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Research Paper

The Effect of Operational Delay Risk to investment Decision Making on Construction of Semarang – Demak Toll Road Project - Indonesia

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ABSTRACT : *Roads play as a key element in a transportation infrastructure with major role in improving connectivity between regions, driving the economic growth and improving public welfare. Unfortunately, the Semarang-Demak National Road, as a part of Pantura (North Coast) road network frequently experiences severe congestions, tidal flooding and land subsidence as the constraints that able to delay the smoothness flow of goods and services in these areas.*

To address these issues and improve capacity and quality of transportation services, the government is planning to build the Semarang-Demak Toll Road, integrated with a sea wall. This national strategic project is expected to improve the connectivity along regional areas, shorten the travel times, reduce logistic costs and protect protect coastal areas from tidal flooding threat.

The method used in this study was a mixed method where it is a combination between quantitative and qualitative methods aided by sensitivity analysis and SWOT analysis. Result of study on the effect of Delay on NPV and IRR values: from sensitivity analysis, showed that operational delay have a significant negative impact on the financial feasibility of the project. As the delay time increases, NPV and IRR values decrease. Further, in the scenario of delay of more than 10 years (more than 2030), the investment becomes detrimental since the present value of the cash inflow is less than the initial investment. Meanwhile the effective mitigation strategies proposed in this study are: based on the SWOT analysis, there are several effective mitigation strategies to reduce the impact of operational delays such as strengthening cooperation with local government, using appropriate construction technology, and implementing proactive risk management and effective stakeholder management.

KEYWORDS: *Toll Road, Investment Decision Making, Risk of Operational Delay.*

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I. INTRODUCTION

The construction project of Semarang-Demak Toll Road extends to 26.70 kilometers in length with a total investment cost of Rp.16.33 trillion. The project is divided into two sections of roads: Section I (IC Kaligawe – IC Sayung) which built under a Public-Private Partnership (PPP) (*Kerja Sama Pemerintah dan Badan Usaha*/KPBU) scheme with the support of A Viability Gap Fund (VGF) of Rp.10.88 trillion from the government, and Section II (IC Sayung – IC Demak) which was built with an investment cost of Rp.5.44 trillion by PT. PP Semarang-Demak.

According to the Toll Road Concession Agreement or *Perjanjian Pengusahaan Jalan Tol*/PPJT time period of Semarak-Demak Toll Road Construction was planned for completion in June 2019 – October 2020, and full operation of both sections began in December 2020. However, in its implementation, this project experienced a significant delay in Section I which potentially delay the entire toll road operation. There are many factors for the causes of delay such as land acquisition constraints (especially destroyed land), licencing issues, complex environmental conditions (peatland and tidal flooding) and limited construction resources.

Operational delays will bring seriuous impact to a project financial viability, increase investment risks for investors and able to reduce the economic benefits for the community. Therefore, a comprehensive research to analyze the impact of operational delays on investment decisions on the Semarang-Demak Toll Road and formulate effective mitigation strategies to maintain project sustainability must be conducted.

So far, discussion related to the Influence of Operational Delay Risk on Investment Decision on the Semarang-Demak Toll Road-Indonesia have not been carried out by many researchers, therefore the problem study raised in here are: (1) what are the causal factors to operational delays in Section I of Semarang-Demak Toll Road?, (2) what is impact of operational delays on the financial feasibility indicators of the Toll Road Business Entity (BUJT) such as Net Present Value (NPV), Internal Rate of Return (IRR), and payback period? (3) what is the most effective and efficient risk mitigation strategy to reduce the impact of operational delays on the Semarang-Demak Toll Road in terms of cost, implementation and sustainability?

II. LITERATURE REVIEW

2.1. Infrastructure Investment

Infrastructure investment is capital allocation in physical assets that support economic growth and social welfare. These investments convering any transportation, energy, water, telecommunications and other public facilities. High-quality infrastructure increases productivity, reduces transaction costs and expands market access, which in turn promotes inclusive and sustainable economic growth. [1]

An infrastructure investment can be made through so many mechanisms such as public funding, private funding, and public-private partnerships (PPPs). KPBU are gaining popularity because it allows governments to leverage private expertise and capital in developing and managing infrastructure. However, PPPs also involve complex risks that requires be carefully managed to ensure project success. [2,3]

The decision of investment in infrastructure according to Boardman et al., become a crucial matter because it will have a long-term and significant impact on the economic and social development of the areas it serves. Therefore, a comprehensive investment feasibility analysis is essential to affirming that project provides optimal and sustainable benefits. [4]

There are several common criterias used in conducting investment feasibility analysis, including: (1) Payback Period or PP, (2) Average Rate of Return or ARR, (3) Net Present Value or NPV, (4) Internal Rate of Return or IRR, (5) Profitability Index (PI), and (6) other financial ratios such as liquidity, solvency, activity, and profitability. In this study, the analysis will focus on three main indicators of Payback period (PP), Net Present Value (NPV), and Internal Rate of Return (IRR). These three indicators were selected because of their relevance in measuring the financial feasibility of toll road projects as well as their easily interpretation and apoplication in investment decision making.

Jaja Suteja explains that investment decisions are a crucial factor in a company's financial function. Fama states that a company value is solely determined by investment decision and good investments will increase the company value and provide benefits to shareholders, while poor investment can lead to losses and bankruptcy. In the context of toll road investments, returns can be in the form of toll revenues, increased asset values around the toll road, and economic benefits for the area served. Meanwhile, risks include construction and operational delays, regulatory changes, interest rate fluctuations, changes in market conditions and operational risks such as decreased traffic volume due to external factors. [5,6,7,8]

Therefore, toll road investments require significant funding and have long-term impacts on companies and communities. A careful and comprehensive investment feasibility analysis must be conducted to avoid investment errors in unprofitable projects. Infrasctructure investment decisions depend on cash flow projections, the Internal Rate of Return (IRR), and project risk. Investors consider the financial viability and stability of a project before commiting to funding. A comprehensive investment feasibility analysis can help investors understand the potential risks and benefits of toll road projects, allowing them to make more informed and accurate investment decisions. [6,9,10]

2.2. Management of Risk of Project Delay

Risk management in a project is a systematic approach to identify, analyzes, and addresses risks which able to delay the achievement of a project objective. One of the main risks in construction projects is delays, which can result in increased costs, operational disruptions, and conflict between stakeholders.

According to ISO 31000:2018, a risk management is a systematic process of identifying, assessing and mitigating the uncertainty impact on a project objectives of an organization. Meanwhile, according to Kerzner, project risk management is the effort to identify potential risks in early onset an implement appropriate strategies to manage them. The risk management process, according to the PMBOK Guide consists of five main stages of:

1. Identify potential risks that able to influence the project (e.g. land acquisition delays, permitting issues, environmental conditions).
2. Risk analysis: assess the probability and impact of each identified risk.
3. Risk evaluation and risk response determination: determine appropriate strategies to address each risk (for example mitigation, transfer, and acceptance).
4. Risk mitigation implementation: implement and identified strategies.

5. Risk monitoring and control: monitor the effectiveness of mitigation strategies and make adjustment if necessary. [11,12]

Project delay is the difference between the planned time and the actual time in completing a project. Moreover, stated some of the main causes of project delays are [13]:

1. Internal factors:
   - Weaknesses in project planning and control
   - Lack of human and material resources
   - Ineffective project management
2. External factors:
   - Changes in government regulations and policies
   - Extreme weather conditions
   - Land Acquisition constraints

There are several common methods frequently used to analyze risk of project delay such as:

1. Risk Matrix → assess the likelihood and risk impact on a quantitative or qualitative scale. [14]
2. Monte Carlo Simulation → make models of various risk scenarios using probability distributions.
3. Critical Path Method (CPM) → identifies critical activity paths that determine project duration. [11]

Meanwhile, delay risk mitigation strategies can be implemented through:

1. A Thorough planning, including initial risks analysis before the project begins.
2. Effective resource management, to avoid material or labor shortage.
3. Good coordination with stakeholders to overcome permitting and regulatory hurdles.
4. Implementation of modern construction technologies, such as BIM (Building Information Modelling) to improve the project efficiency.

Evaluation of major risks in the construction industry, and a good risk management with a systematic approach based on standards such as ISO 31000 and the PMBOK guide can help mitigate the impact of delays and improve a project efficiency.

2.3. The Impact of Operational Delay

Operational delays are deviations from planned schedule of a project or business process which significantly impact the aspects of efficiency, costs and stakeholder satisfaction. In the construction, manufacturing, transportation, and public sector industries, operational delays are often become a major factor in increasing costs and service quality decline. [11]

According to PMBOK Guide, operational delay is the failure to complete an activity or stage of work within a specified timeframe. It can be caused by internal factors such as poor management and resource shortages, or external factors such as regulatory changes and weather conditions. According to Qudah & Bataineh, operational delays can be categorized as:

1. Avoidable delays → caused by ineffective management or poor planning.
2. Unavoidable delays → caused by external factors such as natural disasters or government policies. Disebabkan oleh faktor eksternal seperti bencana alam atau kebijakan pemerintah.
3. Excuseable delays → caused by changes approved by the project owner or stakeholders. [12,13]

In addition, operational delay also able to elicit some negative impacts to parts of the project aspects such as:

4. Financial Impact
   Increased operational costs: delays often lead to increased costs for labor, equipment rental, and materials.
   a. Lost revenue: on infrastructure or manufacturing project, delays can result in lost potential revenues due to delays in services or production.
   b. Claims and Penalties: contractors or project owners may be subject to fines or sanctions for project delays that exceeding the contractual period. [15,16]
5. Operational Impact
   a. Decreased efficiency: delays can disrupt the supply` chain and cause imbalances in resource allocation.
   b. Disruption to other project schedules: delays in one project often impact other related projects, particularly in the construction and transportation industries.
6. Impact to the Company Reputation and the Relationship among Stakeholders.
   a. Low or decreased client confidence: repeated delays can damage a company's reputation at the costumer and investors eyes. [17]
   b. Stakeholder conflict: disagreement between project owners, contractors, and supplier can escalate if delays are not be handled in professional and effective way.
7. Social and Environmental Impacts
   a. Community disruptions: delayed infrastructure projects can disrupts community mobility and increase

noise or dust pollutions. [18]

b. Increased Health and Safety risks: delayed projects can lead to unsafe working conditions and increase the risk of accidents. [19]

From several reviewed literature, operational delays bring broad impacts, extends from financial and operational aspect to reputational and social aspects. Therefore, systematic approach to risk management is essential to mitigate the negative impact of operational delays and improve project or business efficiency.

III. RESEARCH METHOD

3.1. Research Location

The construction of Semarang-Demak Toll Road is a national strategic project aimed at improving the connectivity and driving economic growth in Central Java Province. The toll road project is implemented by PT Semarang-Demak, a joint venture company consisting of PT PP (Persero) Tbk (75%) and PT. Wijaya Karya (Persero) Tbk (25%) with total investment cost is estimated of Rp. 5.440.789.000.000.00.

From geographical perspective, the Semarang-Demak Toll Road is 26.70 km in length and crosses two administrative areas of Semarang City and Demak Regency. The project is divided into two sections of:

1. Section 1: Semarang Kaligawe - Sayung (STA. -0+150 s.d. STA.10+394)
2. Section 2: Sayung -Demak (STA. 10+394 s.d. STA.26+400)

The lay out of Toll Road of Semarang-Demak is listed in the following table (Table 1).

Table 1. Technical data of Semarang-Demak Toll road construction project

Description	Specification
Length	26.4 Km
Road column width	3.6 m/column
Number of road column (initial stage)	2 x 2 column
Number of road column (final stage)	2 x 3 column
Median width (include inner shoulder)	5.5 m
Plan speed	80 Km / hour
Hardening type	Rigid pavement with top layer of a 5 cm thick asphalt
Number of main road bridge	3 bridges in Section 1, 14 bridges in Section 2
Number of overpass	3 overpass
Number of box culvert	21 box culverts

3.2. Analysis of Sensitivity

In the section of study discussion, a sensitivity analysis was conducted with two analyses from several alternative calculations that have produced different NPV and IRR (due to different operational delay times).

In this research, the author conducted a study to determine the extent of impact of the operational delays on the NPV and IRR indicators. The first step is to make several calculations of the operational delay time, including the initial plan compared to the 10-year operational delay time.

From these calculations, the value of NPV, IRR and income is calculated with a loan interest rate of 12 % and an initial planned and reliazed MARR of 12 % and a MARR during operational delay of 14 %. Meanwhile, from the values of NPV, IRR, and revenues, then a graph is created to connect:

1. The relationship between NPV and revenue.
2. The relationship between NPV and investment costs.

In this study, the assumption is the later the operational period, the greater the bank interest on the loan borne for construction costs and the lower the revenue due to concession period of (only) 35 years.

After conducting a sensitivity analysis with two analysis above, a conclusion will be obtained regarding the decision to invest in the construction of Semarang-Demak Toll Road, both in terms of operational delay time, as well as additional investment costs due to the operational delay time by obtaining the NPV and IRR values at the same time.

3.3. SWOT Analysis

SWOT analysis is a strategic planning tool for evaluating the Strength, Weaknesses, Opportunities and Threats in an organization, a project or business activity. In the context of this research, SWOT analysis is used to identify internal and external factors that influence operational delays on the Semarang-Demak Toll Road.

According to to Rangkuti, a SWOT analysis helps organization to identify various strategic factor in a systematic way to formula the appropriate strategy. Internal components such as strength and weaknesses, while the external components include opportunity and threats. In the context of a toll road project, strength could include government support or advanced construction technology, weaknesses could include land acquisition constraints or complex geotechnical condition, while opportunity could include increased connectivity and economic growth, and threats could include regulatory changes or fluctuating material prices. [20]

SWOT analysis is a simple yet effective strategic tool for analyzing the position and direction of an organization. Its broad and flexible use makes it very populat method in strategic management research and practice.

IV. RESULT AND DISCUSSION

4.1. Discussion of Investment through Alternatives of Time Duration of Operational Delay Risks

This research will be discussing the study matter in detail, due to operational delays in Section I caused by land acquisition, design and budget issues, a study was conducted with several alternatives for operational delays. The study examines investment costs and several alternatives length of the operational delays. Some factors were based on figures submitted by the investors, including actual figures and initial investment plans, and some other figures were based on assumptions. The details are as follows:

1. The construction cost:
   There is a delay in the construction progress of Section I that does not affect the total investment realization cost for the Semarang-Demak Investment PP (because the investment cost for Section I are coming from the budget of the Ministry of PUPR).
2. The consultant cost:
   a. There is a delay in the construction progress of Section I that does not affect the total investment realization costs of the Semarang-Demak PP (because the investment costs of section I are coming from the budget of Ministry of PUPR).
   b. The overhead cost (construction period):
      - An increase of human resource cost (10 % per year) was implemented annually during the operational delay period starting from 2019.
      - An increase in vehicle cost (12 % per year) was implemented annually during the operational delay period starting rom 2019.
      - An increase in office rental costs (10 % per year) was implemented annually druing the operational delay period starting from 2019.
      - An increase in fuel costs (0,28 % per year) was implemented annually during the operational delay period starting from 2019.
      - An increase in office equipment costs (10 % per year) was implemented annually during the operational delay period starting from 2019.
      - The overhead costs are the sum of all iterms (a) + (b) + (c) + (d) + (e).
   c. Land acquisition cost
      - An increase in land acquisition cost (8 % per year) is carried out annually during the operational delay period starting from 2019.
      - Land acquisition costs are the sum of item (a) + realized land acquisition cost.
   d. The Interest of construction period of IDC and GDUT
      - The increase in construction period interest (12 % per year) is carried out annually during the operational delay period starting from 2019.
      - The construction period interest cost are the sum of item (a) + actual construction period interest cost.
   e. The Average Daily Traffic (*Lalu Lintas Harian Rata – Rata*/LHR):
      The vehicle traffic based on actual traffic during operational hours and tariffs from August, 9, 2019 to November 9, 2019 (4 months) on toll road sections 1 to 3.
   f. OP and OM (during concention period)
      OP and OM from August 9, 2019 to November 9, 2019 (4 months) use realization data, while the following year uses initial investment plan data.
   g. The tariff used is the tariff approved by BPJT during operations.

4.2. The Calculation of NPV and IRR

The calculation of NPV and IRR was held by using investment cost data and toll revenue projections, for evaluating the financial feasibility of the Semarang-Demak Toll Road project under the initial planning scenario. The discount rate used was [Value]% per year, which reflects [Justification of the discount rate, e.g., the company's weighted average cost of capital (WACC).

Next, the NPV and IRR calculations were performed in this study and yielding the value of NPV of Rp. 1,320,629.00, an IRR of 11.56%, and a payback period of 17.09 years.

A positive NPV indicates that there is a positive NPV interpretation. For example, the project is financially feasible because the present value of the cash inflow is greater than the present value of the cash outflow. An IRR greater than the discount rate indicates interpretation that the project generates a higher rate of return than the investor's desired rate of return. Overall, the result of the financial analysis indicate that the Semarang-Demak Toll Road Project in the initial plan scenario is declared financially feasible and attractive to investors.

4.3. The Relationship between NPV and Income/Revenue Values

The graphical relationship between NPV and revenue value is presented in the following figure (Figure 1). It showed that the lower the revenue received, the more negative the NPV value. Conversely, the higher the revenue received, the more positive the NPV value.

Thus, in making an investment decision the Semarang-Demak Toll Road, the maximum NPV limit is equal to zero, resulting in an income of Rp. 165,242,291,997,733.00.

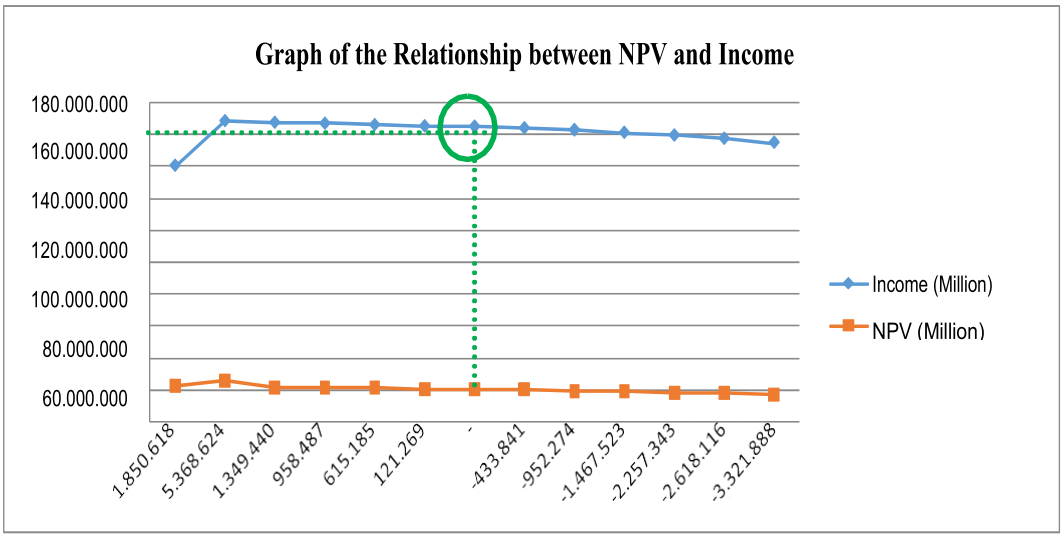

Figure 1. The graph of NPV (in million) and revenue (in million) relationship

4.4. The Relationship between NPV and Investment Cost

The graphical relationship between the NPV and investment costs is presented in the following figure (Figure 2). The graph showed the higher the investment costs, the more negative the NPV value is. Conversely, the lower the investment cost, the more positive the NPV value is.

Thus, in making an investment decision on the Semarang - Demak Toll Road, the maximum NPV limit is zero, requiring an investment cost of IDR 8,599,907,552,997.00.

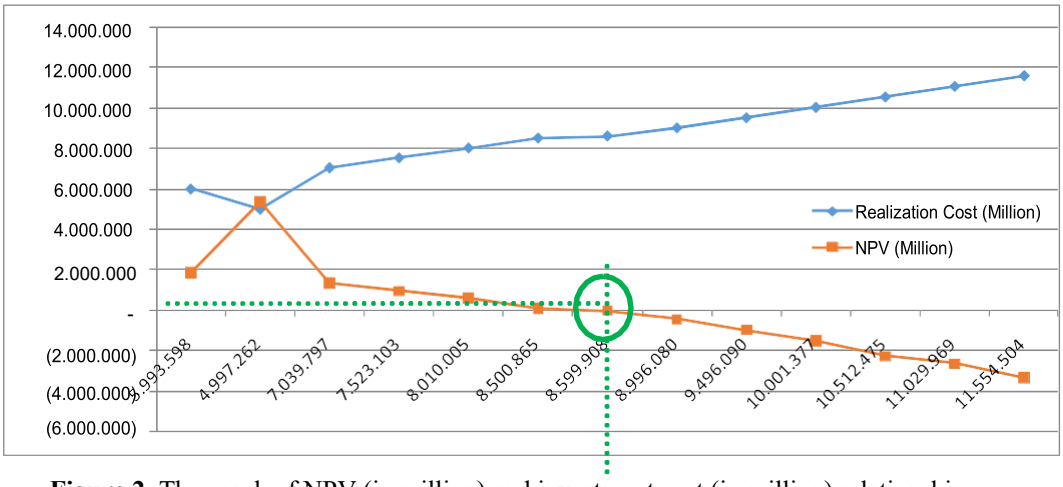

Figure 2. The graph of NPV (in million) and investment cost (in million) relationship

4.5. The SWOT Analysis Related to Risk Operational Delay in Semarak-Demak Toll Road Construction

A SWOT analysis is a strategic framework used to evaluate the Strength, Weaknesses, Opportunities and Threats in a systematical way which affect the Semarang-Demak Toll Road project ability to achieve the stated investment objectives. In the context of this study, the SWOT analysis focuses on identifying internal and external factors that contribute to the operational delays, as well as how these factors interact to influence the project's financial feasibility. Table 2 is the summary of SWOT Analysis results for the Semarang-Demak Toll Road operational delays.

Table 2. Summary of the SWOT Analysis Result

No	Strength	Weaknessess
1	*Strong Central Government Support*: National strategic projects (PSN) accelerate licensing and inter-agency coordination, ensuring project sustainability amidst political or economic changes. (Reference: PSN Document on the Semarang-Demak Toll Road)	*Complex and Protracted Land Acquisition Process*: Negotiations with landowners, identification of waqf and destroyed land, and legal processes related to compensation take unpredictable time, causing construction delays and increased costs. (Reference: Project land acquisition progress report)
2	*Integration with the Sea Wall Project*: Provides double added value (transportation infrastructure and environmental protection), attracting investors who care about environmental and sustainability issues (Reference: Project feasibility study that addresses environmental aspects).	*Challenging Geotechnical Conditions*: Soft, peaty, and swampy soils in coastal areas require special reinforcement techniques (e.g., piles, prefabricated vertical drains) and increasing construction costs and time. (Reference: Project geotechnical report)
3	*Huge Market Potential*: The Semarang and Demak regions are strategic industrial and trade centers, guaranteeing high traffic volumes once the toll road is operational. (Reference: Semarang-Demak arterial road traffic volume data, regional economic growth projections)	*Dependence on External Funding*: The project relies on syndicated bank loans, which are vulnerable to changes in interest rates, financial market conditions, and bank credit policies. (Reference: Project funding structure, credit agreement with bank)
4	*Use of Modern Construction Technology*: The application of Building Information Modeling (BIM), prefabricated methods, and innovative soil stabilization techniques accelerates construction and reduces the risk of errors. (Reference: Application of construction technology in toll road projects in Indonesia).	*Complex Multilateral Coordination*: Involving various government agencies (central, provincial, district), investors, contractors, consultants, and affected communities, requires effective communication and careful conflict management. (Reference: Identification of project stakeholders).
No	**Opportunity**	**Threat**
1	*Boosting Regional Economic Growth*: Toll roads can increase investment in the industrial, property, and tourism sectors along the Semarang-Demak corridor, creating a multiplier effect for the local economy. (Reference: Study of the economic impact of toll roads on surrounding areas)	*Natural Disaster Risk and Climate Change*: Tidal flooding, high waves, and coastal erosion threaten the structural integrity of the toll road, particularly the sea wall. Climate change could exacerbate these extreme conditions. (Reference: Climate risk analysis for the Semarang-Demak coastal area)
2	*Reducing Congestion and Transportation Costs*: Shortening travel times and reducing vehicle-operating costs, improving logistics efficiency and regional competitiveness. (Reference: Study of the economic benefits of toll roads for users and businesses)	*Material and Energy Price Fluctuations*: Rising prices for steel, cement, asphalt, and fuel can increase construction costs and reduce project profit margins. (Reference: Construction Price Index, Inflation Report)
3	*Integration with Public Transportation Systems*: Integrating toll roads with existing public transportation systems (e.g., shuttle buses, trains) can improve accessibility and traffic volume. (Reference:	*Government Policy Changes*: Changes in policies related to toll rates, spatial planning, or environmental permits can influence project feasibility and reduce revenue. (Reference:

	Integrated transportation development plan in Semarang-Demak)	Examples of policy changes relevant to toll roads)
4	*Potential for Development* *Transit-Oriented Development (TOD)*: Developing residential, commercial, and industrial areas around toll gates can increase non-toll revenue and maximize asset value. (Reference: TOD Concept and Its Implementation in Indonesia).	*Community Resistance and Social Impacts*: Protests from communities affected by evictions, noise, or environmental changes can delay projects, increase compensation costs, and damage a company's reputation. (Reference: Examples of social conflict in infrastructure projects in Indonesia)
5	*Innovation in Infrastructure Financing*: Implementing innovative financing schemes such as crowdfunding, green bonds, or infrastructure investment trusts (InvITs) can attract new funding sources and reduce reliance on conventional bank loans. (Reference: Trends and Innovations in Infrastructure Financing).	*Competition with Improved Arterial Roads*: If the government improves the quality and capacity of the Semarang-Demak arterial road, the attractiveness of toll roads may be reduced. (Reference: Semarang-Demak arterial road development plan)

The SWOT analysis provides a comprehensive framework for understanding influential factors of the success of Semarang-Demak Toll Road project. By managing strength, addressing weaknesses, capitalizing opportunities, and aware of threats, stakeholders able to ehance the project's investment viability and make sure the optimal benefit will be received by the community.

V. CONCLUSION

According to the result analysis of quantitative and qualitative data in this study, there are several conclusions able to be drawn on the subject of risk delay management and strategy to enhance the feasibility of investment on the construction project of Semarang-Demak Toll Road as follows:

1. Based on the analysis performed in this study, it was found the operational delays of Section I from Semarang-Demak Toll Road project was caused by a complex interactions of factors: (a) challenging geotechnical conditions and design changes (technical aspect), (b) tidal flood and potential impacts of climate change (environmental aspect), land acquisition and social conflict (social aspect) and innefective coordination and suboptimal risk management (social aspect).
2. Effect of Delay on NPV and IRR Values: Sensitivity analysis showed that operational delay has a significant negative impact on the financial feasibility of the project. As the delay time increases, the NPV and IRR values are decrease along time. In the scenario of a delay in more than 10 years, (more than 2030), then investment getting unfeasible because there is a negative NPV indicates that project or investment is detrimental because the present value of the cash inflows is less than the initial investment.
3. Effective mitigation strategies: based on the SWOT analysis performed in this study, there are several effective mitigation strategies to reduce the impact of operational delays such as: strengthening cooperation with the local government, employing an appropriate construction technology, and implementing proactive risk management and effective stakeholder management.

REFERENCES

[1]. Eberhardinger, K., et al., (2022). Infrastructure quality and economic growth. *International Journal of Development Issues*, **21**(*2*): pp. 203-221.
[2]. Blanc-Brude, F., & Goldsmith, P., (2020). Public-private partnerships in infrastructure: A systematic review. *Transport Policy*, **95**: pp. 17-29.
[3]. Hodge, G. A., et al., (2019). Public-private partnerships in infrastructure: an international review. *Research in Transportation Economics*, **74**: pp. 50-59.
[4]. Boardman, A. E., Greenberg, D. H., Vining, A. R., & Weimer, D. L., (2018). "Cost-benefit analysis: Concepts and practice". Cambridge: Cambridge University Press.
[5]. Suteja, J., & Gunardi, A., (2016). "Manajemen investasi dan portofolio". Bandung: PT. Refika Aditama.
[6]. Fama, E. F., (1978). Permanent and temporary components of stock market data. *Journal of Political Economy*, **86**(*2*): pp. 246-274.
[7]. Damodaran, A., (2012). "Investment valuation: Tools and techniques for determining the value of any asset". New Jersey: John Wiley & Sons.
[8]. Engel, R., et al., (2003). Toll road investment incentives and competition. *The World Bank Research Observer*, **18**(*1*): pp. 123-145.
[9]. Brealy, R., Myers, S., & Allen, F., (2017). "Principles of corporate finance". New York: McGraw-Hill Education.
[10]. Gatti, S., (2018). Infrastructure investment and macroeconomic stability. *Economic Development and Cultural Change*, **66**(*1*): pp. 177-206.
[11]. Kerzner, H., (2017). "Project management: A systems approach to planning, scheduling, and controlling". New Jersey: Wiley.
[12]. PMBOK Guide, (2021). "A guide to the project management body of knowledge (PMBOK Guide)". Project Management Institute.
[13]. Qudah, A., & Battaineh, T. H., (2002). Causes of construction delay: traditional contracts. *International Journal of Project Management,* **20**(*1*): pp. 67-73. DOI:10.1016/S0263-7863(00)00037-5
[14]. Hillson, D., (2002). Extended risk matrix. *Risk Management Journal*, **4**(*2*); pp. 76-81.

[15]. Kaliba, C., Muya, M., & Mumba, K., (2009). Cost escalation and schedule delays in road construction projects in Zambia. *International Journal of Project Management*, **27**(*5*): pp. 522-531. DOI: 10.1016/j.ijproman.2008.07.003.
[16]. Arditi, D., & Pattanakitchamron, T., (2006). Cost growth of contractors' change orders. *Journal of Construction Engineering and Management*, **132**(*4*): pp. 392-400.
[17]. Alaghbari, E. E., Kadir, M. R. A., & Mutalib, A. R., (2007). The effect of project delay on cost and client's satisfaction in construction projects. *Journal of Construction Engineering and Management*, **133**(*10*): pp. 750-757.
[18]. Love, P. E., et al., (2005). Effects of construction delays on project costs in New Zealand. *Proceedings of the 21st ARCOM Conference*: pp. 107-116.
[19]. Hinze, J., & Godfrey, J., (2003). Safety hazard identification and risk assessment in construction. *Journal of Construction Engineering and Management*, **129**(*4*): pp. 373-381.
[20]. Rangkuti, F. (2019). "Teknik membedah kasus bisnis analisis SWOT cara perhitungan bobot, rating, dan OCAI". Jakarta: Gramedia Pustaka Utama.