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The Influence of Time Management Quality on the Timeliness Story Private House Construction Project Using the Critical Path Method

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Abstract
This research investigates how the quality time management affect the time delivery of a two-floor private house project in Samarinda. Using the Critical Path Method, efficient time management is an important thing as it directly impacts project cost, quality, and client satisfaction. CPM was used in this research to spot tasks that might delay the project. Data collection involved observation, interviews, and documentation, which were then analyzed using a project network diagram. The conclusions reveal that this project can be shortened from 458 to 383 days through the optimalization of critical activities which resulting in a 16.38%-time efficiency without reducing construction quality. This study also identifies common challenges encountered on-site, such as limited resources, mid-project design changes, and external interferences.

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Introduction

Construction projects, particularly in residential development, are heavily influenced by thorough time planning. Project success is measured by stakeholder satisfaction, traditionally assessed through the accuracy of cost, time, and quality as agreed upon by all parties involved (Chandra dkk., 2011) [4]. However, in practice, many projects experience delays due to weaknesses in time management, such as incomplete planning, suboptimal resource allocation, and insufficient monitoring of critical activities that significantly impact the overall schedule. These delays not only incur additional costs due to extended project duration but may also harm the contractor's reputation and trigger conflicts with the project owner (Sofyana, 2024) [11]. In smaller project such as building a two-story house, these risks are often overlooked, even though the work depends on many closely linked steps, from start to finising.

Due to ongoing growth of the housing industry in Samarinda, managing time efficiently in construction project has become more crucial. This progress has been largely driven by public programs and private investment to improve residential quality an urban facilities. According to the Housing and Settlement Area Agency of Samarinda, housing development continues to grow substantially. In 2024, 120,572 habitable houses were recorded, up from 119,933 in 2022. Meanwhile, the number of uninhabitable houses has decreased from 22,110 in 2022 to 21,471 in 2024 (Samarinda, t.t.). The city government also supports housing for low-income residents (MBR), with 5,597 units built, and provides vertical housing in the form of three low-cost rental apartment buildings (Rusunawa) with a total of 75 units.

This data indicates a rising demand for proper housing as a result of population growth and urbanization rise. As a response, the construction of private homes, especially two-story houses has become more frequent to accommodate urban family needs. In this situation, effective time management is vital, as on-time completion influences expenses, construction standards, and client satisfaction. Therefore this research will investigates the effect of time management quality on the punctual delivery of two-story house project in Samarinda, using CPM as a planning and monitoring control. Management can also be defined as the art or science of planning, organizing, directing, and controlling human, financial, material, and informational resources to achieve organizational goals (Belferik dkk., 2023) [3]. One analytical tool proven effective for this purpose is the Critical Path Method (CPM), which identifies the critical path of activities based on their dependencies.

Activities are specific tasks with measurable outcomes and durations. The critical path is a sequence of critical activities that determines the overall project duration (Perdana & Rahman, 2019) [7]. However, its application in small-scale projects is often overlooked, considered too theoretical or disproportionate to the project's complexity.

In response to these issues, this research focuses on exploring the impact of time management and timely completion of two-story house construction, as well as to determine the suitability of CPM for smaller construction projects. With efficient time management and accurate execution, construction delays can be minimized (Alfonsius, 2024) [1]. The study also identifies obstacles such as resource unavailability, sudden design changes, or external disruptions (weather, regulations) that often affect schedule consistency. Using a descriptive quantitative approach, this study seeks to offer practical insights for contractors in improving time planning, use resources efficiently, and minimizing the risk of delays. The result are expected to assist construction stakeholders in enhancing scheduling accuracy, controlling costs, and increasing client satisfaction through data-driven such as CPM.

This research centers on the application of the CPM in a two-story private house construction project located in the Pinang Bahari housing area, Jalan APT Pranoto, Sungai Keledang. The study focuses on assessing how well time is managed, specifically how planning, scheduling, and supervision of key activities influence the on-time project delivery. Although several studies have explored CPM in construction, gaps remain in its comprehensive application in small- to medium-scale projects. A study by Surahman et al., n.d. demonstrated that the use of CPM shortened the construction period of a house in the Selili District from 163 days to 148 days; however, the study mainly emphasized the duration estimation and did not explore on-site challenges or how resources were managed. Another study by Surahman et al (2024) [12] emphasized time and cost efficiency using CPM but lacked integration of external risks and supportive technology in field implementation. Meanwhile, Iwawo et al (2016) [5] applied CPM in high-rise building scheduling but limited it to structural works without discussing delay mitigation strategies or acceleration techniques like crashing or cost slope. Hence, further research is needed to not only determine the critical path but also evaluate field implementation barriers and formulate evidence-based efficiency strategies to improve time management in residential construction.

2. Literature Review

1. Time Management in Construction Project

Time management take a vital role in carrying out construction projects, as it greatly affects outcomes related to quality, cost efficiency, and client satisfaction. According to Lagonda et al. (2021) [6], a sound time management system must involve comprehensive planning, scheduling, and control of project activities. In practice, software tools such as Microsoft Project help facilitate project activity management, especially in identifying critical paths and allocating resources efficiently.

2. Factor Causing Project Delays

Romadhon & Tenriajeng (2020) [8] identified various factors contributing to delays in high-rise building construction projects in Indonesia. These were categorized into seven main aspects: labor, materials, equipment, project location, management, finance, and external factors. Their multiple linear regression analysis revealed that labor is the most dominant factor influencing delays, with a regression coefficient of 0.807 and an explanatory contribution of 84% ($R^2 = 0.840$). This finding emphasizes the importance of effective labor management in large-scale construction projects.

3. Delay Control Strategies

Various methods are used in the construction industry to address delays. One widely applied method is CPM, which focuses on identifying the project's critical path. Siregar & Iffiginia (2019) [10] applied CPM and crashing techniques in the case of the Ambarawa General Hospital project. Their findings showed that accelerating critical path activities (e.g., finishing and plumbing) reduced the project duration from 29 to 28 weeks, with cost savings of IDR 12.56 million. A similar approach was used by Lagonda et al. (2021) [6], who used the Cost Slope technique to estimate the extra expense of overtime on key tasks. Through the additional costs linked to working overtime on critical tasks. Through the addition of fours extra working hours per day, the pile cap foundation stage was completed from 50 to 23 days, allowing the project to finish earlier than planned.

The finding from these three studies indicate that delays in construction projects result from both internal and external influences, with labor and resource coordination being key contributors. Methods like CPM and crashing are effective for detecting and managing critical paths. Utilizing time management software alongside cost-efficiency tools such as Cost Slope supports a more integrated and strategic approach to project control (Lagonda dkk., 2021; Romadhon & Tenriajeng, 2020; Siregar & Iffiginia, 2019) [6, 8, 10].

4. Research Method

This study uses a quantitative descriptive approach to analyze project duration and describe field constraints based on quantitative data obtained from documentation and observation. Data collection involves observation, interviews, documentation, and project network analysis. The CPM is used to identify critical paths and potential project delays.

The CPM is a project scheduling approach that focuses on identifying the critical path, which is a series of activities determining the overall project duration (Perdana & Rahman, 2019) [7]. Each activity is analyzed based on its start time, finish time, and lag time. This method involves several systematic steps to ensure timely completion of the project. First, project activities are identified and arranged based on their dependencies. Then, each activity is given a clear duration and a logical relationship, such as whether the activity starts after another activity is completed or can run concurrently.

Next, calculations are made for early start, late finish, and float, which is the time flexibility for each activity. The critical path is identified as a sequence of activities with zero float, meaning any delay in this activity will delay the entire project. Finally, possibilities for accelerating the project are evaluated, such as allocating additional resources to critical activities to shorten the duration without sacrificing quality or efficiency (Nugraha & Wakito, 2023).

3. Results and Discussion

1. Overview of Project Activities

The construction of the private house that is the subject of this study is designed and planned to be completed in a total duration 383 days. This work is divided into several stages such as preparation, substructure work, architectural work, and the final stage. Each stage is interrelated, where delays in certain activities have the potential to affect the overall project duration. Therefore, all activities will be analyzed using CPM to identify critical paths and potential delays. This approach allows the project to focus on activities that require more supervision and allows for efficient adjustment of duration.

Table 1: Project Work Details

No	Type of Activity	Symbol	Standard Duration (Days)	Expedited Duration (Days)	*Predecessor*
1	Arrangement	A	10	7	-
2	Earthworks & Footing	B	35	27	A
3	Structure	C	90	84	B
4	Architecture	D	109	94	C
5	Flooring	E	15	10	D
6	Ceiling Installation	F	13	10	E
7	Painting	G	40	30	F
8	Door and Window Frames	H	32	26	C
9	Stairs and Railing	I	12	8	G
10	Sanitation	J	10	8	I
11	Mechanical and Electrical	K	92	89	D

Source: Processed Data (2025)

Normal Work Duration Before Applying CPM

Referring to the summary project activities in table 1, the researcher presents a network diagram with normal duration. The construction is scheduled to commence on March 17,2025, and is projected to conclude by June 18,2026, with a total estimated duration of 458 standard working days. Based on table 1, the preparation of detailed diagrams and networks with normal duration can be arranged as follows:

Table 2: Project Work Details

No	Type of Activity	Symbol	Duration (Days) Normal
1	Arrangement	A	10
2	Earthworks & Footing	B	35
3	Structure	C	90
4	Architecture	D	109
5	Flooring	E	15
6	Ceiling Installation	F	13
7	Painting	G	40
8	Door and Window Frames	H	32
9	Stairs and Railing	I	12
10	Sanitation	J	10
11	Mechanical and Electrical	K	92

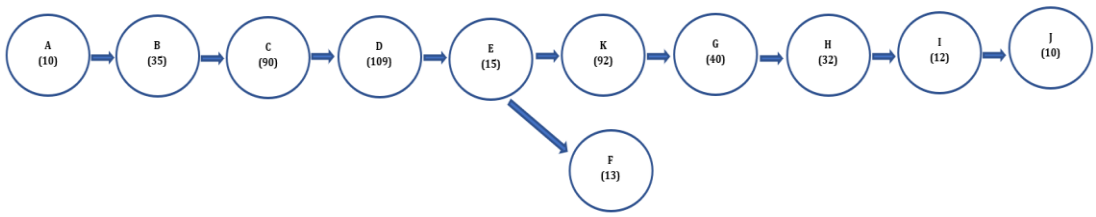


Fig 1: Normal Duration Workflow

Based on Figure 1, the sequence of taks in a residential construction project begins with the site preparation phase and concludes with the finalization of mechanical and electrical systems. From the critical path analysis, it can be seen that activities A – B – C – D – E – F – K – G – H – I – J must be completed on time so that the project schedule is not disrupted. By applying the CPM to the project network, the critical path plays an important role in estimating the overall project duration. By adding up the duration of each activity, the total project implementation time is estimated to reach 458 working days under normal conditions.

Network Planning Using CPM Method

Network planning with the CPM basically follows the same stages as normal network planning. This process refers to the activity summary data in table 1.

Table 3: Accelerated Work Schedule Using CPM

No	Type of Activity	Symbol	Expedited Duration (Days)
1	Arrangement	A	7
2	Earthworks & Footing	B	27
3	Structure	C	84
4	Architecture	D	94
5	Flooring	E	10
6	Ceiling Installation	F	10
7	Painting	G	30
8	Door and Window Frames	H	26
9	Stairs and Railing	I	8
10	Sanitation	J	8
11	Mechanical and Electrical	K	89

Source: Processed Data (2025)

The construction process is scheduled to begin on March 17, 2025, and be completed on April 3, 2026. This period results in an accelerated time diagram as shown below.

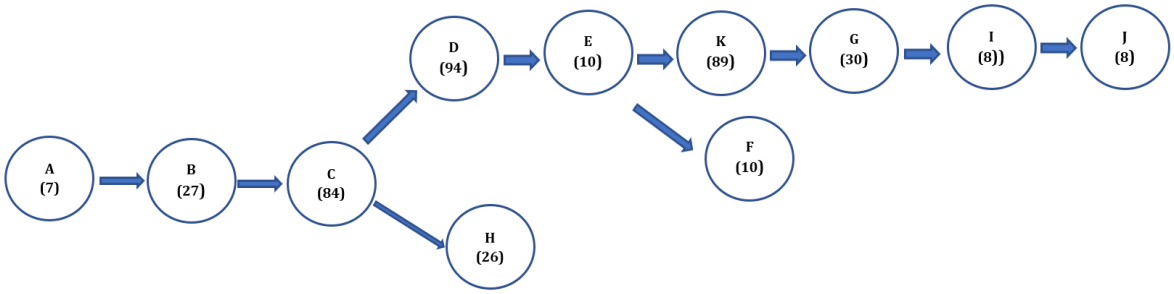
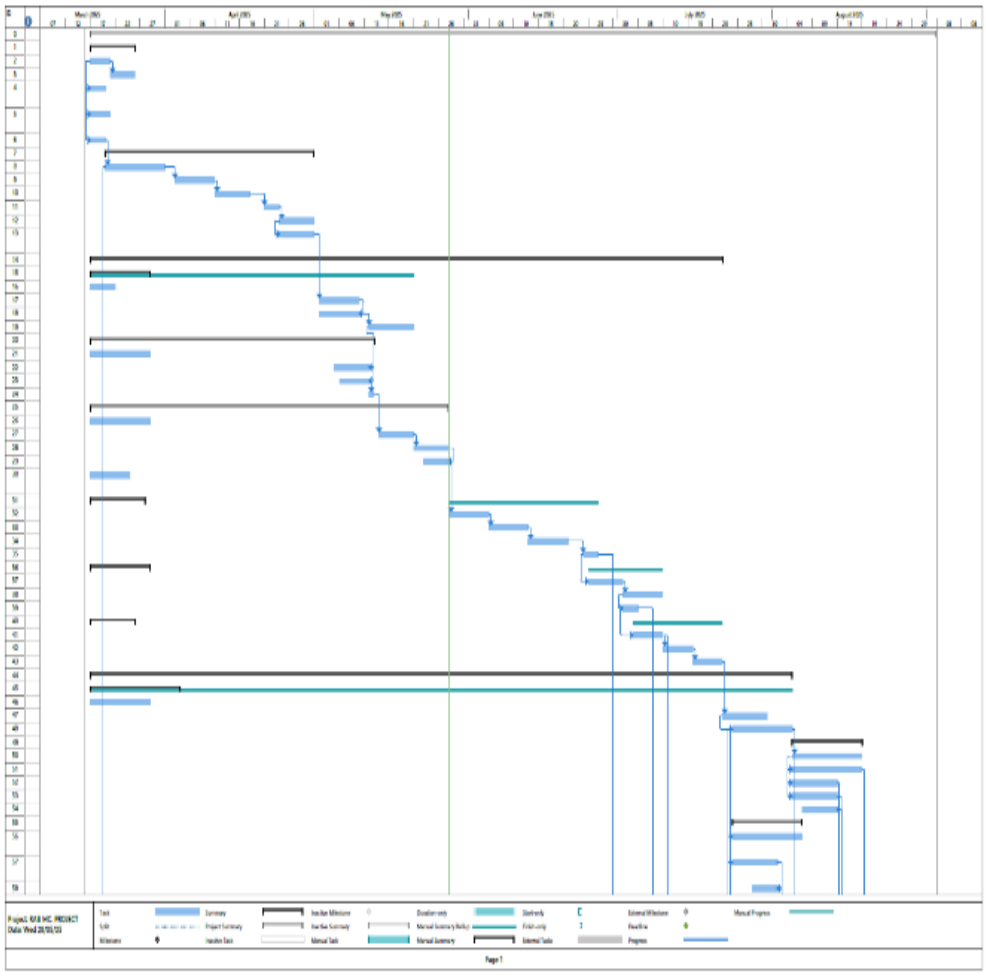


Fig 2: CPM Acceleration Diagram

From the figure above, the acceleration schedule using a Gantt chart can be shown as follows:



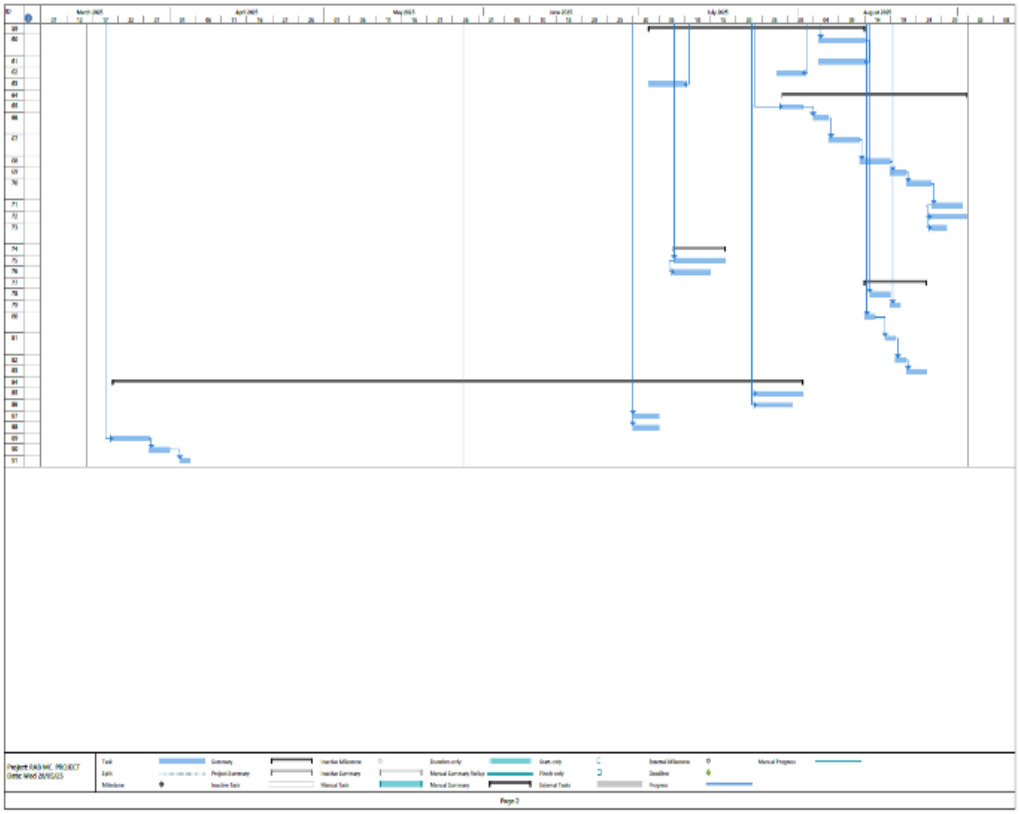


Fig 3: Activity Acceleration Using Gantt in Microsoft Project

Figure 2 illustrates the critical path is set as the sequence A – B – C – D – H – E – K – F – G – I – J. Based on this sequence, the estimated completion time for the two-story private house building project is calculated using CPM model. To determine the minimum duration, the duration of each activity in the network diagram is summed up. The results show that the fastest time to complete the house building project is 383 days.

5. Conclusion

The purpose of this study is to analyze time efficiency in the construction of a two-story private house in Samarinda using the CPM model. The results of the study indicate that the project can be completed within 383 days under optimal conditions. By identifying the critical path which includes Preparation (A), Earthworks & Foundation (B), Structure (C), Architecture (D), Door and Window Frames (H), Flooring (E), Mechanical and Electrical (K), Ceiling Installation (F), Painting (G), Stairs and Railing (I), and Sanitation (J)—the project duration can be shortened to 383 days through the optimization of critical activity resources. This acceleration resulted in savings of up to 16.38%, indicating that the CPM model is effective in preventing delays without sacrificing the quality of construction work. Further research is recommended to explore the impact of acceleration on resources and costs to strengthen the overall project management strategy.

6. Thank-You Note

The author would like to thank previous researchers for their contributions in conducting studies related to time management and the application of the Critical Path Method (CPM) in construction project. Thanks to the insights and research findings from previous studies, I and other readers can obtain comprehensive information regarding the importance of time management quality in achieving project timeliness. This information will certainly be very useful as a basis for further research to create innovative and useful learning media for students. I hope that the results of this article can provide a clearer understanding of how time management quality influences the timely completion of private house construction projects using the CPM approach.

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