PRODUCT PLANNING AND CONTROL USING THE CRITICAL PATH METHOD

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Abstract- Every company, both private companies and individuals, certainly has the goal of getting the maximum possible profit from the business concerned and completing work according to a predetermined schedule. elements that are no less important than the success of a delivery of raw materials, and what is more important is to create a sense of satisfaction for the customer either quality, cost or time. The method used in this study is the CPM method. CPM is a network analysis that seeks to optimize the total project cost by reducing the total project completion time concerned. Microsoft Projects is designed to assist project managers in developing plans, assigning resources to tasks, tracking progress, managing budgets and analyzing workloads. The results of project calculations at the initial conditions with 65 working days normally without using overtime the company spent Rp. 108,623,550, - whereas after accelerating the fabrication time for 3 days from 65 days to 62 days the company spent more project costs of Rp. 127,691,810, -. Based on the results of the crashing this program, the company can anticipate project delays and for achieve a change in project completion time of 62 days and avoid a penalty penalty of 20% of the project value and the company can work on other project work.

Keywords: Critical Activity, CPM

1. INTRODUCTION

Every company, whether it is a state-owned company or an individual, certainly has certain goals. In general, the goal of the company is to get the maximum possible profit from the business concerned and complete the work according to a predetermined schedule (Soeharto, 1999). Completion of work is very dependent on raw materials, and a delivery of raw materials depends on three aspects, including the quality of raw materials sent, cost and finally timeliness (Brier and lia dwi jayanti 2020). So it is clear that the accuracy of delivery is an element that is no less important than the success of a delivery of raw materials, and what is more important is to create a sense of satisfaction for the customer.customer either quality, cost or time. This is in accordance with what is contained in project management. For Therefore, there is a need for Project Management. Project management itself is an integrated control system that monitors from start to finish of the project. In carrying out the development of a construction project, there are 3 (three) main elements that are of concern to every company, namely; cost, quality and
time, (Soeharto, 1999). These three main elements are related, in which a project is expected to be completed at a minimum cost, at the right time and with quality as specified in the project plan. To fulfill the three things above then a company must have a method or method that can be used so that all resources owned can be utilized optimally. PT. Asyatek Indonesia is a company engaged in the field of general contractors, maintenance of general suppliers, pumps, compressors and over houl. Products produced by the company PT. Asyatek Indonesia namely Pressure Vessel, Heat Exchanger, Storage Tank and others. In this study, we will discuss the Heat Exchanger work that is currently underway.The problem faced at this time is the owner of the goods Heat Exchange, namely PT. Marvin Mas Teknik wants to make changes to the work schedule for PT. Asyatek Indonesia, which was originally PT. Marvin Mas Teknik wants this work process to be completed in 65 days, then PT. Marvin Mas. The technique asks PT. Asyatek Indonesia in working on this Heat Exchanger must be able to complete it in 57 days, with the change in completion time PT. Asyatek Indonesia must make changes to the schedule of activities to be able to catch up with the changes in the completion time requested by owner. In working on this Heat Exchanger project, the company only uses Gantt Chart tools.

A. Project Definition

D.I. Cleland and. W.R. Kings, Project is a mix of many resources collected in a temporary organizational containerto achieve a certain goal. (Santosa, 1997). Project activities can be interpreted as a temporary activity that lasts for a limited period of time, with an allocation of certain resources and is intended to produce products or deliverables whose quality criteria have been clearly outlined, the project is part of an organization's work program which is temporary in nature to support the achievement of goals organization, by utilizing human resources and non-human resources.

B. Project Types

According to (Soeharto, 1999), projects can be grouped into Engineering-Construction Projects Consists of feasibility study, engineering design, procurement, and construction.

a) Engineering-Manufacturing Project
   Intended to create new products, including development product, manufacture, assembly, function testing and operation of the resulting product.
b) Research and Development Project
   Aims to conduct research and development in order to produce certain products.
c) Management Services Project
   Project management services do not provide results in physical form, but the final report, for example designing a management information system.
d) Capital Project
   Capital projects are projects related to the use of capital funds for investment.
e) Radio-Telecommunication Project
   Aims to build a telecommunications network that can Cover large areas at minimal cost.
f) Bio-Diversity Conservation Project
   The bio-diversity conservation project is a project related to environmental conservation efforts.

C. Management Definition

Stone and Wenkel, Management is the process of planning,organize, lead and control the efforts of members of the organization, as well as the process of using organizational resources to achieve organizational goals that have been set. (Santosa, 1997) . From this definition it can be said that management problems are related to efforts to maintain the cooperation of a group of people in one unit and efforts to utilize other resources (materials, money, machines, and methods) to achieve certain predetermined goals (Muhassanah and Khozinati 2021). And management will be needed to run an organization, regardless of the form of the organization. Project management can be interpreted as the application of functions
(principles) of management in all activities governing the course of activities in project implementation for all phases of the project.

D. Network Analysis

Network analysis is a project control system by breaking down work into components called activities. Furthermore, these activities are structured and regulated in such a way as to enable the project to be carried out and completed economically, in the shortest possible time with a minimum number of workers. Network analysis is a management technique that useful in designing, planning, and analyzing a system (Santosa, 1997). Besides that, network analysis is a technique that is useful in system design because the technique used will help analytical experts know and identify the linkages contained in existing sub-systems. In order to analyze the network can run properly and planned so as to produce a useful management technique requires a good procedure to be able to implement it. In more detail, to find out about network analysis using a systems approach, that is, we can see that the analysis has clear objectives, has requirements in the application of network analysis and has stages in the application of network analysis.

E. Critical Path Method (CPM)

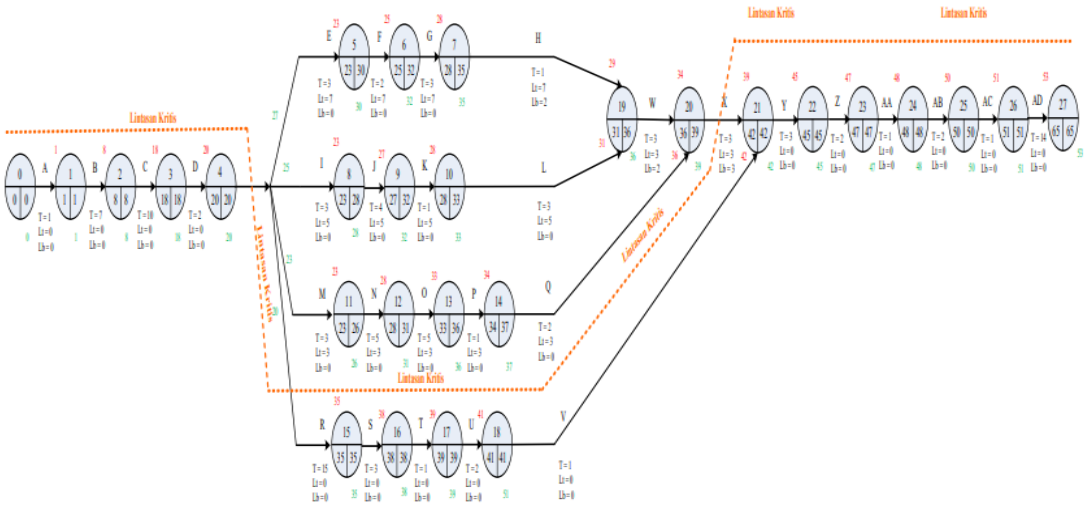
Critical Path Method (CPM) merupakan metode yang menggunakan satu angka estimasi durasi kegiatan tertentu (deterministik) atau perkiraan waktu (durasi) tunggal untuk setiap aktivitas (Single Duration Estimate) (Surveyandini 2022). Metode Critical Path Method (CPM) atau dikenal juga dengan metode lintasan kritis, banyak digunakan kalangan industri atau proyek engineering konstruksi. Metode Critical Path Method (CPM) adalah suatu metode perencanaan dan pengendalian proyek-proyek yang merupakan sistem yang paling banyak digunakan diantara semua sistem yang memakai prinsip pembentukan jaringan. Dengan Critical Path Method (CPM), jumlah waktu yang dibutuhkan untuk menyelesaikan berbagai tahap suatu proyek dianggap diketahui dengan pasti, demikian pula hubungan antara sumber yang digunakan dan waktu yang diperlukan untuk menyelesaikan proyek. Jadi Critical Path Method (CPM) merupakan analisa jaringan kerja yang berusaha mengoptimalkan biaya total proyek melalui pengurangan waktu penyelesaian total proyek yang bersangkutan. Dalam satu sistem yang berkembang dengan baik dari konsep network planning adalah Metode Lintasan Kritis (CPM). Metode ini berkembang pada tahun 1957 pada Dupont Corporation dan Remington Rand. Orientasi sistem ini semata-mata tidak terbatas pada faktor waktu, melainkan juga menerapkan sistematika alokasi sumber daya maupun sumber dana (Sambodo, Silalahi, and Firdaus 2022). Critical Path Method (CPM) memerlukan data yang cocok untuk diterapkan dalam bidang konstruksi, penelitian dan pengembangan, perawatan peralatan dan sebagainya (Jared 2014)

2. METHOD

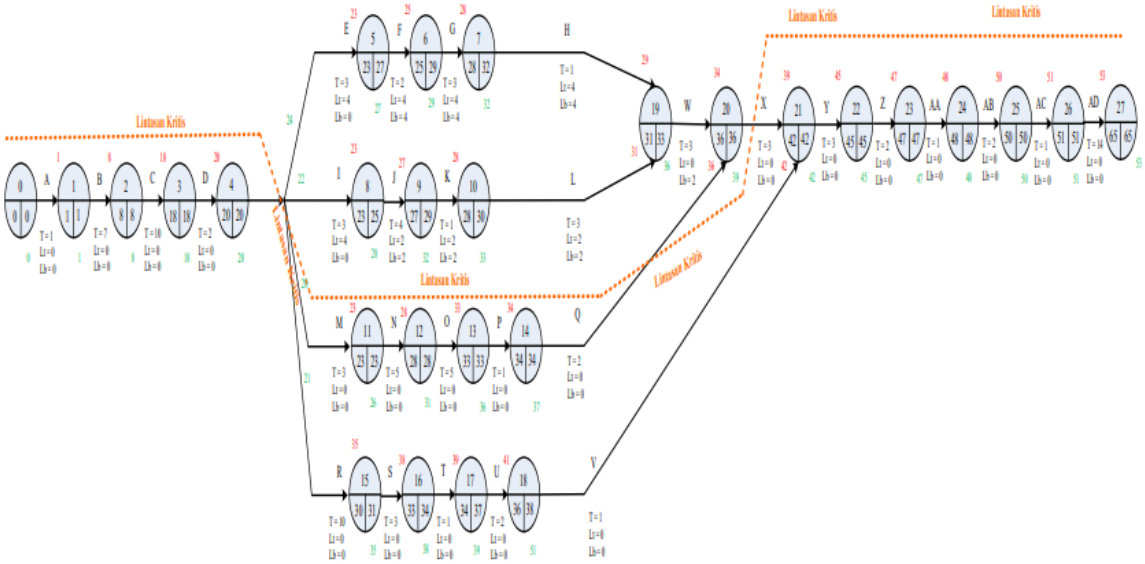
A. Type of Research

Research methodology is an activity of collecting data and information about a problem that has stages arranged in a series and each stage is a decisive part to carry out the next stage. The data that has been collected is then processed according to the method used, in this study the method used is the Critical Path Method or often called the Critical Path Network (CPM) and the calculation of project costs incurred both initial and accelerated conditionsto generate profits.

3. RESULTS AND DISCUSSION



From the normal condition network diagram in Figure 3.1, it can be seen that the time needed to complete the project is 65 days. This initial turnaround time, precludes any change in turnaround time requested by the first party.



From the results of project calculations at the initial conditions with 65 working days normally without using overtime the company spent Rp. 108,623,550, - whereas after accelerating the fabrication time for 3 days from 65 days to 62 days the company spent more project costs of Rp. 127,691,810, -. It is known that the company issued an agreed project cost of IDR 300,000,000. It can be seen that the profit earned for the initial conditions was IDR 191,367,450, while for the 3-day accelerated condition, IDR 172,308,190. This happens because the company holds overtime hours for its employees. By crashing this program, the company can anticipate project delays and for achieve a change in project completion time of 62 days and avoid a penalty penalty of 20% of the project value and the company can work on other project work.

4. DISCUSSION

The data obtained from the project scheduling plan is made of activities and activities that precede those that are in accordance with the Gantt chart and the time it is carried out. The activities of these activities form a network and the network is calculated using the CPM method (Critical Path Method). The CPM (Critical Path Methode) method is useful for analyzing networks that seek to optimize the total project cost by reducing the total project completion time in question. The calculation of the CPM (Critical Path Methode) (Brier and lia dwi jayanti 2020) method is carried out by forward and backward calculations according to the time of the project so as to produce a critical path (Lestari and Yunita 2020).

Forward calculation is the calculation of activity time that starts from the initial activity to the last activity while for the backward calculation the opposite is the calculation starting from the last activity to the initial activity. In this Heat Exchanger project, the critical path was obtained on A-B-C-D-M-N O-P-Q-R-S-T-U-X-Y-Z-AA-AB-AC-AD activities, namely preparation, design, client approval, material inspection, pattern & measure + mark & cut External Shell, welding Con.Reducer to Flange External Shell, Welding Nozzle Flange & N.P Bracket External Shell, Inspection (QC), Finishing, Pattern & Measure + Mark & Cutt Tube Bundle, Comp. Tube Bundle, Expand Tube Bundle, Welding Tube Sheet Tube Bundle, Fit up 2 (fit up 1 assembly + external sheet), Fit up 3 (fit up 2 assembly + tube bundle), welding inspection, hydrotest, sandblasting & painting, finishing inspection and shipping (Kalimantan). The critical path activities must be given more attention because this work affects the next work. If work on the critical path is late, then the next job will be delayed. So that this critical path is used as an activity that will speed up the processing time with the consideration of the smallest cost slope value (Surveyandini 2022). Cost slope is the increase in the cost of speeding up an activity per unit time. Proposed activities that are accelerated are adjusted to the time limit the maximum set by the project owner is 62 calendar days and adjusted to the weight of the work known through the interview process with PT. ASYATEC INDONESIA. In maximum time adjustment (Amiruddin Hi 2012).

Accordingly, the accelerated time starts from the lowest cost slope value. In this case the Cost slope only occurs in activity R because only R activity alone is the root cause that will hinder work on the heat exchanger (Ford Motor Company 2011). Activity R was originally planned to have the duration of the day is 15 days and in Crashing it becomes 10 days(Lestari and Yunita 2020).

5. CONCLUSION

Critical activities using the CPM method there are: Preparation, design, client approval, material inspection, pattern & measurement + mark & cut External Shell, welding Con.Reducer to Flange External Shell, Welding Nozzle Flange & N.P Bracket External Shell, Inspection (QC), Finishing, Pattern & Measure + Mark & Cutt Tube Bundles, Comp. Tube Bundle, Expand Tube Bundle, Welding Tube Sheet Tube Bundle, Fit up 2 (fit up 1 assembly + external sheet), Fit up 3 (fit up 2 assembly + tube bundle), welding inspection, hydrotest, sandblasting & painting, finishing inspection and shipping (Kalimantan). The costs incurred in working on the Heat Exchanger project for initial conditions amounted to Rp. 108,623,550, while for accelerated conditions added to the cost of overtime labor, which amounted to Rp. 127,691,810 (Stamatis 2015).

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