
FINANCIAL FEASIBILITY STUDY FOR ENTERING THE NEW MARKET OF AI TRAFFIC COUNTING TECHNOLOGY (Case Study Of PT. Jasa Marga Tollroad Operator)

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Abstract

This study evaluates the financial feasibility of PT. Jasa Marga Tollroad Operator (JMTO) for entering a new market with AI-based traffic counting technology. Motivated by increasing traffic congestion and the potential of AI to optimize traffic monitoring, the research applies both strategic and financial analyses. A combination of internal and external assessments, including PESTEL, Porter's Five Forces, and VRIO frameworks, is used to understand market dynamics and competitive advantages. Financial feasibility is determined using Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP), and Profitability Index (PI), with additional insights from sensitivity and Monte Carlo analyses. The results indicate a positive NPV of Rp 1.57 billion, IRR of 16.06% (higher than the WACC of 13.79%), a PI of 1.165, and a payback period of 3.35 years, confirming financial viability. Sensitivity analysis reveals selling price and operating cost as key risk factors, while Monte Carlo simulations affirm a 0% probability of negative NPV. The findings support JMTO's strategic move into the AI traffic counting market and recommend proactive cost control, strategic procurement, and collaboration with government stakeholders to mitigate risks and enhance implementation success.

Keywords: AI traffic counting, feasibility study, financial analysis, JMTO, toll road technology

INTRODUCTION

The population is rapidly increasing. This increase has led to a rise in the number of vehicles which impacted the traffic congestion. This situation needs to be controlled and managed by a single system. Traffic counting in Indonesia is one solution to handle this problem. The system could help transport authorities access information about the numbers of vehicles passing, congestion prediction, and implement traffic management strategies.

During the Eid homecoming period in 2022, Indonesia experienced significant traffic issues. Jasa Marga

reported a record-breaking number of vehicles, totaling 103,077, departing from Jabodetabek via the Trans Java Toll Road through Cikampek Utama GT. To handle this surge, the capacity at GT Cikampek Utama was maximized, utilizing 30 transaction lanes along with 4 additional mobile readers in tandem. This adjustment required extra staffing, informed by both predicted and actual traffic data. These measures were essential to mitigate severe congestion during the Eid homecoming, which not only affects Jasa Marga's toll revenue but also impacts the quality of service provided.

Traffic congestion was also reported across several locations in Bali. In 2020, the Volume to Capacity (V/C) ratio for National Road segments servicing the Lovina Beach and Penimbangan Beach tourist areas was recorded at 0.83. This figure suggests a need for ongoing maintaining and strategic controlling of road capacity to prevent and manage congestion effectively.

On the other hand, Toll Road construction is highly growing. In fact, the length of the toll road reached 2700 KM in 2024, the biggest achievement is 650 KM compared to the previous year. This is becoming an opportunity to adopt traffic counting to all the toll road segments which can assist companies or stakeholders such as do traffic management, volume capacity analysis, and forecast traffic as a part of toll road planning.

One of the traffic counting technologies that have been adopted is machine learning or artificial technologies algorithms that act as a brain to collect data, prediction and do analytics. To implement this technology, Badan Usaha Jalan Tol (BUJT) as a toll investment company should invest in this technology due to the benefits it offers. Given this potential market, Jasa Marga Tollroad Operator (JMTO) can sharp position itself as a key operator, service provider and early adopter AI based technology, and it is derivative in Indonesia to offer the service.

Seeing the big potential market but the supply is not available yet based on case of Indonesia, JMTO should penetrate for entering this new market. For this reason, a feasibility study is needed to analyze the cost and benefit, cost of research, cost of production, the

demands, and the price offered to end user which impacted project investment are visible. This study will help JMTO to add one business line of others digital products and ecosystem to be a giant toll-tech operator service company in Indonesia.

LITERATURE REVIEW

Strategic Management

Strategic Management is the integrative management position that combines analysis, formulation, and implementation in terms of competitive advantage (Rothaermel, 2015). It provides all directions to a company by specifying its aims, developing policies and plans to achieve those objectives, and allocating all resources to implement the plans. Furthermore, the management must identify the external analysis and internal Analysis that may affect the company.

External Analysis

A company's external environment consists of all the forces that can affect it potentially gaining and sustaining competitive advantage (Rothaermel, 2015). By conducting external analysis, management can do mitigation threats and leveraging opportunities. An approach to understand how external force impact the company are considering the source and limitation of these force (Rothaermel, 2015). External forces can be generalized environment that is impacted by macroeconomics factors, conducting PESTEL framework and porter five forces.

PESTEL Analysis

Regarding to Rothaermel (2015), PESTEL can be defined as a framework that categorized and analyzes how important set of external forces (political, economics, sociocultural,

technological, ecological, legal) that impact a company.



Figure 1. PESTEL Analysis (Rothaermel, 2015).

1. Political

The political environment includes all the processes and government actions that can influence how companies make decisions and operate. For instance, governments can significantly affect a company's performance through direct political pressure. According to Rothaermel (2015), the legal environment reflects political outcomes in the form of laws, mandates, regulations, and judicial decisions. All these factors can directly impact a company's profit potential. Typically, changes in regulations affect entire industries simultaneously.

2. Economics

The economic environment refers to the overall condition and trends within the economy where a business competes or might compete (Hitt, 2015). Rothaermel (2015) explains that economic elements within a company's external environment are mostly macroeconomic, meaning they influence broad economic conditions. Examples of these macroeconomic factors are growth rates, interest rates, and price stability.

3. Sociocultural

Sociocultural factors involve a society's cultural norms, values, and customs (Rothaermel, 2015). These

factors constantly evolve and vary across different groups within a society (Rothaermel, 2015). Companies must closely monitor these social and cultural shifts, as understanding them is crucial for formulating effective business strategies.

4. Technology

Technological factors involve using knowledge and innovation to develop new processes and products (Rothaermel, 2015). Recent technological advances often trigger significant changes in various industries. Changes in the technological environment can present both opportunities and threats to companies, emphasizing the importance of monitoring and adapting to technological developments (Rothaermel, 2015).

5. Ecological

Ecological factors cover a wide range of environmental issues, including the natural environment, global warming, and sustainable economic development. Organizations and the environment share a close, interdependent connection. Responsibly and sustainably managing this relationship directly affects the survival of human communities and the businesses they develop. Strategic

leaders must recognize that the worlds of nature and business are now deeply interconnected and cannot be treated separately (Rothaermel, 2015).

6. Legal

Legal factors refer to the formal outcomes of political processes, such as laws, regulations, mandates, and court rulings. These elements can significantly impact a company's ability to generate profit. Often, changes in regulations

influence entire industries at once. For example, in the United States, sectors like airlines, telecommunications, energy, and trucking have experienced significant deregulation over the past few decades (Rothaermel, 2015).

Porter's Five Forces

Michael Porter created the well-known Five Forces Model to help strategic leaders assess how profitable various industries could be and determine how companies can position themselves to achieve long-term competitive advantage (Rothaermel,

2015). By blending economic theory with real-world case studies, Porter arrived at two major conclusions that form the foundation of his model:

1. Competition should be understood narrowly as the closest competitors to explain and predict a firm performance. Instead of just focusing on direct rivals, competition also includes other important forces like customers, suppliers, new entrants, and substitute products. All of these can influence how a company performs in its industry.
2. An industry's profit potential depends on these five forces. How profitable an industry isn't random or based solely on internal industry traits. It's shaped by five key competitive pressures: the threat of new entrants, the bargaining power of suppliers, the bargaining power of buyers, the threat of substitute products or services, and the intensity of competition among existing firms.

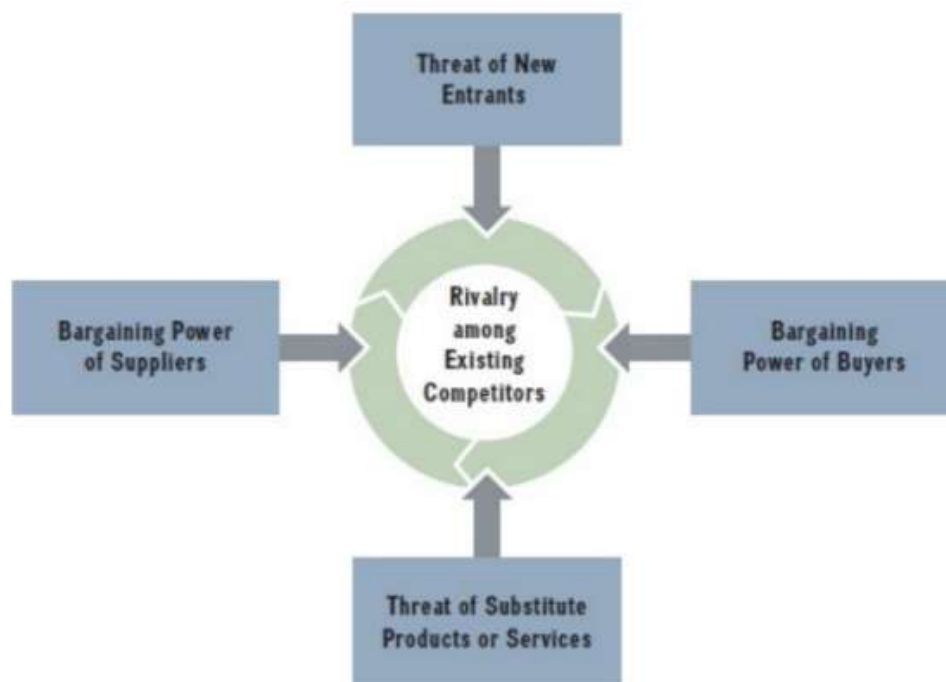


Figure 2. Porter 5 Forces Analysis (Rothaermel, 2015).

The potential for profit in any industry isn't random or solely based on specific industry traits. Instead, it's shaped by five main competitive forces, which include the threat of new entrants, bargaining power of suppliers, bargaining power of buyers, threat of substitutes, and rivalry among current competitors.

1. Threat of New Entrants

This refers to the risk that new competitors may enter the industry, increasing competition and lowering profitability. New entrants can affect profits by increasing supply or introducing new ideas and innovations (Rothaermel, 2015).

2. Bargaining Power of Suppliers

Strong suppliers can take a larger share of value by raising prices, limiting the quality or quantity of goods and services, or shifting extra costs onto businesses (Porter, 2008). When companies cannot pass these cost increases onto their customers, their profits suffer.

3. Bargaining Power of Buyers

Customers can reduce industry profits by demanding lower prices, better quality, or improved services. They may also play one company against another to get better deals (Porter, 2008). The influence of buyers

depends on their importance to the industry and the availability of alternative sources.

4. Threat of Substitutes

Substitute products can cap an industry's profit potential by setting a limit on how much companies can charge (Porter, 2008). The more appealing and affordable the substitute options are, the more they pressure prices and reduce profits.

5. Rivalry Among Existing Competitors

This refers to how intensely companies in the same industry compete with one another. If many strong competitors are fighting for market share, the rivalry tends to be fierce, which can reduce overall profitability (Rothaermel, 2015).

Internal Analysis

One useful tool for assessing a company's resources is a framework that helps answer the question whether resources contribute to competitive advantage. This approach is part of the resource-based view, which highlights specific types of resources as critical to a firm's success. For a resource to provide a competitive edge, it must meet the VRIO criteria. That means it should be valuable, rare, costly to imitate, and the company must be organized in a way that allows it to fully benefit from the resource.

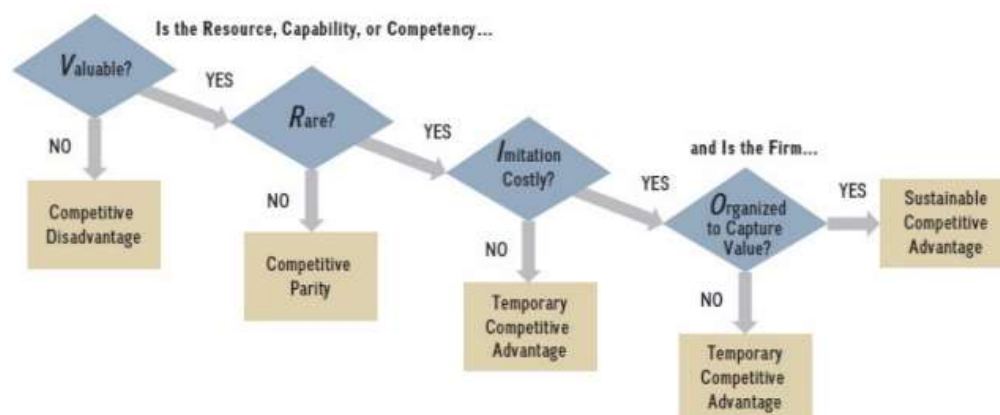


Figure 3. VRIO Analysis (Rothaermel, 2015).

Feasibility Study

A business feasibility study is a type of research that helps determine whether a business idea is practical and worth pursuing. An idea is considered feasible if it offers more benefits to all stakeholders than the potential drawbacks (Suliyanto, 2010). Feasibility study involves any effort made to guide and shape the implementation of a proposal, right up to the point when a final decision is made.

Capital Expenditure

A capital expenditure (CAPEX) is an investment by a company that anticipates returns over more than a year. This research is centered on capital investments targeting the acquisition of new equipment, specifically a fire truck and its related accessories. The study assesses whether purchasing or leasing the fire truck is more economically viable, scrutinizing the cost-effectiveness and benefits of each option for the company (Gitman & Zutter, 2014).

Operating Expenditure

Operating expenditure (OPEX) is the ongoing costs a business incurs for its regular operations. These expenses might occur just once or could be ongoing. For this project, such expenses include all activities related to fire and rescue operations, such as maintaining equipment, fueling the fleet, and compensating employees (Gitman & Zutter, 2014).

Free Cash Flow (FCF)

Free cash flow (FCF) is the amount of cash a company has left over for its investors, both lenders (creditors) and shareholders (owners). After it has covered all its operating expenses and invested in both fixed and current assets. This relates to the term cash flow

refers to the flow of money from financial transactions over a set period. Depending on how detailed the data needs to be, this period can range from days, month, quarters, and years (Gitman & Zutter, 2014). Cash flow plays a critical role in evaluating investments. Unlike profits, which might not be immediately usable, cash flow gives a clearer picture of a business's financial health and ability to generate returns (Suliyanto, 2010).

Cost of Capital

The cost of capital refers to the cost a company incurs to finance its operations, and it is considered the minimum return a project must generate to increase the firm's value (Gitman & Zutter, 2014). According to Frank and Shen (2016), a company's cost of capital comes from a mix of debt and equity financing. By assigning weight to each source of capital based on its proportion in the company's overall financing structure, the firm can calculate its Weighted Average Cost of Capital (WACC).

$$WACC = (re \times we) + (rd \times wd)$$

Source: (Gitman & Zutter, 2014)

Where:

re = cost of equity

we = proportion of equity in the capital structure

rd = cost of debt

wd = proportion of debt in the capital structure

Net Present Value (NPV)

Net Present Value (NPV) is an advanced method used in capital budgeting. It works by subtracting the initial investment cost from the present value of future cash flows, which are discounted using the company's cost of capital. While a company invests, it uses funds that typically come from

investors in some form. These investors expect a return on their money, so a business should only proceed with an investment if the present value of expected cash flows exceeds the original cost of the investment (Gitman & Zutter, 2014).

$$NPV = \sum_{t=1}^n \frac{CF_t}{(1 + IRR)^t} - CF_0$$

source: (Gitman & Zutter, 2014)

Where:

CF_t = Cash flow received in a specific period

r = Discount rate

CF_0 = Initial investment or starting cash outflow

A positive NPV means the project is expected to generate returns higher than the cost of capital. This can increase the company's overall value and, in turn, enhance the wealth of its shareholders by an amount equal to the NPV (Gitman & Zutter, 2014).

Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is the discount rate that makes the Net Present Value (NPV) of an investment equal to zero meaning the present value of future cash inflows is the same as the initial investment (Gitman & Zutter, 2014). The IRR provides insight into how effectively cash flows can cover the investment and over what time, usually expressed as a percentage. This method clearly shows how well a project can recover its initial capital and meet the required financial commitments. The formula IRR can be determined as follows:

$$CF_0 = \sum_{t=1}^n \frac{CF_t}{(1 + IRR)^t}$$

Source:
(Gitman & Zutter, 2014)

Where:

CF_0 = Cash outflow (initial investment)

CF_t = Cash inflow during a given period

IRR = Discount rate (the rate that makes NPV zero)

n = The final period of expected cash flow

Payback Period

The Payback Period (PBP) measures how long it takes for an investment to recover its initial cost through cash flow or earnings. It's a straightforward way to see how quickly the money invested can be earned back, giving an idea of the investment's liquidity and risk. Fundamentally, it shows how fast an investor can expect to get back their initial funds. The payback period is a method used to determine how long it takes for an investment to recover its initial cost through the annual cash inflows generated by the project (Suliyanto, 2010).

PBP

$$= \frac{\text{Initial Investment}}{\text{Annual Cash Inflow}} \times \text{Time period}$$

Source:
(Gitman & Zutter, 2014)

Profitability Index (PI)

The Profitability Index (PI) is a financial tool used to assess whether a project or investment is worth pursuing. There is a variation of the NPV rule called the profitability index (PI). It is related to initial investment and future cash flow. It's calculated by dividing the present value of projected future cash flows by the initial cost of the investment (Gitman & Zutter, 2014).

$$(PI) = \frac{\text{Present Value of Future Cash Flows}}{\text{Initial Investment}}$$

Source: (Gitman & Zutter, 2014)

Sensitivity and Scenario Analysis

Sensitivity analysis is a method used to understand how variations in a specific variable impact the outcome of an objective model. This is typically done by altering the values of different variables to see which ones have the greatest influence on the target outcome. Its main purpose is to identify which variables are most responsive to change, allowing companies to take preemptive actions to mitigate risks stemming from such changes (Saltelli, Tarantola, Campolongo, & Ratto, 2004, p. 42).

Monte Carlo Simulation

Sensitivity analysis is typically used to address deterministic quantitative models, where the input values are assumed to be known with certainty. In contrast, Monte Carlo simulation is used with stochastic models, which assume that input values are uncertain. Unlike deterministic models that yield a single solution, stochastic models generate a range of possible outcomes based on the variability in input values. Monte Carlo simulation provides a set of possible solutions that decision-makers can analyze to gain insights (Haney, 2016).

This technique is commonly used to assess the impact of uncertainty and risk in forecasting models and predictions. Known also as a multiple probability simulation, Monte Carlo simulation is applicable across a wide range of fields including engineering, science, and finance (Kenton, 2019).

Monte Carlo simulation is particularly useful in situations involving uncertainty. Its main purpose is to model the potential outcomes of various alternatives under uncertain conditions. The accuracy of the results improves with a higher number of iterations. The simulation outputs include both risk profiles and average values, which support better decision-making (Clement, 1997, p. 410).

Risk Management

Risk management is a tool used to visually present data related to specific risks in a project. Its main goal is to help organizations better understand potential risks, their impacts, and the most effective ways to address them. Risk management guides are based on the principles of the ISO 31000:2018 risk management standard.

According to ISO 31000:2018, the risk management process includes three main steps: determining the context, assessing the risk, and managing the risk. The first step is setting the context then involves identifying the company's goals, the environment in which those goals will be pursued, key stakeholders, and the range of risk criteria that may apply. This stage is important because it links the specific risks to be managed with the overall business environment, the risk management approach, and the standards used to evaluate those risks.

The diagram shows a conceptual framework. It begins with identifying the challenges faced by JMTO in the business issue terms. Continuing with JMTO should dive deep into knowing business situation analysis both external and internal analysis. The first analysis integrates Porter's Five Forces and PESTEL frameworks to provide a broader perspective on seeing the issues. Porter's Five Forces will examine

external factors of the traffic counting market. Furthermore, VRIO framework to assess how the company's resources align with its performance for finding the competitive advantage. Following these analyses, the company will undertake financial projections that consider initial investments and future cash flows. The financial feasibility will be evaluated using indicators like net present value (NPV), internal rate of return (IRR), payback period (PBP), and

profitability index (PI). The next steps are sensitivity and scenario analysis, Conducting Monte Carlo Simulation through the probability of negative NPV within 1000 iteration and addressing risk analysis to know the risk and its mitigation. As a result, conclusions and recommendations are made by considering all calculations, scenarios, simulations and risks that it is feasible to continue as the new business for JMTO or not.

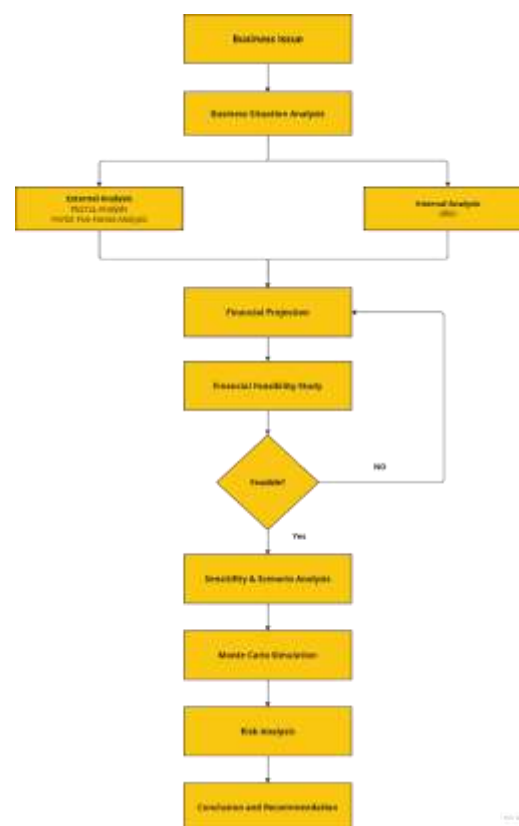


Figure 4. Conceptual Framework (Source: Author Analysis)

METHODS

This research is designed into Five chapters, in the starting points, it discusses the background of this research for identifying problems. After the problem was conducted, research aims collected and packaged into several questions for this research. The

next step is establishing a conceptual framework that will be a guide in finding solutions and adding up with theoretical framework and solve with correct research method before going to the data collection and conducting deep analysis.

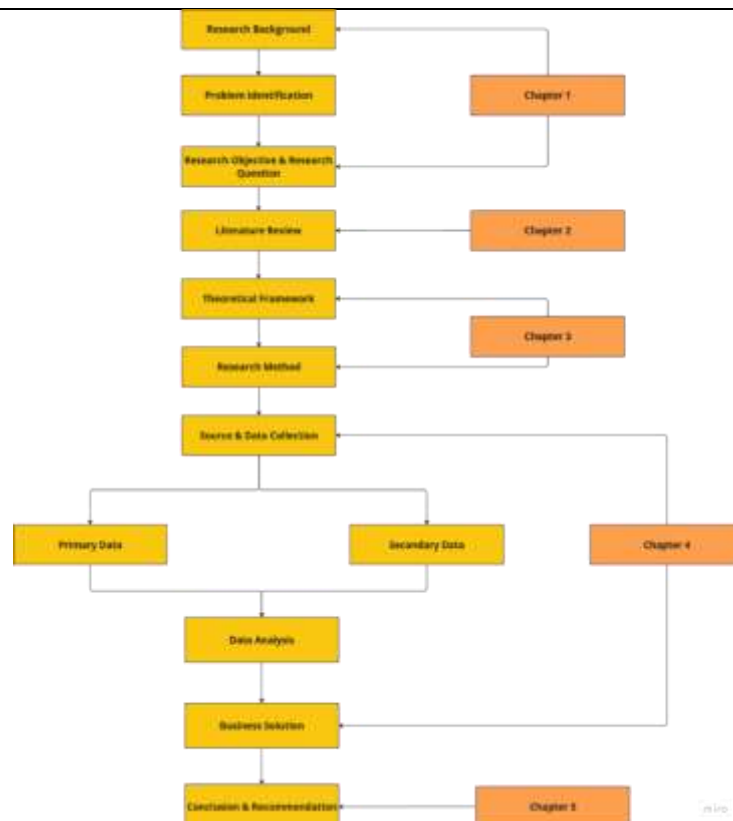


Figure 5. Research Design Process Framework (Source: Author Analysis)

This study employs a quantitative method, primarily utilizing internal primary and secondary data from the company. Following the collection of all necessary data, the analysis proceeds to identify business solutions, culminating in conclusions and recommendations.

The research incorporates both primary and secondary data. Primary data are sourced from interviews with various experts and JMTO management, tailored to address specific contextual issues. Secondary data is acquired from multiple sources including reports, books, journals, articles, websites, and additionally from the company's presentations and its annual and financial reports. This data includes both quantitative and qualitative elements.

The analysis involves both internal and external reviews of the primary and secondary data, which inform financial projections and model development. A financial model simulation created in Microsoft Excel is used to analyze the data. This model generates projected cash flows for each scenario, which are then evaluated using capital budgeting techniques such as NPV, IRR, and PI. The outcomes of these techniques are compared across various scenarios to determine the most viable financial strategies. Moreover, Monte Carlo simulation is conducted within 1000 iterations to find probability negative NPV. Following this, a risk assessment must be conducted to minimize risks associated with traffic counting project investment.

RESULT

PESTEL Analysis

Table 1. PESTEL Analysis

Factor	Analysis
Political	- BUJT investment in technology is affected by government support and regulations are coming from ministry of work & housing, smart city and digital infrastructure projects to adopt. - Public sector projects (Ministry of Transportation, Ministry of Public Works and Housing, BUJT) are influenced by policies, procurement laws, and long decision cycles. - Political stability impacts long-term infrastructure investment, including the technology component prices, such GPU imported from China or America for instance.
Economic	- Initial implementation may require high Capex for hardware, cloud or edge devices, and development. Even there is other architecture that low capex expense can be offered. - Most operating costs can be optimized with scalable AI solutions with cost-efficiency on labor. - Niche market in toll road operations limits revenue scope in early stages but the market is high.
Technological	- Advancements in computer vision (e.g., YOLO, OpenCV) support AI innovation. - Edge computing reduces data transmission needs, enabling real-time analysis. - Integration with existing CCTV infrastructure lowers barriers to adoption, asset optimization and low investment cost
Environmental	- Promotes sustainability by improving traffic flow and reducing congestion/emissions. - Low power consumption on centralized architect implementation.
Social	- Demand for safer, smarter transportation systems continues to grow. - Enhanced AI technology implementation to give a value product to users and stakeholder.
Legal	- Must comply with data privacy regulations. - Procurement laws and certification standards for road infrastructure must be met. - the legal of intellectual property is owned by JMTO as an innovator.

Porter's Five Forces Analysis

Table 2. Porter's Five Forces Analysis

Five Porters Factor	Value	Summary
Threat of New Entrants	Moderate	Developing Traffic Counting Technology is difficult due to lack of expertise in Artificial Intelligence and the system is complex. As an impact, it will be consideration of others company to enter this competition.

Bargaining Power of Suppliers	Moderate	The issue is dependency on the current supplier. As an alternative, some of the devices may switch to other brands or suppliers to ensure that device is available.
Bargaining Power of Buyers	High	The Ministry of public work and housing, Ministry of Industry, Ministry of Transportation, Province's government, city's government, and Toll Road Investment Company (BUJT) are the end users of traffic counting technology. Most of them need accurate real-time transportation data.
Threat of Substitutes	Moderate	The manual counting is still used in some areas. However, the accuracy is not high due to human error counting and bias. The manual counting still can be substituted with alternate technologies such as Inductive loop detectors, radar, and lidar.
Industry Rivalry	Moderate	Competition has always existed in which startups and tech firms compete in a rapidly growing field with players offering ai/ml-based solutions. However, most of them are not captured directly on the toll road issues due to the toll road operation is very specific. Own technology traffic counting based AI made by JMTO is still leading behind all other rivals. This industry shows promising potential with manageable yet growing competition. Despite technical challenges and existing rivals, JMTO holds a strong position due to its solution to market needs specifically on toll road business.

VRIO Analysis

Table 3. Vrio Analysis

Resource Capability	Valuable	Rare	Inimitable	Organized to Exploit	Competitive Implication
AI-based traffic system	Yes	Yes	Yes	Yes	Sustainable Competitive Advantage
Access to toll road data	Yes	Yes	Yes	Yes	Sustainable Competitive Advantage
In-house AI talent	Yes	No (can be created by rivals)	No (can be hired by competitors)	Yes	Temporary Advantage
Strong government relations	Yes	No	No	Yes	Temporary Advantage

Products solve issues in the case of toll road and non-toll road	Yes	Yes	No	Yes	Competitive Parity
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The traffic counting made by JMTO offers a sustainable competitive advantage due to its value, rarity, difficulty for imitating, and organizational readiness to deploy and the information access data is very limited to owned JMTO, no others can access. However, products solve issues in case of toll road provide competitive parity. The product has been solved the issue of toll road, the data analytics specifically figured out the operation theory of toll road, even though, the challenge face when the rivals conduct research of toll road operation continuing the technology AI's research. The rival can do reverse engineering and apply in others toll road operator. Moreover, the non-toll road case can be solved as well.

In addition, internal expertise and strong government relations provide temporary advantages but are not as defensible long-term unless enhanced further. The temporary advantage still can improve to a high level due to its value delivered. Even other rivals get connection to the government relation and doing production to its technology, The ministry and government see JMTO position still superior based on its long experience on toll road operation and the toll road information technology.

Marketing Analysis

For entering the new market, the niche market on the early stage will offer to investment companies (BUJT). It is necessary to ensure a guaranteed market promised by Jasa Marga. The demand has recorded 3000+ CCTV existing on the roads, not including the traffic counting. This demand is not captured yet in detail which BUJT outside Jasa Marga needs. According to previous data, non-JM toll road operated reached 1540 km. It means, while it is divided into 500 meters needs 750+ more CCTVs installed on the fields. Currently, the production capacity is 50 points CCTV every year by JMTO. It means that the demand is higher than its supply. From the market analysis conducted by the researcher, the total demand has not been fulfilled by JMTO or rivals. The project is optimistically expected to be well done by the market and generate profit for JMTO.

Cost of Equity

The cost of equity is estimated using the Capital Asset Pricing Model (CAPM). The input data for this calculation is sourced from Damodaran and Bank Indonesia. The computation of the cost of equity is detailed below.

Table 4. Cost of Equity Assumption

Key Variable	Value	Source
Risk Free Rate	5,75%	(Bank Indonesia,2025)
Equity Risk Premium	6.87%	(Damodaran,2025)
Beta	1.17	(Damodaran,2025)

Calculation:



$$K_e = R_f + \beta * (R_p)$$

$$K_e = 5,75\% + 1,17 * (6,87\%)$$

$$K_e = 13.79\%$$

Table 3. Capital Structure of Project

Capital Structure	Value	Cost
Debt	0%	0 %
Equity	100%	13.79%

Calculation:

$$WACC = W_d K_d + W_e K_e$$

$$WACC = 0 \times 0 + 100\% \times 13,79\%$$

$$WACC = 13,79\%$$

Feasibility Study

By addressing data collection such as the initial investment, operating

cost, income statement and free cash flow, the feasibility study can be calculated as following below.

Table 5. Feasibility Study of Project

NPV	IRR	PI	Payback Period
1,565,945,136	16,06%	1.165	3.35 Years

According to the table, this positive NPV indicates that the project is expected to generate more cash than it costs, adding value and suggesting financial feasibility. Meanwhile, The IRR is the rate at which the project breaks even. A return of 16.06% implies the project is likely to be profitable if the required rate of return is lower than this, the comparison of IRR is WACC which is cost of Equity as the baseline of the percentage of leveraging cost in 13,79%. It indicates that IRR is greater than WACC, meaning the project is expected to generate a return higher than its

financing cost. Those variables will be supported by considering PI greater than 1 indicates that for every IDR 1 invested, there will be a return of IDR 1.165, it is confirming a profitable investment. In addition, the payback period is 3.35 years, it recovers initial investment in about 3 years and 4 months, which is considered a reasonable period in many infrastructure or technology-related projects. According to all considerations, the AI Traffic Counting project is concluded that it is financially stable.

Table 6. Sensitivity Analysis

		Scenario 1, Quantity 100% Price 80%	Scenario 2, Quantity 100% Price 90%	Scenario 3, Quantity 100% Price 100%	Scenario 4, Quantity 100% Price 110%	Scenario 5, Quantity 100% Price 120%
Price Adjust	NPV	(2,169,587,009)	(301,820,936)	1,565,945,136	3,433,711,209	5,301,477,282
	IRR	0.85%	8.79%	16.06%	22.86%	29.32%
	PI	0.77	0.97	1.17	1.36	1.56

	PB P	4.93	3.98	3.36	2.91	2.58
		Scenario 6, Quantity 80% Price 100%	Scenario 7, Quantity 90% Price 100%	Scenario 8, Quantity 100% Price 100%	Scenario 9, Quantity 110% Price 100%	Scenario 10, Quantity 120% Price 100%
Quantity Adjust	NP V	866,958,907	1,216,452, 022	1,565,945, 136	1,915,438, 251	2,264,931,3 66
	IRR	14.16%	15.21%	16.06%	16.75%	17.34%
	PI	1.11	1.14	1.17	1.19	1.20
	PB P	3.49	3.42	3.36	3.31	3.27
		Scenario 11, Cost 80% Price 100%	Scenario 12, Cost 90% Price 100%	Scenario 13, Cost 100% Price 100%	Scenario 14, Cost 110% Price 100%	Scenario 15, Cost 120% Price 100%
Cost Adjust	NP V	5,473,727,0 76	3,519,836, 106	1,565,945, 136	(387,945,8 33)	(2,341,836, 803)
	IRR	28.43%	22.62%	16.06%	8.35%	-1.36%
	PI	1.58	1.37	1.17	0.96	0.75
	PB P	2.80	3.02	3.36	3.90	4.98

According to the table of several scenarios, the calculation is divided into 3 main scenarios are Prices Adjusted, Quantity Adjusted, and Cost Adjusted. The result of the prices adjusted is a negative NPV during price considered to be decreased by 10% up to 20%. On the other hand, the scheme of cost adjusted which cost is increased impacts negative NPV while the operating cost

risers 10 up to 20%. The quantity may not affect the NPV even though the quantity has decreased or increased.

Monte Carlo Analysis

The Monte Carlo analysis was conducted using 1,000 simulations to identify the key variables required for estimating probabilities. The results are as follows:

Table 7. Monte Carlo Calculation

Min	526,625,644
Max	2,922,218,912
Mean	1,675,364,148
Standard Dev	388,358,716
Median	1,668,914,571
Kurtosis	-0.13
Skewness	0.07
Probability NPV <0	0.0%

According to the table, The Monte Carlo simulation was conducted with 1,000 trials to evaluate the Net Present Value (NPV) outcomes. The results show a minimum NPV of approximately Rp 526 million and a maximum of around Rp 2.92 billion. On average, the NPV is Rp 1.67 billion, with a median value of about Rp 1.67 billion as well, indicating a relatively balanced distribution. The standard deviation of Rp 388 million reflects moderate variability in the simulation outcomes. The distribution shows a slight negative kurtosis (-0.13), suggesting it is slightly flatter than a normal distribution, while the skewness is close to zero (0.07), indicating the data is nearly symmetrical. Importantly, the probability of getting a negative NPV is 0%, meaning that all simulations resulted in a positive return, reinforcing the project's financial viability.

Risk Analysis

By conducting the calculation while risk assessment, the range of the average value is calculated less than or equals to 10. It classified the risk as moderate and low. The details are design at low risk, operational is at moderate risk, financial is at moderate risk, investment is at moderate risk, economic is at moderate risk, strategic is at moderate risk and legal social and political is at moderate risk. The risk is accepted to be continued by using backup plan and correct mitigation.

CONCLUSION

Based on the calculation, the project shows a Net Present Value (NPV) of Rp 1,565,945,136, an Internal Rate of Return (IRR) of 16.06%, which is higher than the WACC of 13.79%, a Profitability Index (PI) of 1.165, and a Payback Period (PBP) of 3 years and 3 months. In addition to financial

feasibility, further analysis considering internal, external, and risk factors also supports the implementation of this project at JMTO.

However, if there is a 20% decrease in the selling price, the IRR would drop to only 0.85%, with a negative NPV of Rp -2,169,587,009, an almost 5-year payback period, and a PI of 0.77. A 10% drop in selling price would also result in a negative NPV of Rp -301,820,936, an IRR of 8.76%, and an almost 4-year payback period. Another risky scenario arises when operating costs increase by 20%, which would lead to an even larger negative NPV of Rp -2,341,836,803, an IRR of -1.36%, and an almost 5-year payback period. However, a 10% decrease in operating costs still results in a negative NPV of Rp -387,945,833, an IRR of 8.35%, and an almost 4-year payback period, indicating the project becomes unfeasible.

The analysis highlights that selling price and operating costs are the most influential factors. Sensitivity analysis reveals that a 20% decrease in selling price could lead to a negative NPV, a 10% increase in operating costs would result in a negative NPV, and a 20% increase in operating costs would shift both NPV and IRR into negative territory.

As a final recommendation, based on the overall feasibility analysis, the AI traffic counting project is worth pursuing with an investment of Rp 9,465,419,818. With no debt to reduce the risk of defaulting on obligations, the investment remains financially sound under current assumptions.

Several recommendations for JMTO during the project are as follows: First, controlling operating costs through improved efficiency is essential

for maintaining stable pricing. This can be achieved by securing stock in the first year, identifying alternative distributors, or optimizing manpower to maintain installed traffic counting devices on specific sections of the toll road. Second, the negotiation process should focus on the sales price, with a strategy of not allowing too much room for negotiation under 95%, as the price directly impacts the feasibility of the project. Third, all devices were purchased upfront due to limited GPU availability in the market. Since the devices are currently in stock, effective inventory and production planning are needed. Fourth, coordinating with the Ministry of Public Works and Housing, the Ministry of Industry, the Ministry of Transportation, the provincial government, the city government, and the Toll Road Investment Company (BUJT) to introduce the technology, develop standards, utilize services, and acquire devices should be part of JMTO's strategic consideration to focus on the business-to-business (B2B) and business-to-government (B2G)

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- segments. Fifth, maintaining system performance and reliability is crucial for JMTO to minimize the risks of equipment replacement and maintenance burdens, particularly when providing warranties for the sale and installation of traffic counting devices. Sixth, the integration of the IT functional unit is key to the success of traffic counting sales. The process begins with IT planning, responsible for mapping out requirements and identifying appropriate locations. Next, the IT infrastructure team ensures that all devices are connected to the headquarters' network. Then, the IT development team manages the deployment process, and finally, IT operations takes over for ongoing system maintenance, including daily monitoring and troubleshooting to ensure smooth performance across the entire system. Seventh, the high risk arising from a lack of devices poses a challenge to management, requiring early purchases at the start of operations to smooth the operational process during daily monitoring.
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