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Analysis of Mitigation Strategies For Project Delay Factors In The Probolinggo Square Construction

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KEYWORDS
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ABSTRACT
This study aims to analyze the mitigation strategies for delay factors in the Probolinggo City Square construction project, which has faced significant challenges in terms of time and cost. The research identifies both internal and external factors contributing to project delays, including delays in material approval, changes in the scope of work, additional work during implementation, and incomplete identification of job types. By analyzing these factors, the study proposes several mitigation measures, such as conducting material approval processes before work begins, using Building Information Modeling (BIM) to visualize and identify potential conflicts before construction, and increasing coordination among stakeholders during the planning phase. The study also highlights the importance of workforce training and the use of advanced project management technology to improve efficiency and reduce delays. The findings indicate that adopting these strategies can reduce delays by improving planning accuracy, enhancing coordination, and streamlining approval processes. This research provides a comprehensive framework for managing delays in construction projects, offering practical solutions for public sector projects in Indonesia. The implementation of these mitigation strategies is expected to lead to more efficient use of resources, reduced project costs, and improved quality, benefiting all stakeholders involved in the construction process. The study also contributes to the body of knowledge on delay management in the Indonesian construction industry.

INTRODUCTION

In project work, often during the implementation period there is an unwanted or unknown delay that can be a loss to certain parties involved in the project itself. Presidential Decree No. 61 of 2004 states that fines (financial sanctions) can be imposed on service providers if they cannot carry out the project according to the time available in the specified contract. According to Proboyo (1999), in general, project delays often occur due to changes in planning during the implementation process, poor managerial skills in the contractor's organization, poorly developed/integrated work plans, incomplete drawings and specifications, or failure of the contractor to carry out the work.

The probolinggo city square is a project of the probolinggo city government there are several stages in the project that are expected to be completed on time, but the project is experiencing time delays. Project delays do often occur with several factors in it can be from the service provider or from other parties which result in additional time and costs beyond the existing plan. If the delay comes from the provider or contractor, then the provider can be fined

according to what is stated in the project development contract.

Delays in the implementation of construction projects are one of the main problems that often occur in the construction industry, both at the national and international levels. According to Proboyo (1999), project delays can result from various factors, including changes in planning during implementation, poor managerial skills, and incomplete project drawings and specifications. This phenomenon can lead to increased project costs, decreased quality, and dissatisfaction of the stakeholders involved. The problem of delays in construction projects has become a global issue that affects the success of projects in various sectors. . In Indonesia, research by Sambasivan and Soon (2007) revealed that project delays can be caused by various factors, including lack of labor expertise, material constraints, and poor time management. These delays impact the reputation of construction service providers and the efficient use of the state budget. According to research by Alwi et al. (2002), the average project delay in Indonesia ranges from 10% to 30% of the planned time.

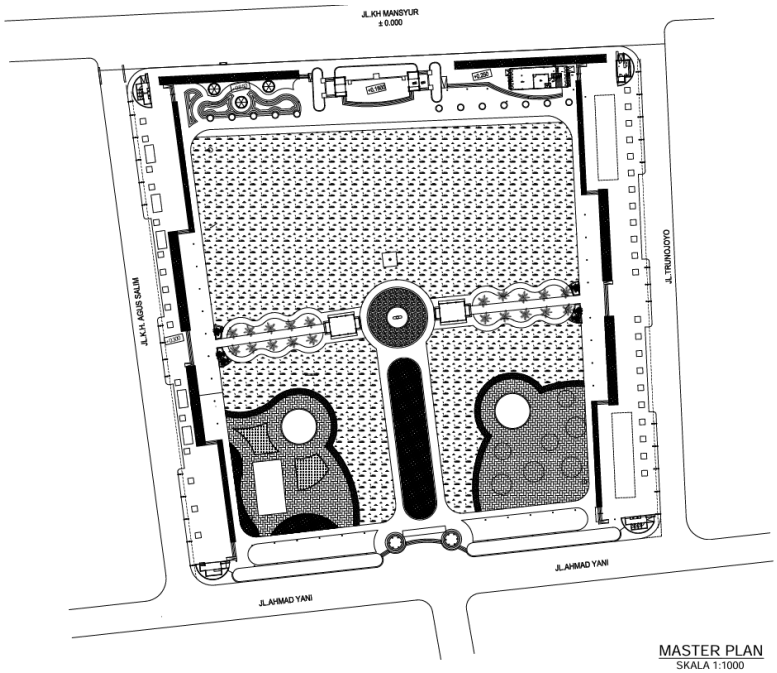

Figure 1. Masterplan of Probolinggo City Square

Definition The success or failure of a project can be measured if the entire implementation of activities in the project can be carried out well even with all the existing limitations. Namely time, cost and quality limitations. In the last two decades, the measure of project success has evolved into demands for meeting the allocated time period. Within the budgeted cost range, the right/good results or specifications, acceptable to the customer or owner (Kerzner, 2003). Construction projects in the public sector often face unique challenges, including budget constraints, complex bureaucratic procedures and high public expectations. According to research by Odeh and Battaineh (2002), government-funded projects tend to be more prone to delays because they involve many parties with different interests.

In this case, the delay in the Probolinggo Town Square project reflects not only technical problems, but also challenges in stakeholder management and resource management. Definition The success or failure of a project can be measured if the entire implementation of activities in the project can be carried out well even with all the limitations that exist. Namely time, cost and quality limitations. In the last two decades, the measure of project success has evolved into the demands of meeting the allocated time period (Patriadi & Fatmawati, 2024). Within the budgeted cost range, the right/good results or specifications, acceptable to the customer or owner (Kerzner, 2003). Construction projects in the public sector often face unique

challenges, including budget constraints, complex bureaucratic procedures and high public expectations. According to research by Odeh and Battaineh (2002), government-funded projects tend to be more prone to delays because they involve many parties with different interests. In this case, delays in the Probolinggo Town Square project reflect not only technical issues, but also challenges in stakeholder management and resource management.

Based on this background, appropriate risk mitigation is needed so that project delays do not occur. Reducing the risk of project delays will provide efficiency in the cost and time of the project being carried out. Therefore, this research aims to find and formulate mitigation measures that can be implemented in similar development projects in the future. This research is expected to be useful especially for service users, service providers and parties directly related to construction project management, to understand the appropriate patterns and strategies for project mitigation.

Literature Review

Previous Research

Various researchers have conducted studies related to construction project delays with the main objective of identifying risk factors that contribute to the problem. These studies not only focus on understanding the main causes of delays, but also analyze their impact on overall project implementation, including aspects of cost, time, and quality. In addition, efforts to formulate effective strategies or solutions to minimize delays are one of the important points in the study, so that the results can be applied as a guide in managing construction projects in the future.

Research conducted by Deny Dwiantoro (2024) on the "XYZ" project revealed that lack of workforce expertise, slow material mobilization, poor planning, and changes in work documents were the main causes of delays. These findings emphasize the importance of workforce training, careful planning, and project document management to minimize delays.

The study by Analysa (2019) on the Graha Mojokerto Service City (GMSC) project used the Fault Tree Analysis method and found that the project delay was caused by the malfunctioning of the supervisory consultant and the many addendums on the project. The planned duration of 130 days was delayed especially in the electrical, electronics, and support unit works. This research highlights the importance of the consultant's supervisory function to ensure the project runs on schedule.

Research by Sony Susanto (2019) used a combination of quantitative and qualitative methods to analyze risks in sustainable construction projects in Surabaya. He found that the high cost of using green materials and tools, as well as the low performance of green products, were the main risks with high levels. This research shows the need for innovative strategies to manage cost and quality in sustainable construction projects.

Based on various studies, delays in construction projects are generally caused by a combination of managerial, technical, and lack of coordination between related parties. In addition, the importance of implementing optimal risk management and well-structured planning are the main findings that can be concluded from previous studies to support the successful implementation of construction projects.

Service Provider

Presidential Regulation No. 16/2018 regulates the public procurement process with the aim of ensuring transparency, efficiency, and accountability in the management of the state budget. In this context, service providers must meet certain requirements set out in the regulation, including qualifications, certifications, and compliance with applicable regulations. The definition of each service provider is as follows:

1. Planning consultants are service providers / business entities that are declared experts in the field of construction service planning that can realize work in the form of

planning documents such as drawings, rab calculations, construction calculations and so on following existing requests.

2. Supervisory consultants are service providers/business entities that are declared experts in the field of construction service supervision that can carry out supervisory work from the beginning of the work until the work is declared complete.
3. Implementing contractors are service providers / business entities that are declared experts in the field of construction implementation that can carry out activities to realize a result of planning into the form of a building.

Cost, Quality, and Time

According to Istiwan Dipohusodo (1996), as befits a service, the provisions regarding the cost, quality and time of completion of construction have been agreed in the contract and determined before construction begins. If in the construction process there is a deviation in the quality of the work, whether intentional or not, the risk that must be borne is not small. How to repair a building that is not in accordance with the specified specifications must be dismantled, after which rebuilding is carried out. On the other hand, efforts to improve cannot change the agreement and implementation period. Thus the cost, time and quality factors in the construction process are absolute agreements that cannot be bargained for and all three are strictly interdependent and influential.

Risk Mitigation

Risk mitigation is intended to be an action that can be taken to reduce the consequences of risk if it has been identified, this action is also a risk management to an acceptable limit, although risk management is not necessarily completely eliminated because sometimes there is still a residual risk called residual risk (Mujianto & Sajiyo, 2024).

Ways of managing risk fall into several categories (Suwandi 2010, Rumimper et al 2015, Tjakra and Sangari 2011): 1) Transfer (T) of risk: means causing another party to accept the risk, usually through a contract or with restrictions; 2) Avoidance of risk: 3) Avoiding activities that may carry risk. An example would be not buying a property or business so as not to take on the debt responsibilities that come with it; 4) Risk reduction (Reduce: Rd): To reduce the risk so that the risk becomes smaller. But not eliminate. Examples include sprinklers designed to put out fires to reduce the risk of fire. 5) Risk acceptance (Receive: R) involves accepting losses when they occur. Self-insurance falls under this category

Definition of Delay

Project Delay is a situation where the completion of a project does not match the planned time or that has been set in the initial schedule. In various studies, project delays are often defined as a mismatch between the actual time of project completion and the planned schedule, which is usually caused by various factors that occur in the field.

According to Wirabakti (2017) project delay is an increase in the implementation time of project completion that has been planned and stated in the project contract.

According to Sambasivan and Soon (2007) that managerial factors and mistakes in managing projects, such as inability to coordinate teams or poor time management, often cause projects to experience delays.

Delay Factors

In the project The construction of the square did experience a considerable delay from the time schedule of the existing plan, a scm was carried out on the delay. In a construction project there will be many possibilities that occur in it. In this explanation, we will explain the opinions of experts regarding the factors of delay. According to Yuliana (2013) the factors causing delays in project implementation time can be categorized into three major groups, namely:

1. Compensable delay is delay that deserves compensation.
2. Non-excusable delay unexcused delay
3. Non-excusable delay excusable delay

Sambasvian and Yau Wen Soon (2006), stated the causes of delay into 8 categories namely, client related, contractor related, consultant related, material related, labor and equipment, contract related, contract relationship related, external cause related. In addition, they found that the main cause of delay was due to the lack of maturity of the implementation method by the contractor due to inexperience and poor site management.

Research on delays conducted by levis and atherley in Langford (1996) on 30 building construction projects in India, which were built between 1978 and 1992 have been able to identify several causes of delays, among others:

1. Late payment by client owner
2. Implementation of shoddy work stages by contractors
3. Material mismanagement by contractors
4. Labor shortage by contractors
5. Heavy rain/Waterlogged job sites
6. Different ground conditions than expected
7. Additional work requested by the client owner
8. Changes in plumbing, structural, electrical work
9. Errors in planning and specifications
10. Unclear planning and specifications
11. Changes in plans and specifications
12. Changes in work methods by contractors
13. Errors in interpreting drawings or specifications
14. Less efficient implementation method or time schedule by the contractor
15. Sub-optimal productivity from contractors
16. Changes in consultant work scope
17. Strikes by contractors
18. Improving the finished work
19. Repairing damage to a job due to a strike
20. Late approval by supervision consultant

Previous studies have explored the causes and solutions to delays in construction projects. For example, Sambasivan and Soon (2007) identified lack of labor expertise, material constraints, and poor time management as major contributors to delays in construction projects. Similarly, Odeh and Battaineh (2002) found that government-funded projects are particularly prone to delays due to complex bureaucratic procedures and the involvement of multiple stakeholders. These studies highlight the importance of understanding both internal and external factors in managing delays, which this study builds upon by analyzing specific mitigation strategies for the Probolinggo City Square construction project.

Construction delays continue to be a significant issue in the industry, leading to increased costs, project inefficiencies, and stakeholder dissatisfaction. In Indonesia, where construction projects are often under the scrutiny of public and government expectations, mitigating these delays is crucial for ensuring efficient use of resources and maintaining public trust. The Probolinggo City Square construction project has faced notable delays, affecting its completion and potentially leading to cost overruns. This research is urgent because it focuses on developing and implementing effective mitigation strategies to address these challenges, offering practical solutions for managing delays in public sector construction projects.

Although delays in construction projects have been well-documented in literature, there is a lack of research that focuses specifically on the application of mitigation strategies to

address the unique challenges faced by government-funded construction projects in Indonesia. Previous studies have often concentrated on identifying delay causes but have not explored detailed, actionable mitigation measures that can be implemented during project execution. This study seeks to fill this gap by analyzing delay factors in the Probolinggo City Square project and offering tailored mitigation strategies that are grounded in the local context.

The novelty of this study lies in its approach to combining both internal and external delay factors and proposing practical, context-specific mitigation strategies for public sector construction projects in Indonesia. While much of the existing literature focuses on general causes of delay, this research uniquely emphasizes the role of digitization, advanced project management technology, and improved coordination to minimize delays. The study's use of BIM technology to prevent changes in the scope of work and its focus on intensive coordination meetings for early issue identification present new, innovative solutions to long-standing challenges in the construction industry.

The primary purpose of this study is to identify and analyze the mitigation strategies for factors causing delays in the Probolinggo City Square construction project. By focusing on factors such as material approval delays, changes in scope, and incomplete work identification, the research aims to provide practical strategies for improving project efficiency. The benefits of this study include providing a framework for effective delay management that can be adopted in future public sector projects, improving cost and time management, and ensuring the quality of construction projects. Furthermore, the study offers insights that can help stakeholders better coordinate and manage construction projects, leading to more successful outcomes.

RESEARCH METHOD

According to Sugiyono (2023), a research method is a scientific method used to obtain valid and reliable data, which can be used to understand, prove, and solve a problem. This method includes systematic steps, including problem identification, data collection, data analysis, and interpretation of results.

Type of Research

This research was conducted on the Probolinggo City Square construction project to obtain the latest information about the project conditions and collect relevant data factually. Furthermore, the researcher evaluates the various problems found to formulate appropriate handling steps, which will be used as a basis for decision making.

Research Location

The location of this research is Probolinggo City Square which is located on KH. Mas Mansyur Street, Mangungharjo, Probolinggo City. The geographical coordinates are about 7°44'38" South latitude and 113°12'52" East longitude.

Location Map of Probolinggo City Square

At the location of Probolinggo City Square is actually very strategic he is in the heart of the city of probolinggo or in the middle of the city area, with the renovation of probolinggo city square is expected to have a new face for the city of probolinggo. And in the process it will be divided into several sections in the process.

Research Objective

The research object itself is the topic of the problem that is the focus of this research, including the same problem as the purpose of this research. The determination of this object is carried out in accordance with the formulation of the problem written in the previous chapter, so that it can contribute to answering the objectives of this research scientifically. In this problem, it will be described how the researcher determines that the object of research to be carried out is at the Probolinggo City Square.

Data Collection

There are two types of data sources, namely primary data and secondary data. Primary data is information collected directly from the field or research results. Meanwhile, secondary data is information collected from existing sources. In this study, data was obtained from literature studies, journals, and books on previous research. Then, researchers distributed questionnaires to related parties. Finally, interviews were conducted to accommodate respondents' input on existing risk mitigation.

RESULTS AND DISCUSSION

Dominant Factors of Delay

Based on the results of data and analysis from respondents, it is shown that there are four dominant factors that affect the delay of the Probolinggo city square construction project. The factors are divided into internal factors and external factors. External factors include long raw materials and changing scope of work. Then, internal factors include too much additional work and incomplete identification of the type of work. A more detailed explanation is shown in Table 1.

Table 1. Dominant Factors of Delay

Factor	Variables	Explanation
External	Long process of requesting and approving material samples	Delays occur because the time required to process, test and approve materials exceeds the planned schedule. This can result in bottlenecks in the execution of work that relies on these materials.
External	Changes in the scope of work at	Changes in the scope of work in the middle of implementation cause adjustments to the schedule and

	the time of implementation	resources, leading to delays. In addition, design revisions or additional work often require additional coordination time.
Internal	There is a lot (often) of additional work	Additional work that often arises during implementation results in additional work volume beyond the initial plan. This affects the project completion time as it requires the allocation of additional labor, materials and time.
Internal	Incomplete identification of job types	Delays occur due to a lack of early identification of all types of work required in the project. As a result, neglected work has to be re-planned in the middle of implementation, affecting the overall schedule.

Mitigation of External Factors

Delays due to external factors were dominated by two things, namely the long process of requesting and approving material samples and changes in the scope of work at the time of implementation. As such, appropriate mitigation is required to address these issues. These mitigations are stated in the following points.

a. Delay in Material Approval

- Conduct Material Approval Before Work Starts Minimum H-7

  One of the main causes of delays is the time-consuming process of requesting and approving material samples. To overcome this, the first step that can be taken is to ensure that all technical specifications of the materials are in accordance before work begins. Implementing a minimum H-7 approval process can be done by organizing a more detailed material procurement schedule and involving all relevant parties from an early stage. This allows the project team to identify potential constraints earlier and reduce time wasted during construction.

  In addition, the utilization of digital systems such as construction management software can help speed up the approval process. These systems allow stakeholders to view material specifications in real-time and provide approvals electronically, reducing reliance on manual processes. Through digitization in construction management, it is able to reduce approval time by 30% compared to conventional methods.

  It is also important to conduct regular evaluations of the material approval process. By involving all parties in regular coordination meetings, any obstacles that arise can be addressed immediately. This process requires intensive coordination between the contractor, supervision consultant, and project owner so that the approval timeline can be adhered to. Finally, education to the project team on the importance of timeliness in procuring materials should be improved. By understanding the impact of delays on the overall project schedule, the team is expected to be more proactive in completing the approval process on time.

b. Changes in Scope of Work During Implementation

- Use BIM Technology to Visualize and Identify Potential Conflicts Before Construction Starts

  Building Information Modeling (BIM) is a very useful tool for minimizing scope of work changes. With BIM, the project team can create a virtual simulation of the project to be built. This simulation helps identify potential technical conflicts between the initial design and field conditions before construction begins. Based on research by Azhar (2011), BIM implementation can reduce design changes by up to 25%.

  The technology also enables collaboration between architects, engineers and project managers at the planning stage. All parties can access the same BIM model,

ensuring that they have a consistent understanding of the scope of work. In addition, potential errors due to poor communication can be minimized as all information is consolidated on a single platform.

BIM can also be used to analyze "what-if" scenarios to anticipate potential changes during construction. With this analysis, the project team can design efficient solutions before conflicts actually occur. For example, if discrepancies are found in the structural design, solutions can be designed and approved long before construction begins.

Finally, training the workforce on the use of BIM is essential. By providing intensive training to the project team, they will be more competent in using this tool to effectively manage scope of work changes.

- Hold Intensive Coordination Meetings at the Planning Stage

  Intensive coordination meetings at the planning stage serve to ensure that the scope of work is understood by all parties. These meetings should include all stakeholders, including the project owner, contractors, and supervision consultants. The meeting agenda should include discussion of technical design details, identification of potential risks, and budget planning. All parties should ensure that contract documents, such as working drawings and technical specifications, are in line with the project needs. Thus, potential conflicts due to disagreements in the scope of work can be minimized.

  In addition, these coordination meetings should be well documented to ensure that the decisions made are not changed during project implementation. This documentation can also be used as a reference in case of disputes in the future. In conclusion, by increasing the intensity and quality of coordination meetings at the planning stage, changes to the scope of work during implementation can be significantly minimized.

Mitigation of Internal Factors

Delays due to internal factors are dominated by two things: the existence of a lot of (frequent) additional work and incomplete identification of work types. Thus, appropriate mitigation is required to address these issues. These mitigations are expressed in the following points.

a. There is a lot (often) of additional work

- Assessing the Impact of Additional Work on Project Schedule and Budget

  The addition of work often disrupts the project schedule and budget. Therefore, it is important to conduct a thorough impact assessment before approving additional work. The first step is to develop a formal procedure to evaluate the impact of additional work on the project timeline and cost. This involves a detailed analysis of the additional resource requirements, potential risks, and time to completion.

  Additional work that often arises can lead to increased costs and extended project duration. According to research by Hermawan (2021), additional work has less impact on increasing costs by 2.47% of the initial contract cost, although it does not always affect the overall project completion time.

  This assessment should also be conducted in a transparent manner involving all relevant parties. Thus, all stakeholders can understand the consequences of the additional work and agree on the best solution to minimize its impact on the project. Finally, it is important to document all additional work in detail, including the reasons, costs, and impact on the project. This documentation will be very useful for managing additional work more efficiently in the future.

b. Incomplete identification of job types

- Conduct an In-depth Review at the Planning Stage

  Incomplete identification of work types can cause significant delays. To address this, the first step is to conduct an in-depth review of all project documents at the planning stage. Documents that need to be reviewed include working drawings, technical specifications, and resource requirement analysis.

  Based on research by Chan & Kumaraswamy (1997), projects that are conducted with in-depth analysis at the planning stage have a 30% higher probability of success than projects that are not. Therefore, this review should be conducted systematically and involve a team of competent experts.

In addition, it is important to conduct project simulations using construction management software. This simulation allows the project team to identify potential missed work types before construction begins. Finally, the implementation of this review should be supported by training for the planning team. By improving their skills in identifying work types, the risk of delays due to negligence in planning can be minimized.

CONCLUSION

This research resulted in several steps that can be taken to mitigate the risk of delays. For delay in material approval, it is essential to approve materials before the work begins, at least H-7, to avoid delays in the provision of materials. To address changes in the scope of work, the use of BIM technology can help visualize and identify potential conflicts before construction begins, along with holding intensive coordination meetings at the planning stage to ensure all parties fully understand the scope. In cases of frequent job additions, it is important to assess the impact of additional work on the project schedule and budget, integrating the additional work into the revised project schedule in a transparent manner. For incomplete job type identification, an in-depth review should be conducted during the planning stage to ensure all types of work are identified, involving a team of experts at the planning stage to minimize the potential for missed work.

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