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LITERATURE REVIEW OF CONSTRUCTION PROJECT SCHEDULING METHODS AND EFFECTIVENESS FOR THE LAST 5 YEARS IN INDONESIA

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Abstract

Resources in the project were definitely limited so planning must be thorough and perfect. To achieve this goal, developers, contractors, and project owners create a project implementation schedule as well as control the implementation of the project itself. Scheduling determines when activities will be started, postponed and completed, so that resource control will be adjusted to the needed that had been determined. In project planning, scheduling was very important in projecting the needed of manpower, materials, and equipment. This study aims to assess project scheduling in general based on literature sources in the form of previous research (journals). The method used in this study was a literature study related to scheduling studies based on construction projects. Data were obtained from several library sources in the form of research journals for the last 5 years related to the research topic. The results showed that each method was complementary, such as LoB combined with CPM or PDM. In scheduling a construction project, a combination of methods needed to be applied to suit the desired construction project.

Keywords: Construction, Effectiveness, Methods, Scheduling

1. INTRODUCTION

Currently, there are often sustainable construction projects in one project so that it requires the use of sustainable resources such as in the construction of houses in housing projects, roads in road projects, pipe installation and so on. Such projects are usually referred to as repetitive or repetitive projects. Cost, schedule, quality are indicators that greatly impact the success of a project. The project is said to be successful if it is completed faster than the planned schedule or must take into account the project costs and does not exceed the set budget. The quality of the work done must meet the required criteria and specifications. Project scheduling is the most important element because then information about the schedule of plans and progress in terms of resource performance in the form of costs, labor, equipment and materials as well as project duration plans and time progress for project completion can be known (Husen, 2009).

Every construction project certainly has a plan and schedule for implementation and completion to how the project will be carried out. The making of the construction project plan must refer to the estimates that existed at the time the construction plan was made, and problems can arise if there is a discrepancy between the plan and its implementation. Resources in the project are definitely limited so planning must be thorough and perfect. To achieve this goal, developers, contractors, and project owners create a project implementation schedule as well as control the implementation of the project itself. In

general, a project uses commonly used project scheduling methods such as line of balance, precedence diagram method, CPM, and so on. These methods have their respective advantages and disadvantages. The selection of the scheduling method is adjusted to the needs to be achieved by a project.

So for the smooth running of a project with project management it is hoped that there will be timeliness. A company certainly pays special attention to planning and controlling time so as to achieve targets without reducing the quality of workmanship. With good planning, it is hoped that the completion of the project will run smoothly. Based on the previous background, this study aims to assess project scheduling in general based on literature sources in the form of previous research (journals).

2. LITERATURE REVIEW

2.1. Overview of Construction Projects

A construction project is a series of activities related to building efforts according to the desired cost, time and quality constraints. The success of the project can be seen based on the planning, namely planning and scheduling. Scheduling a project is known as a way so that during the construction process it runs smoothly in accordance with the stipulated time for the implementation of work items. Construction project scheduling must be planned carefully and optimally so as to minimize delays in time or duration of project activity implementation and other unwanted impacts. Proper planning and in accordance with the characteristics of the project is needed to deal with uncertain project conditions so that the project can be carried out and run efficiently according to the planned time and cost.

Construction projects are reflected as activities that involve resources so as to achieve goals based on a certain period of time until the goals are achieved perfectly. The project does not become a routine or operational activity because it is only temporary so that a project has a characteristic that is there is a timeline (between the starting point and the measurable end point), there are resources in the form of capital and labor, there are tools to run the project and special techniques for Gantt Charts. and S curves, and there are diverse teams from fields & functions (Rosanti et al., 2016).

2.2. Project Scheduling

When project planning takes place, there will be several considerations to get the right resources. An important part of planning is determining the project schedule. From the project schedule, you will see a description of the type of work, when to start and end each work item that is related and interdependent between each activity. Scheduling is planning the division of time and relationships between jobs in a project. Allocating the time available to carry out work in completing a project to achieve optimal results with consideration of limitations is the definition of scheduling. A project to be carried out must be scheduled and it can be known how long it will take to complete the project. So that project management also always has to be improved in line with the increasing number and complexity of project activities.

In scheduling there are several methods commonly used such as bar chart techniques, Line of Balance (LoB), Critical Path Method (CPM), Linear Scheduling Method (LSM), Ranked Position Weight Method (RPWM) and so on. Each method has its advantages and

disadvantages and several methods can be combined for the desired scheduling. Scheduling determines when activities will be started, postponed and completed, so that resource control will be timed according to predetermined needs. In project planning, scheduling is very important in projecting labor, material, and equipment requirements. The benefits of scheduling include:

1) There are guidelines for activity units regarding the time limit for starting and ending each task
2) Provide management tools for systematic & realistic coordination in determining priority allocation of time and resources
3) Provides a means to assess work progress
4) Avoid excessive use of resources so that the project is completed before the set time
5) Provide certainty of the execution time of the work
6) Good planning to make work arrangements, procurement of materials & equipment, allocation of manpower to minimize the possibility of conflicts between activities that hinder project performance

2.3. Time Effectiveness

Effectiveness is defined as a series of inputs, processes and outputs in looking at certain things. A program or series of activities is said to be effective if the resulting output meets the desired goals. Effectiveness is the condition when choosing the expected goals and the means or equipment used along with the desired goals can be achieved with satisfactory results. Factors that affect the suitability of project time and schedule include materials, labor, equipment, finance, contractors, partners, consultants, and external factors. Effectiveness is also interpreted as a measure that describes the quantity, quality and time achieved due to good management and the target has been determined beforehand. Effectiveness is always related to expected results and desired goals so that effectiveness will contribute to future activities (Soleha & Ismail, 2018).

3. RESEARCH METHOD

The method used in this Literature review begins with choosing a topic, then writing down the keywords "Effectiveness", "Construction", "Methods, "Scheduling". The journals used in the literature review were obtained through the Google Scholar database. Searching for these journals was limited from from 2017 to 2022. The number of articles that appear was narrowed down again by selecting articles that were in accordance with what was needed by the authors, subsequent findings were sorted from the most recent, so that the number of articles was 7. The data analysis technique used in this study was descriptive analysis to provide information and explain the data obtained.

4. RESULTS AND DISCUSSION

The results of the identification of methods and effectiveness of construction project scheduling can be seen in Table 1. This study examines the literature from eight previous studies that used five construction project scheduling methods.

Table 1 Identification of Construction Project Scheduling Methods and Effectiveness in the Last 5 Years

No	Researcher	Method	Nature and Methods of Scheduling
A.	Fahrian et al., (2022)	CPM	• Unable to do overlapping work • Duration of work 190 days
		PDM	• PDM method is more effective because of shorter duration scheduling • Reducing financing • Can do overlapping jobs • Job duration 175 days
B.	Yusdiana & Satyawisudarini, (2018)	PERT	• Achieving time effectiveness in project work, which is 41 days
		CPM	• Achieve time effectiveness in project work, which is 11 days • Simple and easy to apply
C	Kalia et al., (2022)	LOB	• Suitable for structured projects (repetitive activities) and not suitable for non-repetitive projects • Effective time which only lasts 132 days • LOB is better used in housing development projects
D	Setiawati et al., (2017)	CPM	• Can only use one time estimate • This method is not good enough for a new project • The duration of cooperation with the duration of the planner
		PERT	• PERT can use three time estimates • More suitable for new projects • Can reduce expenses • Successful completion of 150-day duration projects which is only 25%
E	Soplanit et al., (2021)	LOB	• Effective LOB for the construction of flats • Shorter duration of work, namely 38 weeks with 100% progress • Effective because it is able to provide solutions with field conditions according to the curve
F	Situmorang et al., (2017)	PDM	• PDM projects are more profitable because they save costs
		RPWM	• Duration five days faster than PDM • More optimal time and cost • Equal use of resources • Slightly more costly than PDM
G	Prahadita et al., (2021)	PERT	• Faster time effectiveness • Time for the project to be completed in 95 days, namely 99.98%

(Source : Processed Data Researcher)

Based on the identification results in Table 1, mapping the objectives of construction project scheduling from each previous research, namely construction project scheduling:

1) Determining the start and completion time of the project: researcher A stated that the PDM method can show work constraints starting from early start (ES), early finish (EF), late start (LS) and late finish (LF) as researchers C and E who states LoB can determine the time from start to finish of the project
2) Shows a dependency relationship: researcher A states that CPM shows a dependency relationship between activities
3) Determining the critical path: researchers A and D stated that PDM and CPM could identify the critical path, researcher F stated that the application of RPWM could identify the critical path, researcher G stated that the PERT method could determine the critical path
4) Estimating the probability of project completion time: researcher G states that the PERT method is very effective for estimating the completion time of construction projects, as researcher A states that the PDM method is effective because the schedule is shorter
5) Investigating delays in activities that affect project completion: researchers A and F state that PDM can help determine delays in implementing activities without affecting the overall project completion and researcher D states that PERT can find out the implications and timing of work delays
6) Allows balance of operations so that each activity can continue: researchers C and E stated that LoB can show balance with each activity that is continuously carried out
7) Regulate the use of resources as based on researchers C, E, F who stated that the use of resources, both labor and materials, can be done using the LoB and RPWM methods
8) Provide a broad and real picture for the status of projects C, E, F which states that the LoB and PDM methods show activities from scheduling

Table 2 Mapping of Construction Project Scheduling Methods

No	Construction Project Scheduling Method Functions	Construction project scheduling method				
		CPM	LoB	PDM	PERT	RPWM
1.	Determine the start and end times of the project	√	√	√	√	√
2.	Shows dependency relationships between activities	√	√	√	√	√
3.	Determine the critical path	√		√	√	√

No	Construction Project Scheduling Method Functions	Construction project scheduling method				
		CPM	LoB	PDM	PERT	RPWM
4.	Estimating the probability of project completion time			√	√	
5.	Investigating delays in an activity that affects project completion time	√	√	√	√	√
6.	Allows balance of operations so that each activity can continue		√			√
7.	Manage resource usage	√	√	√	√	√
8.	Provides a broad and real picture for project status	√	√	√	√	√

(Source : Processed Data Researcher)

Table 3 Mapping of the Scheduling Method Against the Characteristics of the Construction Project Scheduling Method

No	Nature of Construction Project Scheduling Method	Construction project scheduling method				
		CPM	LoB	PDM	PERT	RPWM
1.	Simple and easy to understand	√	√	√	√	√
2.	Can be used for all types of projects					
3.	Used for recurring projects		√			
4.	Suitable for complex projects	√			√	
5.	Suitable for linear project scheduling		√			
6.	For vertical repetitive project scheduling					

No	Nature of Construction Project Scheduling Method	Construction project scheduling method				
		CPM	LoB	PDM	PERT	RPWM
			√			

(Source : Processed Data Researcher)

Based on the results of the scheduling method mapping in Table 2, all construction project scheduling methods have their respective advantages and disadvantages. PDM and PERT answer almost all the functions of scheduling methods based on start time, dependency relationships, determine critical paths, estimate project completion time probabilities, investigate delays, manage resources and provide a broad and real picture for project status. Some methods cannot stand alone, so they need to be combined, such as the LoB method combined with CPM or PDM or CPM combined with PERT. Construction projects that have repetitive work packages such as housing, apartments, highways, tunnels and so on require project scheduling that is able to accommodate continuous resource requirements and is properly scheduled without the occurrence of obstacles so that proper scheduling is using the Line of Balance method.

5. CONCLUSION

Based on a literature study of various construction project scheduling methods that have been carried out in the last five years, it is concluded that project scheduling will show a description of the type of work, when to start and end each work item that is related and interdependent between each activity. Factors that affect the suitability of project time and schedule include materials, labor, equipment, finance, contractors, partners, consultants, and external factors. Each method is complementary as is LoB combined with CPM or PDM. In scheduling a construction project, a combination of methods needs to be applied to suit the desired construction project.

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