Analysis of The Effect of Change Orders on Implementation Time and Construction Labor Costs in The Development Project of The Joint Lecture Building III at Unimus

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Abstract. Change orders resulted in a total time deviation of 45 days (18.75%) from the initial plan, with the most substantial delays in structural and MEP work. Regarding labor costs, MEP work experienced the largest deviation at 25% (IDR 150,000,000), followed by foundation work (16.67%), structural work (15%), and architectural work (10%). Change orders also impacted labor productivity, particularly in MEP work (-25%), followed by foundation (-16%), structural (-12.5%), and architectural work (-12.5%). These productivity decreases resulted from changes in work methods, increased complexity, and adaptation requirements to new specifications. The study recommends several measures to minimize change order impacts: more thorough design reviews before implementation, allocation of time and cost buffers, improved documentation and approval systems, and more flexible workforce planning. Effective change order management is crucial for maintaining overall project success.

Keywords: Change Order, Labor Costs, Construction Implementation Time.

1. Introduction

In the execution of construction projects, change orders or work changes are common and often unavoidable (Hao et al., 2008). Change orders can significantly impact project completion time and implementation costs, particularly construction labor costs (Ibbs et al., 2007). The construction project

of the Joint Lecture Building III at Universitas Muhammadiyah Semarang (UNIMUS) is no exception to the potential occurrence of change orders during its implementation.

Change orders can be caused by various factors originating from the owner, contractor, or consultant (Arian et al., 2006). These factors need to be identified and analyzed to determine the primary causes of change orders in the construction project of the Joint Lecture Building III at UNIMUS. This will allow for more effective and efficient efforts in mitigating and controlling change orders. The impact of change orders on project completion time also requires in-depth analysis. Delays in project completion can lead to losses for both the owner and the contractor (Ibbs, 2005). Furthermore, the influence of change orders on construction labor costs needs to be comprehensively analyzed. Increases in labor costs can reduce contractor profits and burden the owner's budget (Moselhi et al., 2005).

By identifying the factors causing change orders, analyzing the most significant causes, and examining their impacts on project completion time and construction labor costs, it is hoped that solutions and recommendations can be developed to minimize the negative effects of change orders on the construction project of the Joint Lecture Building III at UNIMUS and similar projects in the future.

Although numerous studies have been conducted on change orders in construction projects, several gaps remain to be further explored. According to Motawa et al. (2007), most previous studies focused solely on identifying the general factors causing change orders without specifically analyzing the most significant or dominant factors in particular projects. Additionally, Hsieh et al. (2004) stated that studies on the impact of change orders on project completion time and construction labor costs remain limited, especially in projects within educational institutions, such as the construction of lecture buildings.

Moreover, Ibbs (2012) revealed that most prior studies primarily utilized quantitative methods in analyzing change orders, while qualitative approaches such as case studies and in-depth interviews are rarely employed. Such approaches are crucial to gaining a more comprehensive understanding of the dynamics and specific contexts within a construction project.

Therefore, this study aims to fill these gaps by specifically identifying the factors causing change orders in the construction project of the Joint Lecture Building III at UNIMUS, analyzing the most significant causes, and examining their impacts on project completion time and construction labor costs. A qualitative approach will be used to gain deeper insights into the context and dynamics of the project.

2. Methods

The study on the Joint Lecture Building III (GKB III) project at UNIMUS employs a descriptive qualitative method with a phenomenological approach to understand the effects of change orders on labor costs and construction timelines. Data collection involves several techniques: in-depth semi-structured interviews with key stakeholders such as field supervisors, site managers, workers, and project executors; questionnaires using a Likert scale to measure opinions on change orders and their impacts; participant observations to document real-time activities and conditions at the project site; and analysis of project documents, including contracts, progress reports, and change orders. Participants are purposively selected based on their direct involvement and expertise in the project, ensuring the relevance of the collected data. The data is analyzed through a phenomenological framework, involving the identification of significant statements, thematic categorization, and the development of descriptive insights to provide a deep understanding of the causes and impacts of change orders. This comprehensive method aims to generate actionable recommendations for minimizing the negative effects of change orders in construction projects.

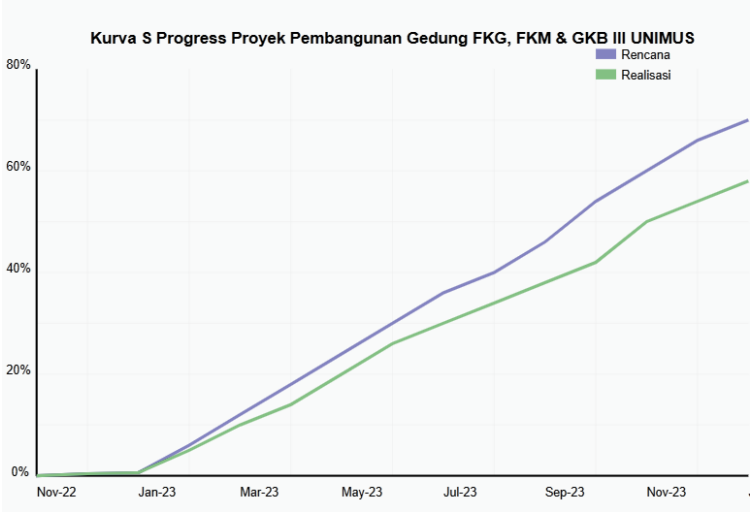

Figure 1. Curva S

3. Results and Discussion

1) Impact on Time

The change order caused a total delay of 45 days (18.75%) from the original plan. According to Soeharto (2018), delays due to change orders generally occur because of:

A. The administrative process of approving the change order
B. The time required to adjust work methods
C. Mobilization of additional resources
D. Schedule adjustments due to work interdependencies

2) Impact on Labor Costs

The project delay due to change orders in the construction of the Joint Lecture Building III (GKB III) at UNIMUS reached a total of 45 days, or about 18.75% of the original planned execution time. This delay can be explained through several key factors identified by Soeharto (2018) as common causes of delays due to change orders in construction projects.

First, the administrative process for approving the change order often takes considerable time. Before changes can be implemented on-site, the documents related to the changes must be prepared and approved by various parties, such as the consultants, contractors, and project owners. This approval process is often delayed, especially if there are differences of opinion or a need for further revisions to the design or budget. This contributes to delays in the execution of work on the ground.

Second, after the change order is approved, adjustments to work methods also require time. Changes in design or work specifications usually affect the planned techniques and procedures. Workers and project managers need to study the new methods and may need to adapt equipment or technology to accommodate the changes. This adjustment phase often requires additional time, which directly impacts the project schedule.

Third, mobilizing additional resources is also an important factor contributing to delays. Change orders that add to the volume of work often require additional labor, materials, or equipment. Mobilizing these resources cannot always be done quickly, especially if new procurement processes are needed or if there are supply constraints on-site. As found by Nugraha

(2021), slow resource mobilization often extends project duration, particularly in large, complex projects.

Fourth, adjusting the project schedule due to work interdependencies is one of the main challenges in managing change orders. Construction projects typically involve various tasks that are interdependent on one another. When one part of the work changes, it can disrupt the sequence or timing of other tasks, ultimately causing further delays. As stated by Hardjomuljadi (2020), adjusting schedules due to change orders often affects overall project efficiency, as changes in one area can have a domino effect on other tasks.

Overall, these factors explain how change orders not only affect the technical aspects of construction work but also add complexity to project management, ultimately resulting in a total delay of 45 days in this construction project.

3) Implications for Project Management

The findings of this study have several important implications that can improve construction project management, particularly in managing the impact of change orders. First, the importance of a comprehensive design review before implementation becomes very clear. Based on the research results, design changes are one of the main factors causing change orders, leading to increased costs and delays in the project schedule. Therefore, before the construction project begins, an in-depth review of the planned design must be conducted. This review should involve all relevant parties, including the project owner, designers, and contractors, to ensure that all project elements have been thoroughly considered and that no significant changes will be required during the implementation process. As stated by Hardjomuljadi (2020), a comprehensive design review can significantly reduce the risk of change orders and their negative impact on the project.

Second, this study emphasizes the need for time and cost buffers planned from the outset to anticipate the possibility of change orders. Given that change orders can cause delays of up to 18.75% and increase labor costs by 10%, project managers should allocate contingency budgets and time reserves to address any changes that may arise. Soeharto (2018) suggests that large projects consider contingency funds in their budgets, so when change orders occur, the project can still proceed without compromising quality or exceeding the agreed deadlines.

Third, the study highlights the importance of an efficient documentation system and approval process. The lengthy administrative process for approving change orders can exacerbate delays in the project. With an organized documentation system and a more efficient approval process, the time spent waiting for approvals can be reduced. Nugraha (2021) suggests the implementation of digital project management technology that enables all documents and communications related to project changes to be reviewed and approved quickly by all stakeholders. This will expedite decision-making and reduce delays caused by change orders.

Fourth, the findings indicate the need for more flexible workforce planning. Change orders often require additional workforce mobilization or adjustments to work methods, so project management must be able to quickly allocate resources as needed. Flexible workforce planning means having mechanisms in place to quickly add or reduce the number of workers according to the changes on-site. Additionally, workers should be trained to adapt to new methods that may be required after a change order. This will ensure that changes do not significantly impact productivity.

Overall, the implications of this study underscore the importance of proactive management in dealing with change orders, through careful planning, resource contingencies, and the use of technology to expedite decision-making processes.

4. Conclusion

Based on the research conducted on the Analysis of the Impact of Change Orders on Labor Costs and Construction Schedule in the Construction of the UNIMUS III Joint Lecture Building, the following conclusions can be drawn:

a. Impact of Change Orders on Construction Schedule

Change orders resulted in significant time deviations:

- Total delay: 45 days (14.29% of the planned schedule)
- MEP work: 15 days (25%)
- Structural work: 15 days (12.50%)
- Architectural work: 8 days (8.89%)
- Foundation work: 7 days (15.56%)

b. Impact on Labor Costs

The impact on labor costs is as follows:

- MEP work: deviation of Rp150,000,000 (25%)
- Structural work: deviation of Rp180,000,000 (15%)
- Foundation work: deviation of Rp75,000,000 (16.67%)
- Architectural work: deviation of Rp80,000,000 (10%)

Productivity decreased by 12.5-25% across all work items.

Based on the findings of this study, here are some recommendations that can be considered for similar construction projects in the future:

a. Improvement of Documentation and Approval Systems

The administrative process for approving change orders often becomes a source of delays. Therefore, a more efficient documentation and approval system is necessary to ensure that required changes can be implemented promptly without causing significant delays.

b. Flexible Workforce Planning

Considering that change orders can affect productivity and may require additional labor, it is important to plan the workforce flexibly. This will allow the project to quickly adjust to changes without disrupting overall productivity.

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