



Analysis Use of PERT/CPM: Optimizing Manufacturing Production Process Resources for Building Construction Projects on Kunjang River Region, East Kalimantan

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Abstract

This study discusses the application of the PERT (Program Evaluation and Review Technique) or CPM (Critical Path Method) in optimizing the manufacturing process of construction project resources in the Sungai Kunjang area, East Kalimantan. The objective of this study is to provide a holistic perspective on sustainable project management indicators that affect construction project processes. The focus is on identifying sustainable project management indicators that affect construction project processes. This study was conducted in the Sungai Kunjang area, which has high infrastructure development potential and requires effective project management to manage construction project resources. The expected outcome of this study is to help improve project performance and achieve sustainable development in the area.

Keywords: Project management, Production, Resource

Introduction

In countries that are developing in the era of globalization, the need to improve the welfare of their people is increasingly urgent. This is caused by the demand for rapid development, while the widely available resources in the form of experienced human resources and funds are very limited. In dealing with these conditions, steps that are usually taken include emphasizing clear priorities and increasing efforts to increase the efficiency and effectiveness of managing available resources. This aims to achieve optimal results from physical construction such as city improvements, infrastructure construction, establishment of heavy and light businesses, telephone network development, and various other activities (Wijaya, 2022).

According to (2006) a construction project is a collection of actions that have been carried out previously and are usually short term, where the resources required for the project are processed to produce a final result, namely construction. Apart from that, building projects have three distinctive characteristics. They are unique, require resources, such as funds, machines, techniques, materials, and the need for an organizational structure. Planning project activities is very important to succeed and complete them quickly. At the project planning stage, it is necessary to know how long the project will last. The amount of time required to complete a project cannot be guaranteed due to the fact that the time required to complete a project varies. The level of accuracy of the estimated completion time for each activity in project planning is used to calculate project time and costs. Optimas is usually used to estimate project time and costs, minimize risks, and optimize existing resources (Wijaya, 2022).

This technique identifies important elements in each task so that if work is late it will impact the overall timeliness of the project. Thus, in the context mentioned above, an analysis of 11 previous studies was carried out with the title "Assessment of Project Evaluation and Review Techniques (PERT) and Critical Path Techniques (CPM) in Building Construction". Background, analysis was carried out on 11 studies. previously with the title "Assessment of Project Evaluation and Review Techniques (PERT) and Critical Path Techniques (CPM) Related to Building Construction." "The main goal of this approach is to understand the amount of time needed to build a construction and the ideal construction materials needed for a particular project.

Literature Review

Project Management

In general, project management is an effort to manage a project or construction in an effective and efficient way. The main goal of project management is to meet all limits, including quality, time, and funds, from the start of the project to its completion. The main goal of project management is to achieve all existing milestones, starting from quality, time, and available funds, all of which continue until the project is completed. It starts with quality, time, and available funds, and continues until the project is complete. According to Anthon et al (2020), "project management is a series of activities carried out by an organization or business to plan, organize, complete tasks and manage daily resources to achieve the desired results within a certain time period.

CPM (Critical Path Metode)

The following data processing uses the Critical Path Technique, which comes from data that researchers have obtained from direct observations and interviews with project team members as well as conducting field surveys to calculate completion time. Many terms are commonly used, as shown below (Lilyana, 2020)

1. E (Last Event Date): The earliest time of the event at the time of the incident.
2. L (Last Event Date): The earliest possible time an event occurred.
3. ES (Earlist Activity Start Time): The first stages of a task.

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4. EF (Earliest Activity Finish Time): Speed of completion of a task.
5. LS (Latest Activity Start Time): The most important tasks can be completed without disrupting project progress.
6. LF (Last Date for Activity Completion): The latest activity can be started without delaying project completion.
7. T (Activity Duration): Tasks that require timing (days, weeks, or months)

Project Evaluation Review Technique (PERT)

PERT focuses more on monitoring and controlling time, while CPM also controls main costs (Kartini 2020). PERT offers three categories of time predictions: optimistic, probable, and pessimistic. According to Upadi in Rijaluddin et al. (2020), the program assessment and evaluation technique is called PERT. The PERT technique is a technique intended to systematically operate, reduce delays and other production problems.

Research Method

Types of research

Research is carried out using a descriptive approach, namely a type of research that uses scientific techniques to answer problems by providing or explaining actual phenomena.

Place and time of research

The study was conducted on the Kunjang River during a project in Loa Bakung, East Kalimantan. It starts on January 2, 2024 and ends on January 31, 2025.

Data collection technique

Data Collection Technique: The researcher examined the literature thoroughly to obtain research information. The PERT-CPM technique in building construction was discussed in eleven previous studies.

Result and Discussion

This section will provide an explanation of the data collected and the processing carried out in accordance with the selected research technique. Next, the data will be interpreted to carry out in-depth analysis and comprehensive discussion of the research techniques used. Construction activities were carried out in the Kunjang River area, East Kalimantan. The construction project management structure is structured as follows:

1. Project Owner

An organization or individual that creates jobs and funds projects, whether public or private. In this case, the PUPR Ministry will be the project implementing agency.

2. Planning Consultant

Project planners are authorized to create structural, architectural, and mechanical/electrical system plans that align with the desires and needs of the project owner.

3. Supervisory Consultant

Supervision Experts act as professionals tasked with overseeing and controlling construction projects so that they are in line with predetermined contracts and specifications.

4. Project Implementer

The party carrying out the project, or what is usually called the implementing contractor, is a business entity that is authorized to carry out construction work. Their appointment is carried out by the project owner and has been formalized in a Work Agreement Letter.

5. Project Manager

The person in charge of the project is appointed by the organizer and has the task of managing the project as a whole, from the planning stage to the evaluation stage.

6. Head of Factory

Leadership abilities, technical knowledge, and extensive field experience are the characteristics of a skilled craftsman.

7. Handyman

The selection of areas of expertise is based on experience and work methods mastered by experts.

8. Coolie

Transporting materials, tools, etc. is the responsibility of the helper.

9. Data Collection

At this stage, project members will be interviewed and observed to collect data related to critical road techniques.

10. Project Implementation Schedule

In Figure 1.2 below, the Construction Project Research on the Kunjang River will start on January 2 2024 to January 31 2025 and will take place based on general schedule planning. Regarding the efficiency of work time at several stages of work in the construction construction process, research classifies construction work into 11 stages, namely: (1) Preparation (2) Foundation work (3) Making pillars (4) Making cast formwork (5) Installing the roof (6) Installing Flooring (7) Installing Doors and Windows (8) Plastering and Painting (9) Making Gardens and Fences (10) Finishing (11) Making Home Interiors. The figure shows that the time efficiency of construction work is 97%. Based on this, overall, construction work was carried out efficiently and on time. However, there are variations in time efficiency at each stage of work in the construction process.

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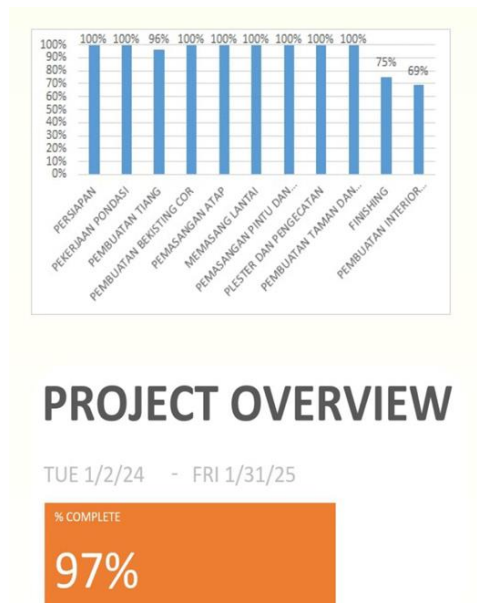


Figure 1. Time efficiency of construction work in the Kunjang River region, East Kalimantan
Source: Project Implementer

Total Construction Costs

Total construction costs are the total amount of funds needed to complete a construction project, including all expenses ranging from planning, materials, labor, to other unexpected costs. Based on figure 1.3 below, the total construction funds are IDR 13,471,332,155,000. This figure is the total cost required to complete a construction project from start to finish.



Figure 2. Total Construction Funds for construction in the region Kunjang River region, East Kalimantan
Source: Project Implementer

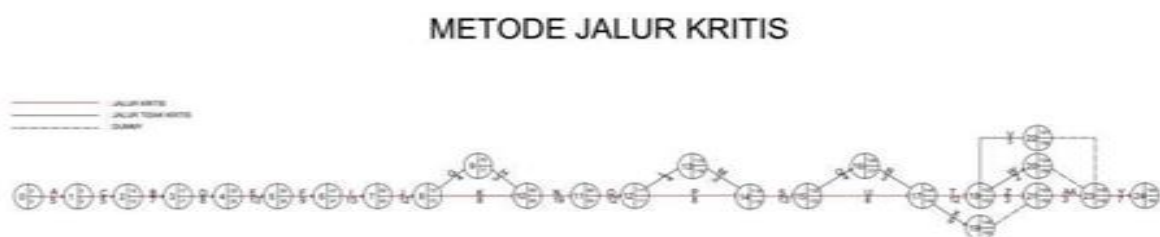


Figure 3. Shows the critical path technique
Source: Wibowo and Rozy (2020)

The image above shows the important trajectories resulting from the project, namely A–B–C–D–E–F–I–J–K–N–O–P–S–T–U–Y–Z–M. Based on the results, the estimated duration of building a house on the Kunjang River is 391 days (13 months) based on S-Curve Barchart analysis and CPM plans.

Putra, JG & Sekarsari, J (2020) using Monte Carlo simulation. Carlo simulation to analyze the performance of large construction projects using PERT and M -PERT methodologies. The study found that the PERT technique starts by dividing data into optimistic, realistic, and pessimistic categories. From here, standard, variation, and deviation values can be obtained. To determine the critical path, a work diagram is created. The five important jobs resulting from critical path analysis are B1, L1, L2, and P1, as shown in the following table:

Kode	Pekerjaan pada Lintasan Kritis	S
B1	Bored pile (Bagian 1)	0,000
L1	Lantai 1 (Bagian 1)	0,000
L2	Lantai 1 (Bagian 2)	0,000
P1	Dinding Bata Ringan (Bagian 1)	0,000
W	Furniture (Mebel)	7,000

Figure 4. Shows the list of jobs on critical routes

Source: Putra, J.G and Sekarsari, J (2020)

The table above shows that completing a multi-storey building takes 121 days with a standard deviation value of 7,000

1. Research was conducted by Syaihu et al. (2016). about maximizing the efficiency of supervision consultants for general workforce in Tarakan City. The study concluded that network design is more important than drainage channel construction. Based on analysis using the PERT-CPM technique, the ideal duration for project completion is 91 calendar days (10 weeks), 29 days faster than the standard 120 calendar days (14 weeks). The optimal time to start a project is 118 calendar days (17 weeks), 32 days faster than the current time of 150 calendar days (20 weeks). For office building construction and supervision, the optimal time is 99.98% or the equivalent of 280 calendar days (37 weeks).
2. Ariani and Ghorizah (2013) conducted this research. in evaluating the development of the Disbuparpora Office in. The study found that, using the CPM technique, project construction under the auspices of the Sampang Regency Disbuparpora Office was completed 16 days ahead of schedule, namely 119 days from the initial estimate of 135 days. The total budget requirement for this project reaches IDR 1,067,848,290.71. With the highest distribution of IDR 112,584,687 occurring in the 14th month.
3. Chilmi, M., and Wulandari, D.A.R. (2020) Optimizing the Laves Grand Sungkono Lagoon Surabaya Mall project schedule using CPM and three deadline options: Case Study. This research found that positive feedback in the workplace can increase productivity. The critical

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path of a project consists of critical work such as earthworks, structures, and MEP. Project duration is evaluated in three scenarios: optimistic, most likely, and pessimistic. Estimated project completion time is 694 days with a possible deviation of 194 days.

Conclusion

The conclusion of this research is that the PERT (Program Evaluation and Review Technique) or CPM (Critical Path Method) technique can be used to optimize the production process for manufacturing construction project resources in the Kunjang River area, East Kalimantan. The PERT/CPM technique allows more accurate and effective planning in estimating project time and costs, so it can help save costs and increase project efficiency and also this technique allows more efficient risk identification and more careful risk management, so it can help in reducing the possibility of problems or project delays. This research found that effective and efficient project management is very important in managing construction project resources in the region. By using the PERT or CPM technique, projects can be run more efficiently, improve project performance, and realize sustainable construction. It is hoped that the results of this research can help increase project efficiency, improve infrastructure quality, and increase construction competitiveness in the Kunjang River area.

Contribusy

The PERT-CPM methodology is recommended for use on projects with a critical path. The critical path can be used to find out when the project will be completed and reduce project completion penalties which can result in fines. In addition, PERT and CPM techniques can help ensure that the next steps are taken correctly. PERT and BPS Engineering can help ensure that the next steps are taken correctly.

Declaration of conflicting interest

The authors declare that there is no conflict of interest in this work.

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