85

The Combination of Critical Path Method and Online Project Management Tool to Improve Accuracy of Project Schedule

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THE COMBINATION OF CRITICAL PATH METHOD AND ONLINE PROJECT MANAGEMENT TOOL TO IMPROVE ACCURACY OF PROJECT SCHEDULE

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Abstract

Project Management is a very important process in governing project activities. Project leader serves as key role to manage project team members, resources, workloads, as well as project schedule or timelines. Moreover, excellent in managing both human resource and time management is the key role for a successful project. Each member of a project team, or in this case a study team has their own roles based on expertise and portion of workload. But, realization of the activities is often vulnerable to timeliness of work completion, especially for task which has dependency to other tasks. task B can not be done if the task A has not been fulfilled, while the C task can be completed when task A and B have been completed. The interrelationship between activities can trigger inaccuracy of project schedule in case one or more aspects are not met. Critical Path Method (CPM) is a technique to help analyzing activities to better predict overall project duration. This method can be used in combination with an online project-based management media to allow team member to carry out and deliver their tasks as targeted regardless time and place.

Keywords: Project Management, Management, Critical Path Method (CPM), Online Application, Open Source Software.

1. Introduction

Every project or study must have a good planning, coordination, and cooperation from each team member, from the beginning of the project framing until execution, to ensure successful project in term of schedule, cost, and quality.

The implementation of study activities in the field of oil and gas is quite extensive, covering upstream to downstream. One of the advantages of the study activities is that the implementation isn't monotonous at one location. The study of "Status Of The Indonesian Oil And Gas Blocks On Borders With Neighboring Countries" (Sunarjanto, et.al 2016), implementer does not have to be in that location for a long time doing the task, but the team will only take important data needed for study activities, from the raw data, then processed together to become the required information in accordance with the study activities. The wide scope of project activities usually consists of multi-disciplinary background resources, including bringing experts from outside core group. Recruiting outside experts can be the right step to strengthen the team, but their distance and mobility sometimes become limitation. This factor also applies to other team members, job sequences are something that needs to be considered. delay of a job may impact to other job completion, including jobs of other project team members. The cost factor also has a role in the case, if the work has been delayed, it can effect on spending cost.

The project leader has full accountability over the continuity of project activities i.e. coordinating overall project tasks, ensuring smooth execution of the works under specified specification, and driving toward project correction in case necessary. Task should be devided by their capability, and

the tasks are clear from the beginning The division of the task for team members must be clear from the bigining, in accordance with the area of expertise, efficiency and to avoid overlapping task. In project management identifying critical activities is important, the CPM (Critical Path Method) is one method for analyzing these critical activities, the completion time of the study activities is the main focus in this method, if this analysis is applied and combined with application-based online as a means of transfer the data needs of the activity to maximize the study completion.

2. Basic Theory

2.1. Management

Management is the process of planning, organizing, leading and controlling the activities of members and other resources to achieve the goals of a predetermined (company) organization ". What is meant by the process is to do something with a systematic approach. While company resources consist of energy, expertise, equipment, funds and information.

Classical management classifies the company's operating activities into:

a. Planning: means choosing and determining the steps of future activities that are needed to achieve the goals or objectives.

b. Organizing: can be interpreted as everything related to how to organize and allocate activities and resources to group participants (organizations) can achieve goals efficiently.

c. Leading: an important aspect in managing a business.

d. Controlling: is guiding, in the sense of monitoring, reviewing, and if necessary making corrections so that the results of the activities are in accordance with those specified

e. Staffing: often included as one of the management functions but many consider this activity to be part of the organizing function, which includes the procurement of personnel, numbers and qualifications needed for the implementation of activities, including recruitment, training, and settlement to occupy positions in the organization.

2.2. Project

Project can be interpreted as activity that lasts for a limited period of time to fulfill a purpose, with the allocation of certain resources and intended to produce products or deliverables. The Research and Development Project aims to conduct research and development in order to produce certain products or conclusions in the form of reports needed for subsequent activities.

2.3. Project Management

According to Kerzner in Soeharto (1999), the notion of Project Management is to plan, organize, lead, and control company resources to achieve predetermined short-term goals. Furthermore, project management uses a vertical and horizontal system approach and hierarchy (activity flow). Project management occurs when the company gives special emphasis and attention to the implementation of repetitive activities to complete one goal.

Based on these explanations, it can be interpreted that project management is a planning, organizing and utilization of resources managed by an organization to achieve a goal.

2.4. Critical Path Method

The Critical Path Method is the sequence of scheduled activities that determines the duration of the project. CPM was created by DuPont Corporation in 1957. Critical Path determines the shortest time to complete a project and it is the longest duration through a task network. Critical task (activity) is a task in critical paths. Each task scheduling can be defined using four parameters:

a. Early Start (ES) : Earliest date the activity can start

b. Early Finish (EF) : Earliest date that the activity can finish.

c. Late Start (LS) : Latest date that the activity can start without causing a delay to the project completion date. The **Late Start (LS)** is the LF - duration + 1

d. Late Finish (LF) : Latest date that the activity can finish without causing a delay to the project completion date, for the last activity in every path is the same as the last activity's EF in the critical path.

Early Start and Early Finish calculated by forward pass. Late Start and Late Finish is calculated by backward pass

2.4.1. Forward Pass

Forward calculations performed starting early network moving towards the end of the network by doing the calculations. ES (Early Start).

a. Except for the initial activities, an activity can only be started if the predecessor has been completed.

b. The earliest time of an activity is = 0 (zero).

c. The earliest time to finish an activity is the same as the earliest start time, plus the time period of the activity in question.

d. If an activity has two or more predecessor activities, the ES is the largest EF of these activities.

e. Can be calculated using the following formula (1).

$$EF = ES + D \; or \; EF_{(i-j)} + D_{(i-j)} \; ...(1)$$

2.4.2. Backward Pass

Backward calculations is used to calculate the slowest start time (LS) and the slowest completion time (LF).

a. The countdown starts from the right end, that is from the last completion of a network project.

b. The time to start at the end of an activity is the same as the last completed time, minus the time period / duration of the activity in question.

c. If an activity has two or more subsequent activities, the most recent time (LF) of the activity is the same as the last time (LS) of the next smallest activity,

calculated using formula (2).

$$LS = LF - D \; or \; LS_{(i-j)} - \quad t_{(i-j)} \; ... \; (2)$$

2.4.3. Total Float

Slack or float is the time delay that is possible without affecting the total implementation time of the project. Total Float (TF) is the amount of time allowed an activity can be postponed, with the formula.

$$TF = LF - EF = \; LS - ES \; ... \; (3)$$

3. Methodology

Action research that is directed at making a problem solving or improvement. This study aims to develop the most efficient work methods, so that production costs can be reduced and the productivity of institutions can be increased. The focus of this research is to improve the process and increase the results of activities

"Action research is characterized as systemic inquiry that is collective, collaborative, self-reflective, critical, and undertaken by the participants of the inquiry. The goals of such research are the understanding of practice and the articulation of a rationale or philosophy of practice in order to improve practice" (McCutcheon dan Jung, 1990:148). The methodology of this study show on figure 1

4. Case Study

Scheduling is the one of planning elements that can provide information about the plan schedule and project progress in terms of resource performance, project duration and progress of time to be completed. In this study, scheduling uses Critical Path Method (CPM). This table show activity project for

"Status Of The Indonesian Oil And Gas Blocks On Borders With Neighboring Countries" (Sunarjanto, et.al 2016), which will be a case study show in table 1.

4.1. Activity Calculation

Based on activity schedule at figure 1 "Status of The Indonesian Oil And Gas Blocks On Borders With Neighboring Countries", if the project activity is sorted with CPM, it will produced a network diagram which is shown by figure 2. Forward calculations performed starting early network moving towards the end of the network by doing the calculations.

Early Start is the maximum (or Highest) EF value from immediate Predecessor(s)

$ES_A = 0$ $ES_D = 5$

$ES_B = 2$ $ES_E = 8$

$ES_C = 2$ $ES_F = 11$

$ES_D = 2$

$EF_A = ES_{before} + Duration = 0 + 2 = 2$

$EF_B = ES_A + Duration = 2 + 3 = 5$

$EF_C = ES_A + Duration = 2 + 2 = 4$

$EF_D = ES_A + Duration = 2 + 2 = 4$

$EF_E = ES_B + Duration = 5 + 3 = 8$

* task E have three predessesor task, take the latest predessesor

$EF_F = ES_E + Duration = 8 + 3 = 11$

$EF_G = ES_F + Duration = 11 + 3 = 14$

After that calculation we can fill in diagram network that shown on figure 2.

Backward calculations is used to calculate the late start time (LS) and the late completion time (LF). Late Finish is minimum (or Lowest) LS value from immediate Successor(s)

$LF_A = 2$ $LF_E = 8$

$LF_B = 5$ $LF_F = 11$

$LF_C = 5$ $LF_G = 14$

$LF_D = 5$

$LS_A = LF_A - Duration = 0 + 2 = 2$

* task A have three predessesor task, take the smallest predessesor

$LS_B = LF_B - Duration = 5 - 3 = 2$

$LS_C = LF_C - Duration = 5 - 2 = 3$

$LS_D = LF_D - Duration = 5 - 2 = 3$

$LS_E = LF_E - Duration = 8 - 3 = 5$

$LS_F = LF_F - Duration = 11 - 3 = 8$

$LS_G = LF_G - Duration = 14 - 3 = 11$

After the calculation, we can find out the maximum time of work that must be completed for 14 days.

4.2. Collaborative with Online Project Management

After formulating the schedule of study activities, the team leader is responsible for sharing the work to the team members. Communication between members is very important, that's why communication and media are needed to keep information and data transfers up to date.

Project management based application online, each team member able to communicate related task that needs to be done, uploading documents, giving job notifications, make a due date, or processing task and the project leader can monitor all these activities. Activity (figure 1) that has been arranged will be shown at board on Trello platform (figure 3).

Board activity is the place where projects get organized that makes each team member able to share a perspective on how's the work getting done and what needs to be done. Boards activity are made up of lists, that represent a workflow or process and another function represent tasks that able to move across these lists to be finished. The project activities can be shown and created in a board, such as "To Do." List names can be as

simple as steps like “To Do,” “Doing,” and “Done”.

The most popular way to use the online project management is for tracking tasks in either projects or processes. Projects tend to have a start and end date, like planning a project and collaborate with others. The advantage is based on a website, that can be connected via email, there is a platform version of the gadget (android / iOS) that can be downloaded, and each member can use it anywhere and anytime

According to the timeliness of activities, this platform can provide notifications to each team member and provide work due date, if the team member task is nearing due date, the project leader can give a warning to the team member.

5. Result and Discussion

Management of Indonesian Oil And Gas Blocks and Project Leaders still make plans related to the task, monitoring/evaluation and adapted with Information and Technology/Online Project Management application where each activity will be given a due date.

The combination of management projects with the online tool can be an alternative in conducting studies. It’s makes easier to use in terms of transferring data, notification, scheduling, and comment features. Each team member can communicate and team leader able to monitor other's project activities. Utilizing technological developments in project management changes the perspective and way of working.

6. Conclusion

Collaborative beetwen activities and online-based management can improve the accuracy in implementation of study activities, project leader as the person in charge of the activities able to monitoring and provide deadlines task on members, using computer or gadget devices that connected to internet. The main function in this collaboration is as a medium of communication, urgency and time discipline for teams that influent for future activities.

7. Recommendation

The recommendations generated in this study are,

a. Due to the wide scope of oil and gas studies, adjusting the time allocation in each activity becomes a part that cannot be ruled out
b. In addition to the use of the Critical Path Method, it is expected to apply supported methods adding cost estimates and risk management
c. The understanding of each team member on the use of online-based management applications.
d. Team leaders have an active role in each activity and carry out monitoring
e. Limitations of internet connection, can be dealt with by assigning tasks to other team members that located at strategic locations

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List of Figures

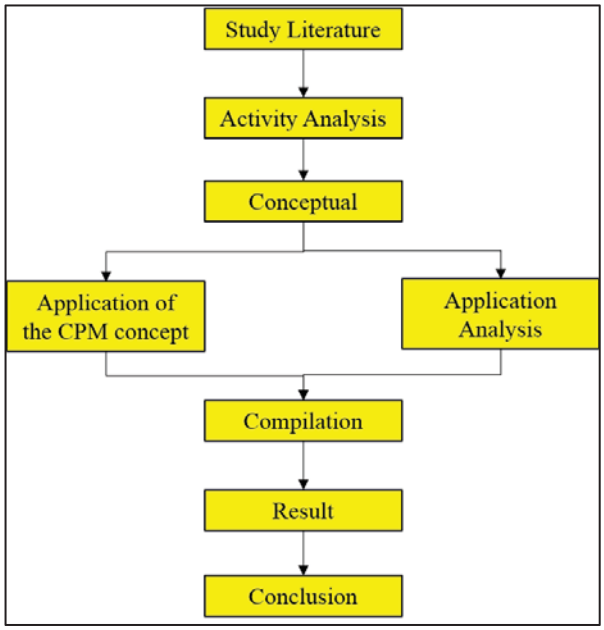

Figure 1. Work Flow of the Study

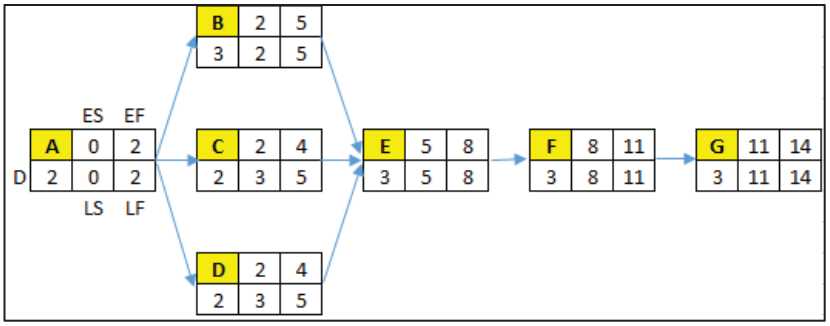

Figure 2

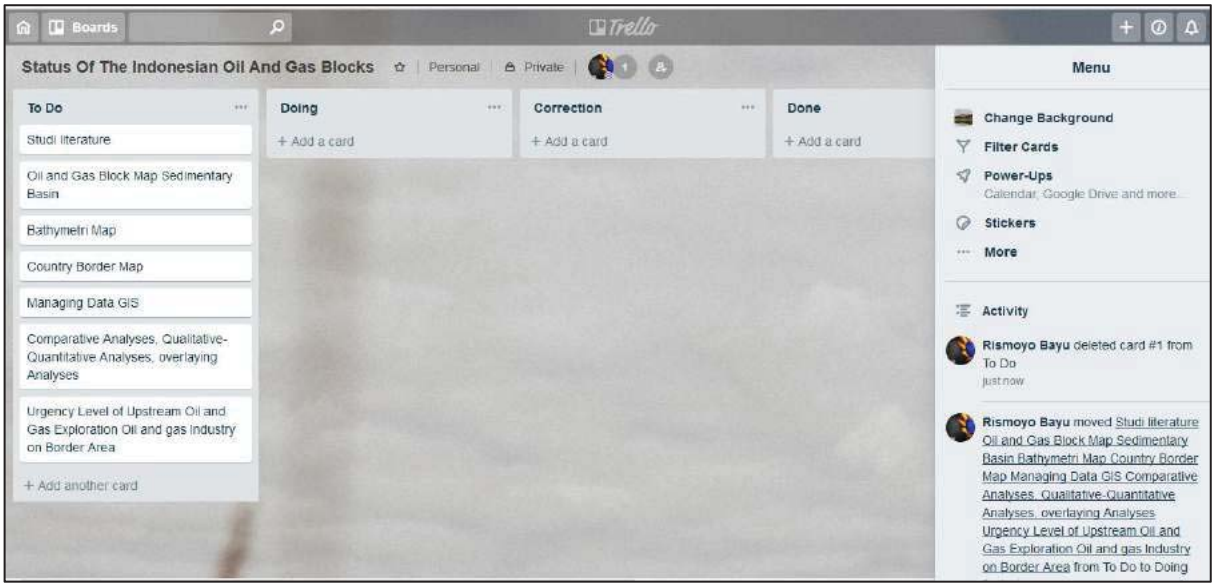

Figure 3. Trello Homepage (Online Project Management)

List of Tables

Table 1 Project Activity

Code	Activity	Predecessor	Duration (Day)
A	Studi literature		2
B	Oil and Gas Block Map Sedimentary Basin	A	3
C	Bathymetri Map	A	2
D	Country Border Map	A	2
E	Managing Data GIS	B,C,D	3
F	Comparative Analyses, Qualitative-Quantitative Analyses, overlaying Analyses	E	3
G	Urgency Level of Upstream Oil and Gas Exploration Oil and gas Industry on Border Area	F	3
TOTAL			18

Table 2 ES and EF Calculation

Code	i-node	j-node	Duration (Day)	Early Start	Early Finish
A	0	A	2	0	2
B	A	B	3	2	5
C	A	C	2	2	4
D	A	D	2	2	4
E	B,C,D	E	3	5	8
F	E	F	3	8	11
G	F	G	3	11	14

Table 3 LS and LF Calculation

Code	i-node	j-node	Duration (Day)	Early Start	Early Finish
A	0	A	2	0	2
B	A	B	3	2	5
C	A	C	2	3	5
D	A	D	2	3	5
E	B,C,D	E	3	5	8
F	E	F	3	8	11
G	F	G	3	11	14