cost of materials = Rp. 27.932,53 Kg
f. Normal daily productivity / hour
=8,2845m²/hour
= 170,36 Kg
g. The daily productivity acceleration
= 1.533,21 Kg
h. Crash duration = a / g
= 19.080 / 1.533,21
= 12,5 day → 13 day
i. Normal wage / hour = (d x f)
= Rp. 36.978 x 170,36 Kg
= Rp. 6.299.466,43 /hour
j. Normal wage / day = (8 hour x i)
= 8 x Rp. 6.299.466,43
= Rp. 50.395.731,43 /day
k. Overtime wage/day = (1,5 x 1) x i
= (1,5 x 1) x Rp. 6.299.466,43
= Rp. 9.449.199,64 /day
l. Wage cost/day = (j + k)
= Rp. 50.395.689 + Rp. 9.449.191
= Rp. 59.844.931,07 /day
m. Total wage cost = (h x l)
= 12 x Rp. 59.844.880
= Rp. 753.104.750,56
n. Total material Cost = (a x e)
= 19.080 Kg x Rp. 27.932,53
= Rp. 532.952.672,40
o. Crash Cost = (m + n)
= Rp. 744.736.920,00 + Rp. 532.952.672,40
= Rp. 1.286.057.422,96
p. Crash Slope = (o – c)/(b – h)

$$= \frac{(1.286.057.422,96 - 532.952.672)}{(14 - 13)}$$

= Rp. 531.954.943,14

3 FINAL

3.1 Coclusion

Based on the results obtained in this thesis, it can be concluded as follows:

1. *Management information systems this project is quite able to walk according to the purpose, IE can help site managers in scheduling with critical path analyses on works that are in the project is to make it easier to focus the work.*
2. *Management information systems this project will facilitate the site manager in project time and cost control, so the site manager can figure out the costs that will be incurred thereafter.*
3. *Information systems project management can assist the project manager in identifying risk will likely be impacted badly on the*

implementation of the project, and can prepare action responses.

4. *Information systems project management can assist the project manager to perform control measures the acceleration of the project with the addition of alternativework hours or overtime, this action aims to accelerate the completion of the projectin the event of delay.*

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