



Risk-Based Evaluation for the Financial Model of Trans Sumatra Toll Road Infrastructure Development Project

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Abstract. The construction of the Trans-Sumatra Toll Road is estimated to cost up to IDR 476 trillion. The delay in the construction of the project is considered to be detrimental to state finances worth IDR 3 trillion per year. This figure is compiled from various sources by assuming a total increase of 10–12% in construction and land acquisition costs. In order to avoid this financial loss, a risk-based evaluation for the funding model of Trans Sumatra toll road infrastructure is conducted. The purpose of this study is to analyze financial risk that occurs in the funding model of Sumatra Toll Road Infrastructure. Data were collected through questionnaire involving 30 respondents. The study has identified a total of 37 financial risks in the 19 funding stages of Trans-Sumatra. The author used probability and impact matrix as a method to analyze the data obtained. The result of this study indicated that 9 risks are identified as medium risks and 24 risks are identified as high risks. The highest financial risk identified is toll road company's financial difficulties. The result of this study can be used as a guidance in managing financial risks in Trans-Sumatra Toll Road infrastructure development project.

Keywords: Risk Factor · Toll-Road Projects · Infrastructure

1 Introduction

According to the Ministry of National Development Planning of Indonesia, from 2015 to 2019, the government has accelerated the development of infrastructure in various fields. One of the infrastructure areas that will be accelerated is road infrastructure. Road infrastructure development is encouraged to create inter-regional connectivity, so that logistics costs can be reduced and enhance the economy. Of the ten infrastructure projects priorities that began to be built in 2015, there are two priorities for toll road projects namely the construction of four Trans Sumatra toll roads with an investment value of Rp. 30 trillion and the construction of the Balikpapan-Samarinda toll road with an investment value of Rp 11.4 trillion [1]. Trans Sumatra Toll Road is a road network that span $\pm 2,704$ km connecting cities on the island of Sumatra, from Lampung to Aceh [1]. It is one of the longest toll roads in Indonesia which is targeted to be completed in 2024 and has 24 sections connecting Sumatra Island with eight priority sections [2].

According to Choudhry and Iqbal [3], economic factors are the most important risk in the toll road project agreement. In general, stakeholders try to avoid or transfer this risk. Therefore, it is important to identify risks and design a risk severity matrix [4]. In this study, the authors identify the financial risks in each stage of the funding model of Trans Sumatra Toll Road infrastructure development, level the risks and provide risk mitigation strategies. The aim of this research is to perform risk-based evaluation for the financial model of Trans Sumatra Toll Road infrastructure development project. The financial model of the Trans Sumatra Toll Road will be explained in the first section of the literature review. On the second section of the literature review, the author explains the risk management process. These literature review then used in the discussion section, where the author evaluate the financial model with the risk variables that has been validated by the respondents.

2 Literature Review

2.1 Financial Model for the Development of the Trans-Sumatra Toll Road

According to the Government Regulation of the Republic of Indonesia No.15/2005 [5] on Toll Roads, the prerequisite conditions for the state-owned enterprise (SOE) assignment funding model in Indonesia are as follow; 1) Not financially feasible, 2) Limited government budget, 3) Required to support regional development. In this model, the form of government support include; 1) State investment and 2) Government guarantees for loans (bond and debt). According to Presidential Regulation No. 100/2014 [6] on The Acceleration of The Trans Sumatra Toll Road Construction, the sources of financing for the SOE assignment model in Indonesia include; 1) State equity participation, 2) Continuation of loans from foreign and/or domestic government loans, 3) Issuance of corporate bonds guaranteed by the government, 4) Loans from financial institutions or multilateral financing institutions guaranteed by the government, 5) Loans and/or other forms of funding from government investment agencies, 6) other sources of financing in accordance with statutory provisions (Fig. 1) (Table 1).

2.2 Risk Management

Project risk management is a systematic process of identifying, analyzing, responding, and controlling project risks [8]. According to the Project Management Institute [8], the stages of risk management are as follows:

1. Plan Risk Management
2. The process of determining how to carry out risk management activities for a project.
3. Risk Identification
4. The process of identifying individual project risks as well as sources of project risk as a whole and documenting their characteristics.
5. Risk Analysis
6. A method for prioritizing a list of identified risks for further treatment.
7. Risk Response Planning
8. The processes, techniques, and strategies to deal with risks that may arise.

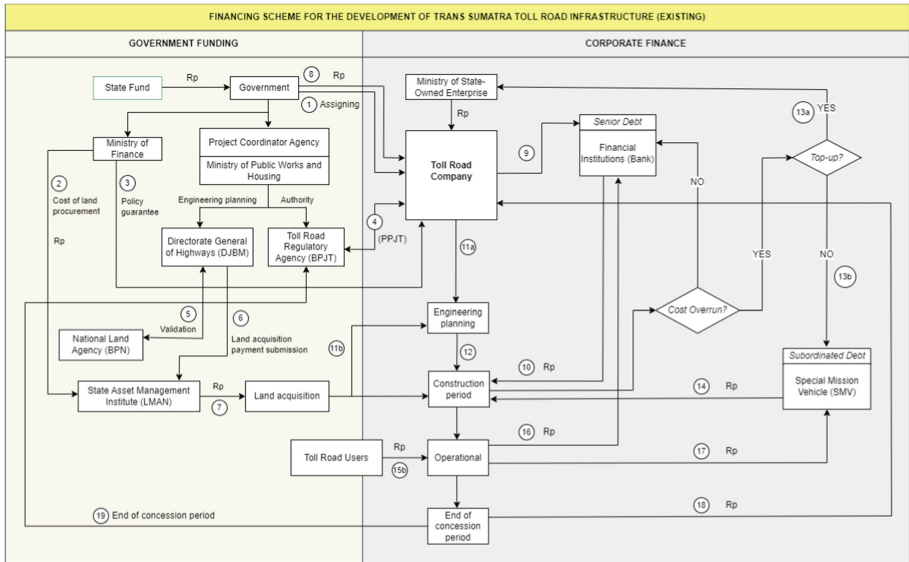


Fig. 1. Financing Model for The Development of Trans Sumatra Toll Road Infrastructure. (Fakhrin, 2021)

Table 1. Stages of the Trans Sumatra Toll Road Infrastructure Financial Model. (Fakhrin, 2021)

| | |
|----------|---|
| Stages 1 | The government gave the assignment to Toll Road Company to carry out the Trans Sumatra Toll Road Infrastructure Development; |
| Stages 2 | The Ministry of Finance obtains funds from the state budget for land acquisition costs which are then used by the State Asset Management Agency (LMAN); |
| Stages 3 | The Ministry of Finance provides a guarantee policy directly to Toll Road Company; |
| Stages 4 | The Toll Road Regulatory Agency (BPJT) implements the Toll Road Concession Agreement (PPJT) with Toll Road Company; |
| Stages 5 | The Directorate General of Highways (DJBM) provides a land acquisition plan to the National Land Agency (BPN) for validation and administrative processes for land acquisition; |
| Stages 6 | The Directorate General of Highways (DJBM) submits a request for payment for land acquisition to the State Asset Management Agency (LMAN); |
| Stages 7 | The State Asset Management Agency (LMAN) carries out land acquisition by obtaining funds from the Ministry of Finance; |
| Stages 8 | The government provides State Equity Participation (PMN) to Toll Road Company as equity to implement the Trans Sumatra Toll Road Infrastructure Development; |

(continued)

Table 1. (continued)

| | |
|-----------|---|
| Stages 9 | Toll Road Company submitted a senior debt to a Financial Institution (Bank) which was used as additional capital to carry out the Trans Sumatra Toll Road Infrastructure Development; |
| Stages 10 | Financial Institutions (Bank) provide loans to Toll Road Company which is used to finance the construction; |
| Stages 11 | After land acquisition and financial close have been completed, Toll Road Company can carry out technical planning; |
| Stages 12 | After the technical planning is completed, Toll Road Company can proceed to the construction implementation stage; |
| Stages 13 | If there is a cost overrun of 20% at the construction stage, then Toll Road Company can submit requests for State Equity Participation (PMN) back to the Government through the Ministry of State-owned enterprise or can apply for subordinated debt to Special Mission Vehicle (SMV) under the Ministry of Finance; |
| Stages 14 | Special Mission Vehicle (SMV) under the Ministry of Finance provides loans to XYZ corporation which is used to finance construction implementation; |
| Stages 15 | At the operational stage, Toll Road Company gets toll revenue from toll road users in the form of traffic and toll road fees; |
| Stages 16 | The proceeds from the toll revenue are used to repay loans to Financial Institutions (Banks); |
| Stages 17 | The proceeds from the toll revenue are also used to repay loans to SMV. |
| Stages 18 | In addition, the results of the toll road revenue can be a profit for Toll Road Company; |
| Stages 19 | After the end of the concession period according to the Toll Road Concession Agreement (PPJT), then Toll Road Company will return the assets of the Trans Sumatra Toll Road to the Toll Road Regulatory Agency (BPJT). |

3 Research Methods

In an attempt to understand the risks associated in the financial model of Trans Sumatra Toll Road Infrastructure Development Project, the authors were spreading questionnaire towards 30 respondents that worked in the toll road projects to validate the financial risks that was collected from the literature study. The authors used Kruskal-Wallis to validate the responds given by the respondent. In the questionnaire, the respondents were asked to measure the risk impact and the risk probability using the Likert scale (Table 2 and Table 3).

Table 2. Scale used to measure probability of risk occurrence. (PMBOK, 2017)

| Scale | Probability | Description |
|-------|-------------|---------------------------------------|
| 1 | Very Low | 1–10% probability of risk occurrence |
| 2 | Low | 11–30% probability of risk occurrence |
| 3 | Moderate | 31–50% probability of risk occurrence |
| 4 | High | 51–70% probability of risk occurrence |
| 5 | Very High | >70% probability of risk occurrence |

Table 3. Scale used to identify impact of risk. (PMBOK, 2017)

| Scale | Impact | Description |
|-------|-----------|-------------------------|
| 1 | Very Low | 1 week time impact |
| 2 | Low | 1–4 weeks’ time impact |
| 3 | Moderate | 1–3 months’ time impact |
| 4 | High | 3–6 months’ time impact |
| 5 | Very High | >6 months’ time impact |

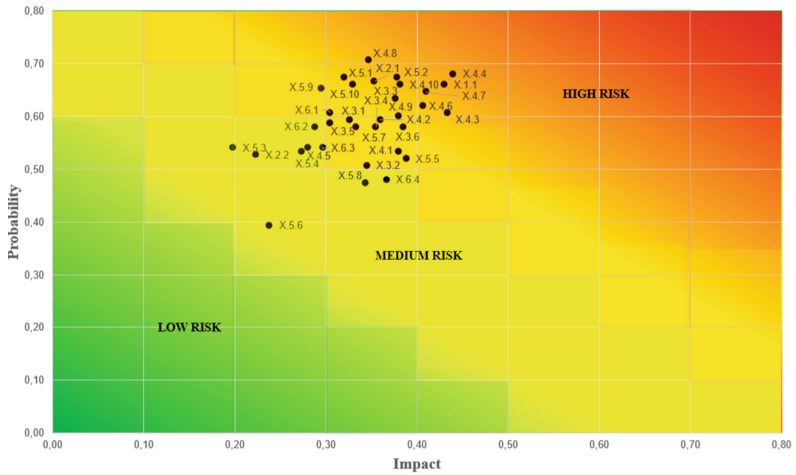


Fig. 2. Risk Matrix of The Financial Risks in Financing Stages of Trans Sumatra Toll Road.

4 Result

This research has identified 33 financial risks which are then classified into six stages of toll road concessions cycle in Indonesia [9] (Table 4). The stages are as follow; 1) Project preparation, 2) Land procurement, 3) Toll Road concession auction, 4) Financing, 5) Planning and construction, 6) Operation and maintenance. The risks are also grouped

Table 4. Financial Risks in Financing Stages of Trans-Sumatra Toll Road

| No. | Risk Event | Risk Index (P x I) |
|------------|---|--------------------|
| X.1 | Project Preparation | |
| X.1.1 | Poor feasibility study; planning and design schemes (including project scale, technology, equipment standards, etc.) that are unreasonable and inappropriate. | 0.28 |
| X.2 | Land Procurement | |
| X.2.1 | One of the reasons for the increase in land acquisition costs is the large number of intermediaries (brokers) in land acquisition. | 0.24 |
| X.2.2 | Additional tax fee | 0.12 |
| X.3 | Toll Road Concession Auction | |
| X.3.1 | Lack of standard contractual agreements; ambiguity of contracts, imperfect price adjustment mechanisms, irrational profit sharing, imperfect dispute resolution mechanisms, and incomplete contracts. | 0.19 |
| X.3.2 | Lack of supportive policies for investors. | 0.17 |
| X.4 | Financing | |
| X.4.1 | Inflation | 0.24 |
| X.4.2 | Interest rate fluctuation | 0.21 |
| X.4.3 | Foreign currency fluctuation | 0.18 |
| X.4.4 | Difficulty getting a bank loan | 0.22 |
| X.4.5 | Government credit risk | 0.20 |
| X.4.6 | Delay in financial closure | 0.21 |
| X.4.7 | Delay in financing from investors | 0.26 |
| X.4.8 | Financial difficulties in the toll road company | 0.30 |
| X.4.9 | Devaluation | 0.15 |
| X.4.10 | Company liquidity; The company cannot convert its assets into cash. | 0.25 |
| X.5 | Planning and Construction | |
| X.5.1 | Inaccurate cost estimation | 0.27 |
| X.5.2 | Increase in material cost | 0.24 |
| X.5.3 | Corruption | 0.23 |
| X.5.4 | Unpredictable site condition | 0.25 |
| X.5.5 | Many changes in the scope of work; a change in scope means a change that has an impact on the project cost or schedule. | 0.22 |

(continued)

Table 4. (continued)

| No. | Risk Event | Risk Index (P x I) |
|------------|---|---------------------------|
| X.5.6 | Geotechnical conditions; Unpredictability of underground conditions which causes additional costs and time for foundation work. | 0.25 |
| X.5.7 | Theft; theft of supporting resources for construction work, for example materials and tools. | 0.11 |
| X.5.8 | Repair work back; redo the job or correct the wrong job. | 0.15 |
| X.5.9 | Natural disasters; natural disaster risk is unfavorable natural conditions and can disrupt the course of development and damage infrastructure that is being or has been built. | 0.20 |
| X.5.10 | The existence of important objects such as fossils, religious buildings and others: the existence of important objects is the existence of historical or spiritual objects including buildings, stones or other objects that have important historical value for the country, so they need to be protected which can change the design or hinder toll road construction work. | 0.09 |
| X.6 | Operation and Maintenance | |
| X.6.1 | Unexpected earnings; difference between the actual earnings and the earnings expected | 0.19 |
| X.6.2 | Asset ownership; the act of taking over project assets (including nationalization) by the government, either directly or indirectly, which can trigger the termination of the project contract which has an impact on the Business Entity so that it affects project performance. | 0.16 |
| X.6.3 | Excess operational costs; operating costs are greater than income. | 0.19 |
| X.6.4 | High maintenance costs; maintenance costs are higher than expected. | 0.22 |
| X.6.5 | Tariff issue; the determination of the initial tariff and the mechanism for adjusting the tariff were not transparent and inconsistent, causing revenues that were not in accordance with the plan. | 0.19 |
| X.6.6 | Road demand is one of the risks of a toll road project that cannot be predicted accurately even for a short period of time, let alone for a long period of time. | 0.17 |
| X.6.7 | Competitive routes; competition for business or routes can reduce toll road revenues. | 0.16 |
| X.6.8 | Violation of government contracts; violation of contractual agreements by the government that has the potential to reduce project profits. | 0.18 |

into three categories based on the risk matrix (Fig. 2). 24 risks are identified as high risks while 9 risks are identified as medium risks. It is found that financial difficulties in the toll road company (variable X.4.8) in the financing stages has the highest risk index. It has the highest probability and impact on the Trans-Sumatra toll-road concession. The 2nd and the 3rd risks with high index is poor feasibility in project planning (variable X.1.1) and unpredictability of geotechnical conditions (variable X.5.6).

5 Discussion

Table 5 provide the risk response planning for the Trans-Sumatra Toll Road Funding Model. The author incorporates the data of Trans-Sumatra funding stages that is obtained from the literature review with the risks variable that has been validated by the respondents. The author lists the risks according to the six project stages and 19 Trans-Sumatra funding stages.

Table 5. Risk Response Planning of The Trans Sumatra Toll Road Financing Stages

| No | Project Stages | Trans-Sumatra Funding Stages | Risk Variable | Risk Level | Risk Mitigation |
|----|-------------------------------------|------------------------------|---------------|------------|--|
| 1. | Project Preparation | Stages 1 | X.1.1 | High | <ul style="list-style-type: none"> > Clarification should be held during the tender process. > Output specifications must be clear and refer to the best practice. > Tender documents should be presented clearly and easily understood. |
| 2 | Toll Road Concession Auction | Stages 2 | X.2.1 | High | <ul style="list-style-type: none"> > Road planning is recommended to avoid residential areas and trade areas to avoid the social costs of the project. > The government conducts an analysis of the spatial suitability of the project location with the neighborhood unit where the project will be implemented. > The government needs to determine the project location and ensure that all requirements have been met before applying for a location determination permit. > The government needs to ensure that there is a team that carries out the land acquisition process according to procedures. > The government needs to ensure that the land acquisition process can proceed in accordance with the statutory provisions |
| | | Stages 3: | X.3.2 | Medium | <ul style="list-style-type: none"> > The certainty of the legal framework must be clear; this is related to the concession period of the business entity. > The rules that support the assignment scheme must be created. |

(continued)

Table 5. (continued)

| No | Project Stages | Trans-Sumatra Funding Stages | Risk Variable | Risk Level | Risk Mitigation |
|----|------------------|------------------------------|---------------|------------|---|
| | | Stages 4 | X.3.1 | High | <ul style="list-style-type: none"> > Increase employee competence in the field of law. > Examine further on all agreements for companies and partners. > Making standard of procedure for contract document management. > Socializing document archiving method. |
| 3 | Land Procurement | Stages 5 | X.2.2 | Medium | <ul style="list-style-type: none"> > Mediation and negotiation > Political risk insurance > Government guarantee |
| | | Stages 6 | | | |
| | | Stages 7 | X.2.1 | High | <ul style="list-style-type: none"> > Road planning is recommended to avoid residential areas and trade areas to avoid the social costs of the project. > The government conducts an analysis of the spatial suitability of the project location with the neighborhood unit where the project will be implemented. > The government needs to determine the project location and ensure that all requirements have been met before applying for a location determination permit. > The government needs to ensure that there is a team that carries out the land acquisition process according to procedures. > The government needs to ensure that the land acquisition process can proceed in accordance with the statutory provisions. |
| 4 | Financing | Stages 8: | X.4.7 | High | <ul style="list-style-type: none"> > Ensure timely budgeting process. > The government provides bailout funds managed by certain units. |
| | | Stages 9 | X.4.2 | High | <ul style="list-style-type: none"> > Using rate indexation factors and interest rate hedging. > If the fluctuations are extreme, the risk can be shared in half with the government. |
| | | | X.4.3 | High | <ul style="list-style-type: none"> > Using IDR currency for financing. > Incorporating currency fluctuations into account. > Hedging instruments, including futures contracts and currency options. |
| | | | X.4.4 | High | <ul style="list-style-type: none"> > Fulfillment of lender requirements. > Good business entity performance history. |
| | | | X.4.5 | High | <ul style="list-style-type: none"> > The government is expected to provide guarantees. |
| | | | X.4.1 | High | <ul style="list-style-type: none"> > Rate indexation factors and interest rate hedging. > If the fluctuations are extreme, the risk can be shared in half with the government. |

(continued)

Table 5. (continued)

| No | Project Stages | Trans-Sumatra Funding Stages | Risk Variable | Risk Level | Risk Mitigation |
|----|---------------------------|------------------------------|---------------|------------|--|
| | | | X.4.8 | High | > Periodic monitoring of project progress. > Capital restructuring. |
| | | | X.4.9 | Medium | > Using IDR currency for financing. > Incorporating currency fluctuations into account. > Hedging instruments, including futures contracts and currency options. |
| | | | X.4.10 | High | > Divestment. |
| | | | Stages 10 | X.4.6 | High |
| 5 | Planning and Construction | Stages 11 | X.5.1 | High | > Conducting reliable traffic survey. > Using experienced sing consultant on toll roads. |
| | | Stages 12 | X.5.2 | High | > Accommodating price escalation factor calculation in the contract. > Good relationship with suppliers. > Penalty clause for liquidated damages. |
| | | | X.5.4 | High | > Conducting utility identification at the time of route planning supported by adequate data. |
| | | | X.5.5 | High | > Good project preparation that answers all stakeholder needs. > There is an amendment clause related to this risk. > Good contract understanding by both parties. |
| | | Stages 13 | X.5.8 | Medium | > Experienced and reliable design consultant or EPC. > Credible process in selecting contractors and subcontractors. > Agreement on standards/methods to be applied by the parties as early as possible. |
| | | | X.5.6 | High | > Conducting geology survey. |
| | | | X.5.9 | High | > Insurance |
| | | Stages 14 | X.5.10 | Medium | > Implementation of identification of historical objects at the time of planning supported by historical land use data and land investigations. |
| | | | X.5.7 | Medium | > Insurance |
| | | | | X.5.3 | High |

(continued)

Table 5. (continued)

| No | Project Stages | Trans-Sumatra Funding Stages | Risk Variable | Risk Level | Risk Mitigation |
|----|---------------------------|------------------------------|---------------|------------|---|
| 6 | Operation and Maintenance | Stages 15 | X.6.5 | High | > Public socialization > Good operating performance. |
| | | | X.6.7 | Medium | > Conducting reliable survey of consumers' ability and willingness to pay. |
| | | Stages 16 | X.6.3 | High | > Reliable operator > Develop an operational management plant and implemented it in a professional manner. |
| | | | X.6.4 | High | > Develop control and monitoring plans as well as regular evaluation of the effectiveness of the design and implementation. |
| | | | X.6.1 | High | > Lower operating expenses. > Improve efficiency and cost leadership. |
| | | Stages 17 | X.6.6 | Medium | > Regulations governing the rate and period of tariff adjustment. |
| | | Stages 18 | X.6.2 | Medium | > Making contracts that clearly regulate the transfer of assets. |
| | | Stages 19 | X.6.8 | High | > Political risk insurance. |

6 Conclusion

This paper has identified 33 risks in the 19 stages of Trans-Sumatra funding model. 24 risks are identified as high risks while 9 risks are identified as medium risks. The author presented risk mitigation for each risk that has the probability to be occurred in the 19 stages of Trans Sumatra funding model. The highest risk is occurring in the stage nine of the Trans Sumatra funding stage. In this stage, the toll road company submitted a senior debt to a financial institution (bank) which was used as additional capital to carry out the Trans Sumatra toll road infrastructure development. The risk mitigation for this risk variable is by periodically monitor the project progress and conducting capital restructuring.

References

1. *Trans Sumatera*. (2020). PT Hutama Karya (Persero) Website. Retrieved November 30, 2022, from <https://www.hutamakarya.com/trans-sumatera>.
2. Fakhurozi, Ningrum S, & Amanda. (2020). Kajian Studi Dampak Pembangunan Jalan Tol Trans Sumatera (JTTS) Terhadap Infrastruktur dan Lingkungan. *Jurnal Ilmiah Penalaran dan Penelitian Mahasiswa*, 4 (1). E-ISSN: 2598-0262.
3. Choudhry, & Iqbal. (2013). Identification of Risk Management System in Construction Industry in Pakistan. *American Society of Civil Engineers*, 29, 42-49. [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000122](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000122).
4. Khahro, S.H. Ali, T.H. Hassan, S. Zainun, N.Y. Javed, Y. Memon, S.A. (2021). Risk Severity Matrix for Sustainable Public-Private Partnership Projects in Developing Countries. *Sustainability*, 13, 3292. <https://doi.org/10.3390/su13063292>.

5. *Peraturan Pemerintah Republik Indonesia Nomor 15 Tahun 2005 Tentang Jalan Tol*. (2005). Jakarta: Presiden Republik Indonesia.
6. *Peraturan Presiden No.100 Tahun 2014 Tentang Percepatan pembangunan Jalan Tol Trans Sumatera*. (2014). Jakarta: Presiden Republik Indonesia.
7. Fakhriin, M.R. (2021). Risk-Based Institutional Evaluation of Trans-Sumatera Toll Road Infrastructure Development to Improve Time Performance. *Thesis*. University of Indonesia: Faculty of Engineering.
8. PMI. (2017). *A Guide to The Project Management Body of Knowledge PMBOK Guide Sixth Edition*. Project Management Institute. ISBN: 978-1-62825-184-5.
9. *Investasi Jalan Tol*. (2022). Badan Pengatur Jalan Tol Website. Retrieved December 03, 2022, from <https://bpjt.pu.go.id/konten/investasi/tahapan-makro-pengusahaan-jalan-tol>.

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