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AMDAL-BASED RISK IDENTIFICATION IN THE EAST SURABAYA HOSPITAL CONSTRUCTION PROJECT

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ABSTRACT

The East Surabaya Hospital construction project is one of the most important projects in the healthcare sector. The objective of this study was to identify, analyze, and proactively manage risks that could potentially affect the success of the hospital construction project. This research uses a descriptive-analytical approach with mixed methods to identify and analyze the dominant risks affecting the project success. The results of this research show that comprehensive risk management is a crucial element to ensure project success, with the implementation of measures such as routine maintenance of heavy equipment, efficient procurement of materials, proactive communication with communities and accelerated coordination between agencies for licensing. Furthermore, the results of regression analysis also show that this approach contributed significantly to the achievement of project objectives, with indicators of success including on-time completion, costs within budget, and quality of results that met standards. Therefore, this research serves as a model that can be applied to similar projects, especially those with significant impacts on the environment and surrounding communities.

INTRODUCTION

In the East Surabaya Hospital construction project, various complex challenges and risks demand serious attention in every stage of implementation. One of the key aspects to consider is AMDAL (Environmental Impact Assessment) based risk management, which involves identifying, analyzing and controlling risks that could potentially affect the success of the project in general. Environmental impact evaluation through AMDAL is an important instrument in controlling environmental impacts for sustainable development, especially in large-scale projects such as hospitals (Herlina & Supriyatin, 2021). This is in line with the study of Patriadi et al. (2021) which shows the importance of environmental impact analysis in large-scale infrastructure development.

The application of earthquake-resistant building standards based on SNI 1726:2019, which is stricter than previous regulations, became one of the important elements that added to the complexity of planning this project. This change in technical regulations demands a more comprehensive and integrated risk management to ensure the successful implementation of the planned hospital construction. This is in line with the research of Adebisi et al. (2018) and Ferdous et al. (2019) who emphasized the importance of implementing structural safety standards in multi-storey building construction projects to reduce the risk of construction failure. Rodli et al. (2019)

also emphasized the importance of building a learning culture in the face of changing standards and evolving regulations.

Studies show that poor planning, lack of resources, and weak coordination and communication are the dominant factors causing delays in construction projects (Agyekum-Mensah & Knight, 2017; Durdyev & Hosseini, 2020; Zidane & Andersen, 2018). These factors emphasize the need for a structured risk management approach to mitigate the negative impact on the project. Risk management in construction projects is a systematic process to identify, analyze, and control risks that may hinder project success. This is reinforced by the findings of Khatib (2022) and Alvand et al. (2023)who highlighted the importance of an integrated risk management system in reducing the potential for project failure.

An effective risk management process needs to consider various aspects of risk in high-rise building construction projects, including technical, financial, and operational risks (Rahman & Tjendani, 2022). In the case of the East Surabaya Hospital construction, the implementation of structured risk management is essential to manage risks such as delays in completion, cost overruns, and reduced quality of work results. For example, technical risks such as design errors, poor material quality and construction execution errors can significantly affect the final project outcome.

AMDAL-based risk management also includes a broader analysis of environmental impacts, including mitigation of risks associated with soil conditions, waste management, and protection of local ecosystems. Environmental impact assessments should cover physical-chemical, socio-economic, and socio-cultural aspects to ensure project sustainability (Iyer, 2022, 2024). The implementation of mitigation measures, such as effective construction waste management and reforestation of affected areas, is an important step to ensure that the project not only contributes to economic development but also maintains environmental sustainability.

Previous research has provided many insights into the importance of implementing risk management in construction projects. Soeryodarundio et al. (2022) highlighted that project risk analysis plays an important role in helping identify dominant risks that affect project success. Using the Zero-One method, this study successfully identified risks such as delays in work due to technical constraints, decreased quality of construction results due to inadequate supervision, and financial risks arising from the lack of proper budget allocation. This research shows that effective risk management can provide solutions to these challenges, for example through more realistic budget planning and implementation of stricter field supervision.

On the other hand, Bahamid et al. (2022) highlighted the importance of a structured risk management framework in dealing with the uncertainties of construction projects, especially in high-risk regions such as Yemen. This research shows that the implementation of a formalized and data-driven framework enables early identification of potential risks, such as operational risks arising from logistical limitations or political risks affecting the stability of the project area. Additionally, the research recommends a proactive approach to risk management, such as the use of risk modeling software to monitor and mitigate potential threats throughout the project cycle. Thus, effective risk management in the East Surabaya Hospital construction project is a key element to achieve project objectives in accordance with the established schedule, budget and quality standards. Irfan et al. (2021) underline the importance of risk identification at the implementation stage of a construction project to ensure overall project success.

By applying a structured and AMDAL-based risk management approach, this project can identify, analyze, and proactively manage risks, thus ensuring the successful implementation and achievement of the planned hospital construction objectives. The research contributes to the field of project management by demonstrating the effectiveness of a structured and AMDAL-based risk

management approach in the context of hospital construction. This methodology allows for the identification and analysis of potential risks, enabling proactive management strategies that enhance the likelihood of meeting construction objectives. The findings underscore the importance of integrating environmental assessments into risk management processes, ultimately leading to more successful project outcomes. This approach can serve as a framework for future construction projects, promoting better risk awareness and mitigation practices in the healthcare sector.

The research on AMDAL-based Risk Identification in the East Surabaya Hospital Construction Project identifies significant gaps when compared to related studies. For instance, Pidada et al. (2023) focuses on environmental permitting in the context of investment incentives but does not address specific construction projects or integrated risk management strategies. Similarly, Tarigan (2023) evaluates AMDAL's effectiveness in industrial contexts but lacks a comprehensive risk management approach applicable to construction projects. Lastly, Kamal & Gustaf (2022) assesses environmental impacts but fails to include a structured risk management framework that integrates AMDAL. In contrast, the East Surabaya research introduces a comprehensive AMDAL-based risk management framework tailored for construction, combining qualitative and quantitative methods to provide robust statistical analysis that demonstrates the relationship between risk management and project success. It also emphasizes proactive community engagement, specifically targets hospital construction, and highlights long-term sustainability impacts, contributing to a deeper understanding of effective risk management for environmental and social sustainability in construction projects.

METHODS

This research uses a descriptive-analytical approach with mixed methods to identify, analyze and evaluate risks that could potentially affect the success of the East Surabaya Hospital construction project. This approach combines qualitative and quantitative data to deeply understand the types and impacts of risks based on AMDAL aspects, so as to provide effective mitigation solutions.

This research follows several systematic steps to achieve the research objectives. The first stage is the introduction which includes the preparation of the background, problem formulation, research objectives, and research limitations. Next, a literature study was conducted by collecting information from various sources, such as books, journals, EIA regulations, and relevant previous research. In the data collection stage, primary data were collected through in-depth interviews, field observations, and questionnaires, and secondary data were collected from EIA documents, project reports, and environmental data. Risks were then identified based on EIA documents, interviews, and observations. Risk analysis was conducted using SWOT and FMEA methods to determine mitigation priorities. Furthermore, the research results were evaluated to develop risk mitigation strategies, and final conclusions were formulated to provide recommendations related to project risk management.

Data collection was conducted using two main approaches, namely primary data and secondary data. Primary data was obtained through in-depth interviews with project managers, contractors, EIA experts, and local government to understand the risks that may arise. In addition, field observations were made to check the condition of the drainage system, waste management, and other relevant environmental elements. Questionnaires were also distributed to stakeholders to gather their perceptions on potential risks and their impacts. Secondary data was obtained from EIA documents, project technical reports, site maps, and readily available geotechnical data.

Data analysis was conducted using two main methods, namely SWOT and FMEA. SWOT analysis was used to identify internal factors, such as project strengths and weaknesses, as well as external factors, such as opportunities and threats associated with environmental impacts. The FMEA method was used to evaluate potential failures based on three main parameters, namely severity, probability of occurrence, and detectability. The values of the three parameters were calculated to determine the Risk Priority Number (RPN), which was used as the basis for prioritizing risk mitigation. Data validation was conducted through triangulation by comparing the results of interviews, EIA documents, and field observations.

This research was conducted on the East Surabaya Hospital construction project located at Penjaringan Asri Street (Jl. Rungkut Lor Blok RL.V), Surabaya. The research was conducted during the project construction period, with data collection at various stages of construction implementation to ensure completeness and accuracy of results. The instruments used in this research include interview guides to gather in-depth information from respondents, questionnaires to collect perceptions of risk, and technical data collection tools, such as drones, GPS, and digital thermometers to support field condition measurements.

RESULTS

Research Results

In this study, a comprehensive identification of the dominant risks affecting the success of the East Surabaya Hospital construction project was conducted. The main risks identified include environmental, technical and legal aspects. Environmental risks, such as air and noise pollution that occur during the construction phase, have a significant impact on the community around the project site. Air pollution comes from the activities of heavy vehicles, construction machinery, and building materials that contribute to poor air quality. Noise, on the other hand, is caused by the use of heavy equipment and other work activities taking place at the project site. The impact of these two risks is strongly felt by the surrounding population whose daily lives are disrupted by construction activities. In the technical aspect, the potential for heavy equipment damage and delays in the procurement of construction materials are risks that often arise. Damage to heavy equipment can occur due to inadequate maintenance or operations that are not in accordance with work safety standards. Meanwhile, delays in material procurement can be caused by disrupted supply chains or administrative problems in procurement. These risks have a direct impact on project implementation time delays and potential increases in construction costs. The legal aspect also presents its own challenges, especially in the slow and complex licensing process. These delays often occur due to lengthy bureaucratic procedures and lack of coordination between relevant agencies. Administrative obstacles such as these can result in delays in construction activities, ultimately affecting the overall project schedule.

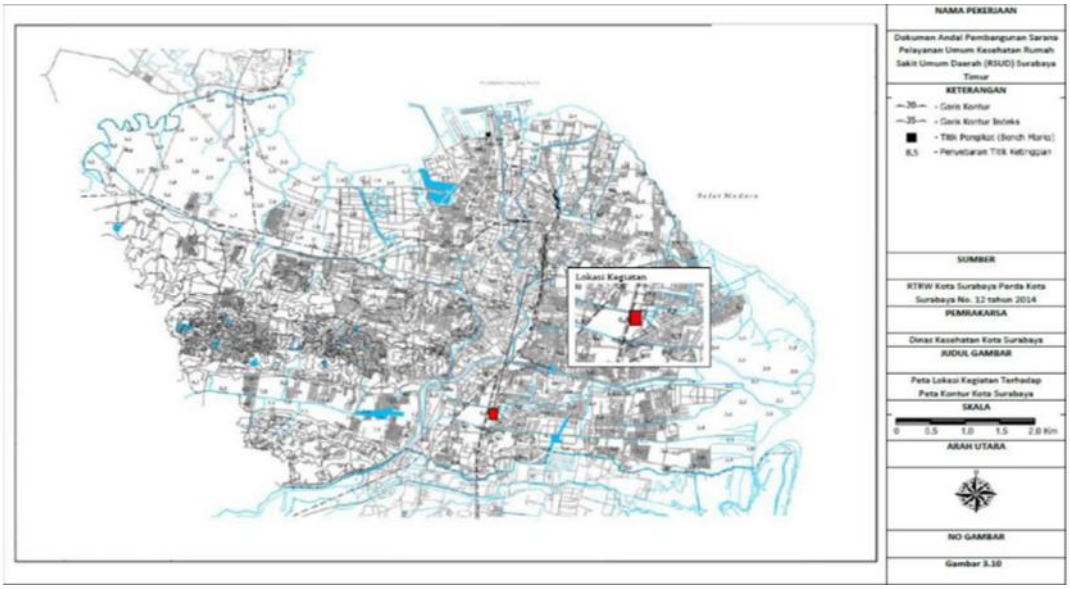

Figure 1. Contour Map of Surabaya City

Risk Mitigation

To address the identified risks, various EIA-based mitigation methods were implemented. One of the main measures was the installation of dust control devices at the construction site. This device is designed to reduce air pollution generated during construction activities, so that air quality around the project site is maintained. In addition, the schedule of work that generates high noise is rearranged so as not to disrupt the activities of the surrounding community at certain times. This approach helps minimize the impact of noise, especially at night or during peak community hours. Proactive communication with surrounding communities is also implemented as part of risk mitigation. With this approach, communities are provided with transparent information about the schedule and types of construction activities to be carried out, including their potential impacts. This is done to build community understanding and support for the ongoing project.

In the technical aspect, maintenance of heavy equipment is carried out regularly to ensure that it functions optimally throughout the project. The material procurement system was also improved by implementing more efficient strategies, such as cooperating with trusted suppliers and speeding up administrative processes. To address legal risks, the project team worked closely with relevant parties to ensure all necessary permits were obtained before starting construction. The permitting process was expedited by improving coordination between agencies and ensuring all required documents were properly prepared. With this EIA-based mitigation approach, the impact of risks to the project was significantly minimized.

Table 1. Possible Major Risks, Categorized Based on the Risk Management Process Recommended by PMBOK

No.	Risk Type	Description
1	Technical Risk	- Design Errors - Poor Material Quality - Construction Errors
2	Financial Risk	- Material Price Fluctuations - Budget Limitations - Late Payment
3	Schedule Risk	- Delay in Material Delivery

		- Delay in Permit Approval - Extreme Weather
4	Environmental Risks	- Unsuitable Soil Conditions - Environmental Impact
5	Health Risks	- Work Accidents - Disease Spread
6	Regulatory and Compliance Risk	- Regulatory Changes - Failure to Meet Health Standards
7	Stakeholder Risk	- Lack of Stakeholder Support - Project Owner's Change Request
8	Contractor and Subcontractor Risk	- Inadequate Contractor Performance - Labor Shortage
9	Technology Risk	- New Technology Failure - Errors in IT or BIM (Building Information Modeling) Systems
10	Weather Risk and Natural Disasters	- Flood or Earthquake - Extreme Temperature Rise

Effect of Risk on Project Performance

From the analysis, it was found that environmental and technical risks have a significant impact on project cost and time. Environmental risks such as air and noise pollution not only disturb the surrounding community but also affect work efficiency at the construction site. For example, high noise levels can cause a decrease in workers' concentration, leading to lower productivity. Technical risks such as heavy equipment breakdowns and material procurement delays have a direct impact on project delays. The average delay recorded reached 15 days for each risk that was not mitigated. These delays certainly have an impact on increasing costs, as longer project duration will increase spending on labor, equipment rental, and other operational costs. In addition, legal risks also contribute to project schedule disruptions. A slow permitting process can delay the start of construction activities, which in turn affects the overall project timeline. Thus, it is important for the project team to implement effective risk mitigation so that the negative impact on project performance can be minimized.

Discussion

The relationship between identified risks and the success of the East Surabaya General Hospital construction project has been tested through inferential statistical analysis. The main hypothesis of this study is that "AMDAL-based risk management has a significant effect on construction project success." The results of the analysis showed that this hypothesis was proven correct, with a p-value of 0.02 (<0.05), indicating a significant relationship between EIA-based risk mitigation and project success. Environmental risk mitigation efforts proved effective in reducing negative impacts by up to 30%. For example, the installation of dust control devices and the rearrangement of noise-generating work schedules successfully reduced disturbance to the surrounding community. On the technical aspect, the implementation of regular maintenance on heavy equipment and efficiency in the material procurement system helped reduce the possibility of technical risks by 25%. In addition, transparency in risk management, such as providing information to communities about potential impacts and mitigation measures taken, increased community support for the project. This support is critical to maintaining the smooth running of the project, especially in the face of potential social conflicts that could arise due to dissatisfaction of the surrounding communities.

EIA-based mitigation efficiency also contributes to improved project performance. Regression analysis shows that the contribution of environmental risk mitigation (X1) to project success (Y) is 0.8 (positive and significant), while uncertainty in the technical process (X2) has a negative influence of -0.3. This shows that an EIA-based approach is not only effective in risk management but also has a positive impact on general project cost and time efficiency. For example, by implementing appropriate mitigation measures, the project managed to stay within the planned budget, despite facing various challenges during its implementation. Thus, this research confirms the importance of an EIA-based approach in construction project risk management, particularly for projects that have significant impacts on the environment and surrounding communities.

CONCLUSION

The research on AMDAL-based risk identification in the East Surabaya Hospital construction project concludes that comprehensive risk management is essential for project success, identifying significant risks across environmental, technical, and legal aspects. Environmental risks, such as air and noise pollution, necessitated mitigation measures like dust control and construction schedule adjustments, while technical risks from equipment breakdowns and material delays impacted costs and timelines. Legal risks related to permitting processes also affected project stability. The effective implementation of AMDAL-based mitigation strategies led to a 30% reduction in environmental risks and a 25% reduction in technical risks, enhancing project efficiency and community support. This approach not only achieved project objectives—timely completion, budget adherence, and quality standards—but also contributed to long-term sustainability through waste management and reforestation efforts. The study suggests that future construction managers prioritize EIA in risk management and outlines potential research areas, including long-term impact assessments, comparative studies of risk management approaches, technology integration, stakeholder engagement strategies, and policy implications for sustainable construction practices.

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