Financial Risks in Toll Road Development in Indonesia: Challenges and Development Strategies for the Probowangi Toll Road

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ABSTRACT

Probolinggo-Banyuwangi toll road, which crosses mountainous areas in East Java. Toll road construction in areas with varying topography often faces significant technical and environmental challenges, which can affect costs, completion time, and project sustainability. This study uses a quantitative approach with a descriptive method to evaluate risk factors that impact project finances, such as construction costs, dependence on funding sources, interest rate fluctuations, and traffic volume predictions. Primary data was collected through questionnaires, while secondary data was obtained from financial planning documents and related project topography. Data analysis was conducted using multiple linear regression with a path analysis model. The results of this study are expected to identify key variables that influence financial risk and provide recommendations for effective mitigation strategies. This research is expected to contribute to the development of policies and financial risk management practices for similar infrastructure projects in the future.

Keywords: Financial risk, Risk management, Infrastructure project
JEL Classification:

INTRODUCTION

Toll road construction in Indonesia, particularly in mountainous regions, presents significant challenges that require careful consideration from technical, environmental, and financial perspectives. Indonesia, with its diverse topography, has numerous mountainous areas that serve as strategic routes for the development of toll road infrastructure to enhance connectivity and accessibility between regions. However, these geographical conditions also pose significant risks such as landslides, erosion, and other natural disasters that can impact the construction and operational processes of toll roads. Additionally, construction costs in mountainous areas tend to be higher due to the need for specialized technologies such as tunnels and bridges, as well as slope reinforcement to address soil instability. Extreme weather conditions, such as high rainfall, can also slow down projects and increase long-term maintenance costs (Tyagita, et.,al, 2023). On the other hand, strict environmental regulations, especially in conservation areas or protected forests, add complexity to projects as they must minimize impacts on local ecosystems. Therefore, studies on the risks of toll road construction in mountainous regions are essential to formulate effective mitigation strategies (Afandi & A'yun, 2022), and to ensure the sustainability and safety of such infrastructure in the future.

As of the first half of 2024, the total length of toll roads in Indonesia has reached 2,893 kilometers. This achievement is part of the government's efforts to improve connectivity between regions in Indonesia, which consists of various areas with diverse geographical characteristics. Toll roads, as strategic infrastructure, play a vital role in facilitating the flow of goods and passengers, reducing travel time, and supporting national economic growth. The rapid development of toll

roads reflects the government's commitment to improving transportation infrastructure as part of sustainable development (Wijaya & Yudhistira, 2020). In terms of costs, the construction of toll roads in Indonesia on average requires a budget of around Rp 305 billion per kilometer. This cost includes various components, such as planning, land acquisition, construction, and the technology required to maintain safety and quality standards. Toll roads in Indonesia are often built through areas with challenging geographical conditions, such as mountains and forests, which can increase construction costs. In addition, toll road construction must also consider environmental factors (Haicheng, et.,al, 2020), regulations, and natural disaster risks, adding to the complexity of projects (Naeruz, Damayanti, & Tanjung, 2022).

Funding for toll road construction in Indonesia comes from a combination of government funds and private investment. The government, through its budget, contributes about 20% of the total investment required. Meanwhile, the remaining 80% comes from investors or through loans. This financing model, known as a public-private partnership, has become a primary strategy for accelerating large-scale infrastructure development in Indonesia (Rahmawati & Tenriajeng, 2020). With the involvement of investors, financing risks can be shared, while the government continues to play a role in oversight and policymaking to ensure that toll roads can function optimally and sustainably in the long term (Wijaya & Yudhistira, 2020; Kadzafi, Khamim, & Marjono, 2021). This collaboration between the government and investors is not only important for financing, but also in the management of toll roads after they are completed. Investors, through toll road operators, are responsible for managing and maintaining the infrastructure, while the government continues to monitor the quality of service and compliance with regulations. Through this partnership model, it is hoped that toll road construction can continue on target and have a positive impact on the economy and the welfare of people throughout Indonesia.

The development of toll roads in Indonesia continues to grow rapidly as part of the government's efforts to improve national connectivity and accelerate economic growth. With a total length of toll roads reaching thousands of kilometers and very high construction costs of around Rp 305 billion per kilometer, this project requires very careful financial management. Financial risks in large infrastructure projects, especially toll roads, include cost overruns, funding uncertainties, and operational and environmental risks. In the Indonesian context, the construction of toll roads that cross areas with difficult geographical conditions such as mountains makes these risks even more complex (Maklas & Erizal, 2024). These conditions demand in-depth studies on financial risks in toll road development to anticipate potential financial losses and ensure the sustainability of projects. The existence of significant financial risks in the construction of toll roads in mountainous regions makes this research very urgent to provide a clearer picture of the challenges and strategies for mitigating financial risks (Afandi & A'yun, 2022). The lack of comprehensive studies on financial risks in challenging geographical contexts, such as toll roads in mountainous areas, can lead to significant losses for both the government and investors. Therefore, in this article, it is important to help stakeholders understand and manage the risks faced during the construction and management of toll roads.

This article will examine the Probolinggo-Banyuwangi toll road construction project as a research object based on several important reasons. First, this project is a National Strategic Project that plays a significant role in improving the economy and regional development, making it very relevant to study its impact. Second, this study focuses on the first phase of construction (Gending-Besuki section), allowing researchers to conduct a specific and in-depth study at the ongoing phase. In addition, with the estimated completion in late 2024 or early 2025, this project provides an opportunity to conduct longitudinal research, observing developments from start to finish. Third, construction in mountainous areas presents significant challenges, such as difficult geographical conditions and natural disaster risks, making it a research object rich in problems and potential findings, and the relevance of this project to contemporary issues such as infrastructure, environmental impact, and regional development in Indonesia, makes this research have the potential to make a significant contribution to the development of future development policies.

This research aims to analyze the financial risks associated with the construction of the Probolinggo-Banyuwangi toll road, particularly in the context of mountainous regions with unique topographic challenges. This study identifies the main factors that affect construction costs, including the risk of budget overruns and potential project delays. In addition, this study also examines how partnerships between the government and the private sector (Public-Private Partnership/PPP) play a role in funding this project and effective risk mitigation strategies. The novelty of this research lies in its comprehensive approach to examining the financial risks of infrastructure development that crosses mountainous regions. Specifically, this study highlights how extreme topographic challenges, such as difficult natural conditions, disaster risks, and increased construction costs, affect the success of toll road projects. In addition, this study offers new insights into the role of public-private partnerships (PPPs) in managing financial risks on high-risk projects. Through in-depth analysis of risk mitigation and resource optimization, this research provides a new contribution to the literature on infrastructure project risk management, especially in regions with challenging geographical conditions such as mountains.

METHOD

This research employs a quantitative research method with a descriptive approach. This quantitative research aims to measure and analyze the financial risks faced in toll road construction, particularly on the 176.4-kilometer Probolinggo-Banyuwangi toll road. This toll road, which began construction in 2019 and is currently in its first completion phase, is the main research object due to its location crossing mountainous areas and regions with significant topographic challenges.

The data used in this research consists of primary and secondary data. Primary data is collected through questionnaires with a closed-open free choice model. These questionnaires will be distributed to parties involved in the construction and management of toll roads, including project managers, investors, and other stakeholders. These questionnaires aim to measure their perceptions and experiences regarding financial risks in the construction process and the mitigation strategies implemented. Secondary data is derived from relevant documents such as topographic maps of the area, financial planning documents, and reports from

agencies responsible for the construction and management of the Probolinggo-Banyuwangi toll road. This secondary data will help provide in-depth information about the background and specific conditions of the project.

The collected data will be analyzed using the path analysis method with a multiple linear regression (MLR) model. This analysis is conducted to test the relationship between independent variables, namely financial risk factors such as construction costs, topography, and investment, and the dependent variable, the success and efficiency of toll road construction. In addition, this study also uses an intervention variable to see how other factors, such as geographical conditions or regulations, affect the relationship between independent and dependent variables. This method will help illustrate the complex relationship between risk factors and project success, and determine the most effective risk mitigation strategies (Kadzafi, Khamim, & Marjono, 2021).

RESULTS AND DISCUSSION

Description of the Probolinggo-Banyuwangi Toll Road Construction Project

The Probolinggo-Banyuwangi Toll Road, also known as the Probowangi Toll Road, is a vital infrastructure project in Indonesia aimed at connecting Kraksaan in Probolinggo to Ketapang in Banyuwangi, East Java. This project not only serves as an efficient transportation route but also plays a significant role in enhancing connectivity between Java and Bali (Tukimun, et al., 2024), particularly through integration with Ketapang Port, the main ferry port from Java to Bali.

To achieve the target completion date of 2025, the project is currently in a crucial planning phase where the division of construction areas or sections is essential. This division not only simplifies management and construction execution but also ensures that each section receives special attention according to its specific topographic and environmental characteristics (Kadzafi, Khamim, & Marjono, 2021). This allows for more appropriate adjustments to construction strategies to address potential challenges such as hilly geographical conditions and natural disaster risks.

These conditions underscore the need for a structured approach in the planning and implementation of the toll road project, where data on the division of areas or sections must be carefully examined. By mapping each section based on its specific needs and challenges, project managers can formulate more efficient and effective solutions and ensure that construction is carried out according to the established schedule and budget (Brodjonegoro, 2016). The success of this project will significantly contribute to improving the local economy and public mobility, making it one of the national strategic projects worthy of attention. Therefore, the work model planning for the construction of the Probowangi toll road is designed as shown in the following table.

Table 1. Division of Work Zones for the Probolinggo-Banyuwangi Toll Road Construction

Section	Development Corridor Area	Long Road
Section 1	Gending-Kraksaan	12,88 Km
Section 2	Kraksaan-Paiton	11,20 Km
Section 3	Paiton-Besuki	25,60 Km

Section 4	Besuki-Situbondo	43,30 Km
Section 5	Situbondo-Asembagus	16,76 Km
Section 6	Asembagus-Bajulmati	37,45 Km
Section 7	Bajulmati-Ketapang	29,21 Km

Source: PT. Jasa Marga Probolinggo-Banyuwangi (2024)

The construction, divided into 7 sections, considers a route that is closer to economic zones. Therefore, topographically, the area traversed by the Probowangi (Probolinggo-Banyuwangi) toll road is dominated by hilly to mountainous regions. This is indicated by the dense and winding contour lines, especially in the central to eastern parts of the toll road trace. The dense contour lines indicate significant elevation differences within a relatively short distance, which indicates the presence of steep slopes along the route. These conditions reflect natural challenges in construction, such as the risk of landslides, slope stability, and increased construction costs due to the need for special technology to adapt the road structure to steep terrain. This topography also requires a mature mitigation strategy to minimize environmental impacts and manage risks during the construction process, as shown in the following map.

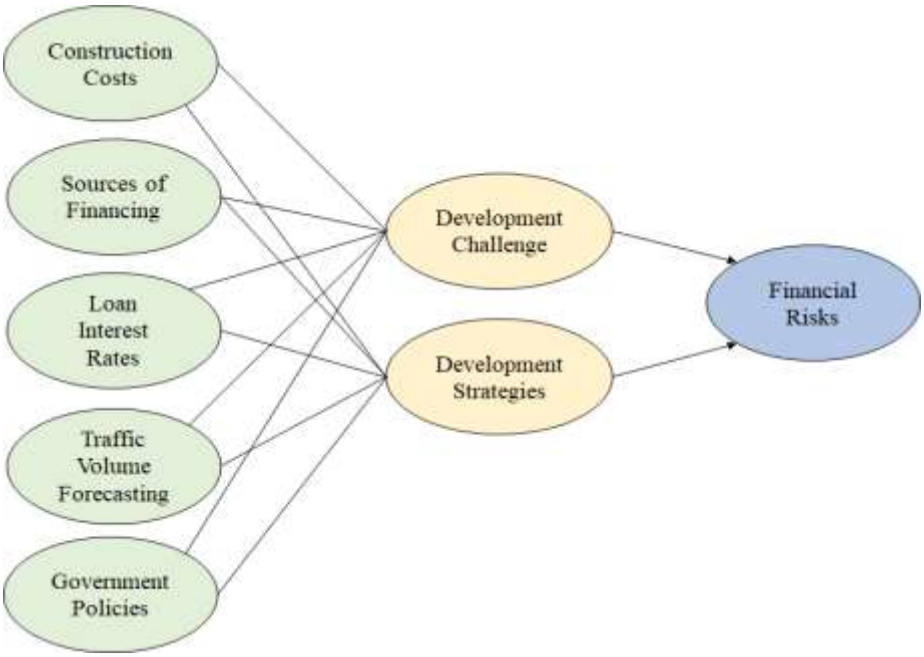
Source: PT. Jasa Marga Probolinggo-Banyuwangi, 2024

Figure 1. Topographical Conditions (Developments Challenges and Strategies)

The varied topography in the toll road construction area, particularly in mountainous regions, brings several important implications that need to be considered. First, construction costs become higher, as projects in mountainous areas require specialized technology, additional materials, and longer completion times compared to lowland construction. Second, the construction techniques used must be adapted to address challenges such as unstable soil conditions, steep slopes, and increased landslide risks (Tukimun et al., 2024). Third, construction in these areas has the potential for significant environmental impacts, including forest destruction, soil erosion, and changes in river flows, which can affect local ecosystems. Lastly, the required construction time is usually longer, which can impact the project completion schedule and operational costs.

These topographical conditions illustrate that all of these factors can be integrated to analyze the financial risks involved in the Probolinggo-Banyuwangi toll road construction. These variables, including construction costs, construction techniques, environmental impact, and construction time, will be the main focus of

this research, which aims to provide a deeper understanding of how topography affects the overall success and effectiveness of the project. By analyzing the relationships between these variables, this study is expected to generate concrete recommendations for better risk management and mitigation strategies in the context of infrastructure development in areas with similar topographical challenges. Therefore, the financial risk analysis, which is the subject of this study, can be constructed by various conditions, also influenced by the readiness of the toll road managers, considering the challenges and strategies as moderating variables. This can be illustrated in the following research framework.



Source: Compiled by the Researcher

Figure 2. Relationship Between Research Variables

The analysis of this diagram illustrates the complex relationship between challenges, financial risks, and influencing factors in the context of toll road construction. At the center of the diagram, challenges are identified as the core issue, encompassing various obstacles that may arise during the construction project. These challenges act as the primary triggers that can lead to the emergence of financial risks, which are the ultimate outcome of various arising problems. These risks can manifest as increased project costs, delays in completion, or even the overall failure of the project.

The diagram also highlights several factors that influence the challenges, as suggested by Tukimun et al. (2024). Among them, construction costs, which, if high or fluctuating, can add a financial burden to the project. Furthermore, the source of financing becomes critical; dependence on specific sources, such as loans, can increase risks if there are changes in interest rates or policies related to financing. Rising loan interest rates will exacerbate the project's financial burden, while inaccurate traffic volume predictions could lead to toll revenues falling short of expectations, affecting the project’s ability to repay debt. According to the report by Manalu and Harsono (2024), government policies also play a significant role; regulatory changes or licensing issues can hinder the project and potentially

increase costs. All of these factors directly contribute to the challenges faced, and in this context, those challenges become the cause of financial risks. Faisal (2021) explains that by understanding the relationship between challenges, financial risks, and contributing factors, the parties involved in the project can formulate more effective mitigation strategies to reduce the negative impact on the toll road construction project's sustainability.

The diagram illustrates that financial risks in toll road construction projects arise from the complex interaction between various internal and external factors that affect the project's progress. Construction projects, especially toll roads, are highly vulnerable to changes in economic, political, and environmental conditions, which can trigger uncertainties in their planning and execution. Therefore, early identification and management of these risks are crucial to ensuring the success of the project. Risk management theory suggests that proactive risk management can help minimize negative impacts on the project's budget and schedule (Kerzner, 2017).

The implications of this analysis lead to several strategic steps for better decision-making. First, an in-depth risk analysis is required before starting the project to identify all potential risks that may arise, whether technical, financial, or regulatory. Next, sound financial planning becomes critical; creating a robust and flexible financial plan can help stakeholders deal with various possible scenarios that may occur during the project implementation (Setyaning, Riyanto, & Prasetyo, 2023). Additionally, effective project management implementation will play a role in controlling the project’s costs, time, and quality, helping to achieve the expected results. Furthermore, periodic monitoring and evaluation are essential to identify changing risks that may arise and to take corrective actions necessary to keep the project on track (PMI, 2017).

Risk Mitigation

Risk mitigation in toll road construction projects is crucial to ensuring the smooth execution of the project and minimizing the negative impacts of various potential risks. One of the initial strategies is conducting an in-depth risk analysis during the planning phase, aiming to identify potential risks, both internal factors such as project management, and external factors like weather conditions or changes in government policies. Additionally, flexible financial planning is essential, which includes preparing a budget that accounts for unforeseen costs, and applying sensitivity analysis and scenario planning to anticipate changes in cost variables.

In terms of technology, Setyaning, Riyanto, & Prasetyo (2023) suggest that utilizing the latest innovations such as Building Information Modeling (BIM) and project management software can improve efficiency and reduce the risk of errors during construction. Moreover, training the project team on risk management and safe construction techniques helps to minimize operational errors. On the environmental side, Rahmawati and Tenriajeng (2020) explain that the mitigation of impacts, such as waste management and forest area restoration, needs to be carefully planned to reduce the environmental effects of toll road construction in mountainous areas. Additionally, stakeholder involvement plays a significant role in reducing social risks (Rahmawati & Tenriajeng, 2020). Consulting with local

communities, regional governments, and relevant agencies can minimize conflicts and gain full support for the project's success.

Furthermore, the project must implement continuous monitoring and evaluation to detect changes in risks early and take corrective actions (Faisal, 2021). Project insurance is also an important mitigation step to cover financial risks that may arise due to damage or delays. With effective time management and careful planning, the project can mitigate the risk of delays, particularly in areas prone to extreme weather conditions. These strategies, if applied properly, will help ensure that the project proceeds according to plan and that emerging risks can be effectively managed.

Financial Risk Analysis

Key Performance Indicators (KPI) in managing financial risks in construction projects, such as highway construction, play a crucial role in assessing the effectiveness of risk control. One of the main indicators is the timely completion of the project, where any deviation from the established schedule signals ineffective risk management. Delays can trigger cost overruns, which directly impact the financial stability of the project. Additionally, adhering to the project budget is another important KPI (Kadzafi, Khamim, & Marjono, 2021). Variations or overruns from the planned budget indicate poorly managed financial risks, such as fluctuations in material or labor costs.

Another indicator is the Return on Investment (ROI) ratio, which measures the project's ability to generate profits in line with initial expectations. The lower the ROI compared to the initial plan, the higher the financial risk faced by the project. Furthermore, project cash flow should be closely monitored. A stable cash flow demonstrates that the project is managing its income and expenses well (Tukimun, et al., 2024). Significant fluctuations in cash flow can cause liquidity problems, indicating suboptimal financial risk management (Rahmawati & Tenriajeng, 2020).

Another KPI that can be used is the project's ability to meet target toll traffic, which directly affects project revenue. If the traffic volume is well below the target, financial risks increase, as the revenue generated does not match initial projections. The balance of funding sources also becomes a key indicator, especially in projects that rely on a mix of private investment and government funds. Changes in interest rates or reduced investor commitment can add financial pressure (Rahmawati & Tenriajeng, 2020; Tyagita, et al., 2023). References to KPIs for financial risk management in construction projects can be found in studies such as those from the Project Management Institute (PMI) on project management and risk management standards (PMBOK Guide), as well as other literature emphasizing the importance of sound financial management in mitigating risk.

External factors such as natural disasters and climate change have a significant impact on financial risks in construction projects, including highway construction (Brodjonegoro, 2016). Natural disasters, such as earthquakes, floods, landslides, and volcanic eruptions, can cause infrastructure damage, project delays, and increased construction costs due to repair needs. Highway projects crossing mountainous areas, such as the Probolinggo-Banyuwangi route, are highly vulnerable to landslides and erosion, which can slow down the construction process

and require more expensive construction techniques. Climate change also affects financial risks through extreme weather pattern changes, such as increased rainfall and longer dry seasons. These conditions can affect soil stability and the technical requirements for strengthening road structures, potentially adding to the project's costs. For example, increased rainfall intensity due to climate change can cause more frequent floods or landslides, disrupting the construction process and requiring additional investment for environmental impact mitigation.

Additionally, Tukimun, et al., (2024) explain that government policy changes related to the environment, as a response to climate change issues, such as carbon emission regulations or restrictions on the use of certain lands, can affect operational costs and the feasibility of construction projects. Stricter environmental protection policies may require project design and implementation adjustments to reduce negative environmental impacts, increasing cost risks. A study by the Intergovernmental Panel on Climate Change (IPCC) emphasizes that climate change presents new challenges for infrastructure, including increased risks of physical damage and maintenance costs (Naeruz, et al., 2020). Furthermore, literature such as from the World Bank (2019) also identifies natural disasters and climate change as key external factors to be considered in infrastructure planning to reduce financial and operational risks.

CONCLUSION

The conclusions of this study indicate that the construction of highways, particularly along the Probolinggo-Banyuwangi route that traverses mountainous areas, faces significant challenges in terms of topography, construction techniques, and external factors such as natural disasters and climate change. The financial risks arising from these challenges, such as increased construction costs, funding fluctuations, and potential project delays, require well-thought-out mitigation strategies and comprehensive planning. This national strategic project is highly relevant in the context of infrastructure and regional economic development, and the research findings are expected to contribute to improving the quality of risk management in future infrastructure development projects. Thus, this study can also serve as a basis for decision-making for stakeholders to ensure project success through effective and sustainable risk management.

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