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FINANCING SCHEME FOR THE TRANSIT-ORIENTED DEVELOPMENT PROJECTS IN INDONESIA

Mohammed Ali Berawi[1], Pradhana Listio Wicaksono[2], Gunawan Saroji[3], Mustika Sari[4], and Perdana Miraj[5]

ABSTRACT

Transit-Oriented Development (TOD) is expected to increase public use of mass transportation and reduce private vehicle usage. However, its development entails a high financial investment. This paper determines a financing scheme to boost private sector investment in TOD projects, considering the TODs in Indonesia's Jabodebek Light Rail Transi (LRT) as the case study. Simulation of cost-sharing scenarios between public and private sectors was simulated to form the financing scheme, along with the benchmarking study to establish the institutional scheme. The findings reveal that an optimal Internal Rate of Return (IRR) of 14.92%, indicates that the project is financially viable. The optimal distribution of initial cost, operational and maintenance cost, and revenue incurred to the private sector are 39.86%, 66.02%, and 72.02%, respectively. The government is responsible for developing and operating the proposed institutional scheme's LRT and other supporting infrastructure, while the private sector handles the development and operation of TOD mixed-used properties.

Keywords: *Financing Scheme, Light Rail Transit (LRT); Public-Private Partnership (PPP); Transit-Oriented Development (TOD).*

1. INTRODUCTION

Though many cities in developing countries are growing at a staggering rate, cities in Indonesia are growing at an average of 4.1% per year, relatively faster than other Asian cities (Abiad et al., 2019). In 2030, over 73% of Indonesia's population is predicted to live in cities (Narieswari et al., 2019). If not equipped with sufficient urban infrastructure, this rapid urbanisation often brings about urban issues, primarily when most of the population relies heavily on private vehicles, which could vary from congestion and air pollution to social inequality of accessibility (Berawi et al., 2021; Suzuki et al., 2015).

Due to rapid urbanisation, Jakarta, the capital city, has faced traffic congestion problems caused by ever-increasing private automotive use (Hidayati et al., 2019). To tackle this

[1] Professor, Department of Civil Engineering, Universitas Indonesia, Indonesia, maberawi@eng.ui.ac.id
[2] Researcher, Center for Sustainable Infrastructure Development, Universitas Indonesia, Indonesia, csid@eng.ui.ac.id
[3] Associate Professor, Department of Civil Engineering, Politeknik Negeri Bengkalis, Indonesia, gunawan@polbeng.ac.id
[4] Lecturer, Department of Civil Engineering, Universitas Indonesia, Indonesia, mustika.sari01@ui.ac.id
[5] Ph.D. Researcher, Delft University of Technology, Netherlands, perdana.miraj@gmail.com

problem, it has now developed an immense infrastructure with new mass transit networks, such as Mass Rapid-Transit (MRT), Light Rapid Transit (LRT), and the extension of the commuter line. The development of these transportation systems is expected to shift the paradigm of private vehicle use in favour of public transportation (Mudigonda et al., 2014; Ma et al., 2018; Berawi et al., 2020).

However, as the development of this transportation infrastructure entails substantial financial investment, a built environment intervention focused on the availability of mass transportation, called Transit-Oriented Development (TOD), should also be proposed as a part of the transit system. TOD is undoubtedly one of the most effective strategies for tackling the challenges faced by car-dependent cities by developing a compact, mixed-use, pedestrian-friendly development organised around a transit station (Berawi et al., 2020; Suzuki et al., 2013). It is believed to improve the feasibility of transit projects by developing real estate around transit stations and increasing public interest in using public transportation (Cervero & Murakami, 2009; Gunawan et al., 2020).

Due to insufficient funds for necessary infrastructure investments, the Indonesian government must seek alternative financing by involving the private sector through Public-Private Partnership (PPP) schemes. To boost private sector participation in infrastructure development, the government needs to enhance the attractiveness of these investments. Economic viability is a critical success factor for implementing PPP (Zhang, 2005). A previous study conducted by Berawi et al. (2019) calculated the financial analysis of a TOD area development for LRT Jabodebek's Phase I project, the results of which show that the Internal Rate of Return (IRR) for the development of TOD LRT Jabodebek was estimated to be 9.75%. The Net Present Value (NPV) was projected to be around 190 trillion Rupiahs. The result might look promising at first glance. However, suppose the IRR was compared with the Weighted Average Cost of Capital (WACC) for Indonesia's construction and materials sector, which is around 11.01%. In that case, the project could be deemed financially unattractive to private investors.

Therefore, this study aims to develop a feasible PPP-based financing scheme that could attract more private investors to participate in the TOD projects. Several successful TOD projects have implemented PPP financing schemes. The innovative integration of transportation infrastructure with urban development is exemplified by these initiatives, which promote the development of economically viable and sustainable communities. The TOD in Hong Kong is a prime example of this, which has seamlessly incorporated its extensive metro system with real estate development (Musil, 2020).

2. LITERATURE STUDY

2.1 TRANSIT-ORIENTED DEVELOPMENT

TOD is a concept of urban area development that arises as a solution to resolve urban problems caused by uncontrolled rapid urbanisation, such as environmental pollution, resource deficiency, unreasonable land use, traffic congestion, and unrestrained urban sprawl (Habibi & Asadi, 2011; Petrova & Prodromidou, 2019). Per Wey and Chiu (2013), TOD integrates urban land use and public transportation, allowing city residents to meet all their daily needs without relying on private vehicles. Moreover, TOD is a medium- to high-density housing equipped with public facilities, retail facilities, and strategic workplaces, emphasising the strategic development areas around the transit area

(Calthorpe, 2022). The mixed-use area comprises various building functions, such as residential, offices, malls, hotels, etc.

Commonly the developments of TOD in various countries have primarily relied on conventional construction and mortgage financing schemes, with banks as the primary sources of lending (Venner & Ecola, 2007). However, it is important to consider that mixed-use schemes entail several uncertainties and risks associated with the TOD, ultimately leading to higher required rates of return. Mixed-use developments pose significant challenges that are amplified by the intricate design and construction processes, resulting in heightened financial obstacles for TOD. Effective strategies to overcome these obstacles include aligning structures with established product categories, securing patient, high-equity investments, utilising alternative construction methods and materials, adopting advanced information management systems, collaborating with seasoned stakeholders, and employing value engineering.

2.2 PUBLIC-PRIVATE PARTNERSHIP (PPP)

PPP involves collaboration between the government and the private sectors in the financing, developing, and operating of public projects in any or all phases of the projects, starting from design and construction, capacity building/rehabilitation, to operation and maintenance (Wilhelm et al., 2009; Engel et al., 2019). ADBI (2000) defines PPP as the collaborative activities among interested groups and actors based on mutual recognition of respective strengths and weaknesses, working towards commonly agreed objectives developed through effective and timely communication. The long-term contract provides a balanced service in facilities received by the government and the benefits received by the private sector.

PPP can be used to sustainably meet funding needs by mobilising private funds, increasing quantity, quality, and efficiency of service through healthy competition, improving the quality of management and maintenance in infrastructure facilities, and considering the users' ability to pay. While PPP emphasises mutually beneficial cooperation between the public and private sectors, it is also crucial to share risks and responsibilities between the parties involved (Mohd-Rahim et al., 2018).

PPP schemes enable knowledge transfer and innovation in design, construction, maintenance, and operation, as well as fill financing voids, thereby providing superior value for money (Berawi, 2019). The implementation of PPPs is based on the distribution of responsibilities between the public and private sectors, which varies by country (Viegas, 2010). Thus, various types of PPP implemented in worldwide infrastructure projects have shown mixed results.

2.3 FINANCIAL FEASIBILITY ANALYSIS

Financial feasibility analysis is conducted in the pre-investment phase of a prospective project to ensure that the project's investment is profitable and attractive for the investors by meeting their objectives and interests (Halil et al., 2016). Several approaches with diverse characteristics can be used in the investment feasibility analysis, as it is carried out based on the institution or individual who invests in the project or has a direct interest in it. The key principle of financial feasibility assessments is to maintain positive cash flow at all project stages (Dikareva & Voytolovskiy, 2016). Several indicators, such as NPV and IRR can be used in the financial feasibility analysis.

NPV and IRR are considered the standard Life Cycle Cost (LCC) approach for evaluating a project's economic feasibility over its life cycle and estimating the profitability of the investments by considering the time value of money (Fouche & Crawford, 2017). NPV is calculating the cost invested by estimating the value in a particular period. The formula can be expressed as follows (Equation 01):

$$NPV = \sum_{t=0}^{n} \frac{(R_t)}{(1+i)^t} \qquad \textit{(Eq. 01)}$$

Where:
R_t = net cash flow during a time t
i = discount rate
t = number of cash flow time

With the criteria:
NPV>0, investment is feasible
NPV=0, the investment returns the same amount of value as the money invested
NPV<0, investment is not feasible

Meanwhile, IRR is a method to evaluate the level of interest in potential project investment, depending on whether the value reaches the Rate of Return (RoR) set or not. The IRR of the investment rate is the prevailing interest rate, which shows that the NPV is equal to the project's total investment. The formula for the IRR calculation is as in Equation 02:

$$IRR = i_1 + \frac{NPV_1}{(NPV_1 - NPV_{2)}} (i_2 - i_1) \qquad \textit{(Eq. 02)}$$

Where:
i_1 = lower discount rate chosen
i_2= higher discount rate chosen
NPV_1 = NPV at i_1
NPV_2 = NPV at i_2

3. METHODS

The development of the LRT Jabodebek project was planned to be conducted in two phases, with a total length of 83.6 km track that consists of six corridors i.e. (i) Cawang-Cibubur corridor, (ii) Cawang-Kuningan-Dukuh Atas corridor, (iii) Cawang-Bekasi Timur corridor, (iv) Dukuh Atas-Senayan corridor, (v) Cibubur-Bogor corridor, and (vi) Palmerah-Bogor corridor. The first phase of the development comprises a 14.5 km long Cawang-Cibubur corridor with four stations, an 11.5 km long Cawang-Kuningan-Dukuh Atas corridor, and an18.5 km long Cawang-Bekasi Timur corridor with that have seven stations each. Hereinafter, Cibubur-Bogor, Dukuh Atas-Senayan, and Palmerah Bogor corridors will be developed in the second phase. The length of each track would be around 25 km, 7.8 km, and 5.7 km, respectively.

This study will determine the financing scheme for developing TOD concepts for four stations of LRT Jabodebek developed in a previous study by Berawi et al. (2019), including Bekasi Timur, Cibubur, Ciracas, and Jaticempaka stations, with a total length of 42.1 km LRT rail track. According to the results of the LCC analysis conducted previously, the initial cost for the development of TOD LRT Jabodebek was estimated at IDR 57 trillion (USD 3.95 million), while the OM cost was projected at IDR 152 trillion

(USD 10.52 million) with the revenue of around IDR 562 trillion (USD 38.95 million) for 40 years. Furthermore, its cash flow projection will also be used as the basis of the calculation conducted in this study to develop a more optimal financing scheme that can improve the investment attractiveness from the private sector's point of view. Table 1 presents the proposed TOD design concepts in the four stations.

Table 1: TOD conceptual design for four stations of LRT Jabodebek
Source: Berawi et al. (2019)

Category	TOD Location			
	Bekasi Timur Station	**Cibubur Station**	**Ciracas Station**	**Jaticempaka Station**
Land Area (m^2)	50,000	14,075	122,678	53,574
Building Area (m^2)	45,000	12,300	109,700	47,830
Gross Floor Area (m^2)	357,500	98,760	769,280	390,554
Building Coverage Ratio (BCR)	90%	87%	89%	89%
Floor-Area Ratio	7.15	7.02	6.27	7.29
Residential Area (m^2)	162,000	45,360	233,280	171,481
Offices (m^2)	65,000	18,000	127,500	69,678
Hotel (m^2)	40,500	10,800	80,000	46,867

Afterwards, the financing scheme was then developed by dividing the financial responsibility-sharing scenarios based on the project life cycle, which can potentially improve the delivery of each project stage since the responsible parties are encouraged to optimise the economics of their investments in the project stage (Eldrup & Schutze, 2013). Several types of cost-sharing scenarios combine the initial cost, OM cost, and revenue, where the optimum IRR generated from a sharing scenario will be considered for developing an institutional scheme for the PPP implementation of the project.

There are four financing options developed in this study, i.e., (i) initial cost-sharing, (ii) OM cost-sharing, (iii) initial cost and OM cost-sharing, and (iv) costs and revenue sharing. The IRR and NPV resulting from the main financing options would be evaluated to obtain the most optimal financing scheme. Subsequently, only scenarios that produced IRR surpassing the WACC value of 11.01% would be considered.

In the initial cost-sharing scheme, the project's financial feasibility would be evaluated if the government and the private sector share only the initial cost burden. The private sector would entirely incur the OM cost, and the revenue would be fully entitled to the private sector. The government would have no obligation to manage the project. The three options on which the evaluation for the initial cost-sharing scheme would be based are as follows: the first scenario is where the government's share of the initial cost is at 60% while the private sector bears the other 40%. The second scenario is where the government and private sector bear the same initial cost-sharing, each at 50%. In the third scenario, the government's share of the initial cost is 40%, while the private sector bears 60%.

The project's financial feasibility would be evaluated in the OM cost-sharing scheme if the government and private sector share only the OM cost burden. This means that the private sector would incur the initial cost entirely, and the revenue would be fully entitled

to the private sector. The share of the OM cost would follow the cost-sharing percentage used in initial cost-sharing scenarios.

Furthermore, the initial cost and OM cost-sharing scheme will simulate the potential IRR and NPV generated from the financing scenario where the government and private sector share the burden for initial cost and OM cost. The private sector would be fully entitled to the revenue in these sharing schemes. There are nine scenario options where the evaluation would be based: the first three scenarios are where the government's share of the initial cost is at 60%, and the share of OM cost is each varied from 40-60%, while the second three scenarios are where the government's share of the initial cost is at 50%, and the share of OM cost is each varied from 40, 50, and 60%. Furthermore, the last three scenarios are where the government's share of the initial cost is at least 40%, and the share of OM cost each varied from 40, 50, and 60%.

In the costs and revenue sharing scheme, the government and the private sector are simulated to share both initial and OM costs and the revenue. There are 27 scenario options for this sharing scheme, where each of the scenarios from the nine scenarios in the previous Initial Cost and OM Cost Sharing has three different options for the government's share of revenue, consisting of 40%, 30%, and 20%.

The results of the cost-sharing scheme evaluation were used to determine the distribution of responsibility between the public and private entities in the project. The cost and revenue distribution between the government and private sector were further adjusted based on the benchmark of best practices of PPP implementation in TOD projects, such as the one in the Hong Kong MTR project (Suzuki et al., 2015) and Beijing No. 4 Metroline MRT (Chang, 2013).

An institutional scheme for PPP implementation in the TOD project was then developed by conducting the following steps:

- Reference study to the institutional schemes in transit infrastructure projects
- Benchmark study to the governance of infrastructure systems in other countries
- Identify the internal and external stakeholders in the TOD LRT Jabodebek projects
- Evaluate the roles and responsibilities of the government
- Determine the sharing of responsibilities among stakeholders in the concession
- Determine the concession duration
- Determine the relationship between the concession and the lender
- Determine the mechanism of the monitoring and evaluation processes

The proposed financing and institutional scheme resulted from this study were then validated through in-depth interviews with the experts from the National Development Planning Agency (Bappenas) and PT Sarana Multi Infrastruktur (SMI), a special mission vehicle (SMV) under the Ministry of Finance engaged in financing and preparing infrastructure project.

4. RESULTS AND DISCUSSION

4.1 COST-SHARING FINANCIAL SCHEMES

This research evaluates 42 sharing options, including three initial cost-sharing scenarios, three OM cost-sharing scenarios, nine initial cost+OM cost-sharing scenarios, and 27

initial cost+OM cost+revenue sharing scenarios. Each type of these sharing schemes generates an optimal IRR and NPV result. For the initial cost-sharing scheme, the scenario that produces the optimal IRR and NPV is when the government provides 60% of the initial cost. The IRR is approximately 18.15%, while the NPV is around IDR 92.29 trillion (USD 6.39 million). The evaluation of the OM cost-sharing scheme produces a similar result. The scenario that results in the most optimal IRR and NPV is when the government provides 60% of the OM cost, which equals 11.44% and IDR 90.07 trillion (USD 6.24 million), respectively. In the financing scheme where both initial and OM costs are shared between the government and private sector, the scenario that produces the optimal IRR and NPV is where the government covers 60% of the initial cost and operational and maintenance costs. This scenario results in an IRR of 21.40% and an NPV of IDR 119.3 trillion (USD 8.26 million).

As for the financing scheme in which both parties share the initial and OM costs and the revenue, the most optimum scenario is where the government covers 60% of the initial and OM costs and gets 20% of the revenue. The private sector could expect an IRR value of 17.84% and an NPV of IDR 87.96 trillion (USD 6.09 million) from this scenario.

The study shows that the most profitable scenarios for private investors involve significant government contributions to costs and minimal revenue sharing. While these scenarios attract private investors, other factors, such as risk-sharing, should be considered for optimal financing. Higher risks for private investors typically drive efficiency in cost and time management, affecting their return on investment and payback periods. Although a scenario with the government covering 60% of costs and receiving no revenue offers the highest IRR for investors, it is not recommended.

A financing scheme that involves the government covering a part of the initial and operational costs and receiving a revenue share is preferred. This approach reduces the risk of a private sector monopoly and facilitates the transfer of knowledge, including technological and management innovations, from the private sector to the government (Delmon, 2015). Sharing costs and revenues enables the government to recoup a portion of its expenditures, rendering this scenario advantageous.

The share of costs and revenue was then adjusted, referring to the result of a benchmark study on the Hong Kong MTR project (Suzuki et al., 2015). Responsibility in the financing scheme was determined based on the literature study, where the government is the responsible party for the land acquisition, land and building permits, and the development and operation of rail infrastructure and other supporting infrastructures, such as Water Treatment Plant (WTP) and Sewage Treatment Plant (STP). On the other hand, the private sector is responsible for developing and operating mixed-use properties surrounding the transit stations (e.g., hotels, apartments, malls, offices, etc.). As for the revenue, the government would be entitled to the revenue from the apartment sales transaction, farebox revenue, and utility revenues (WTP and STP). The private investors would be entitled to the revenue from other mixed-use properties (e.g., hotel, mall, office, park and ride facilities, etc.). The details of the division of responsibility between the government and the private sector are shown in Figure 1.

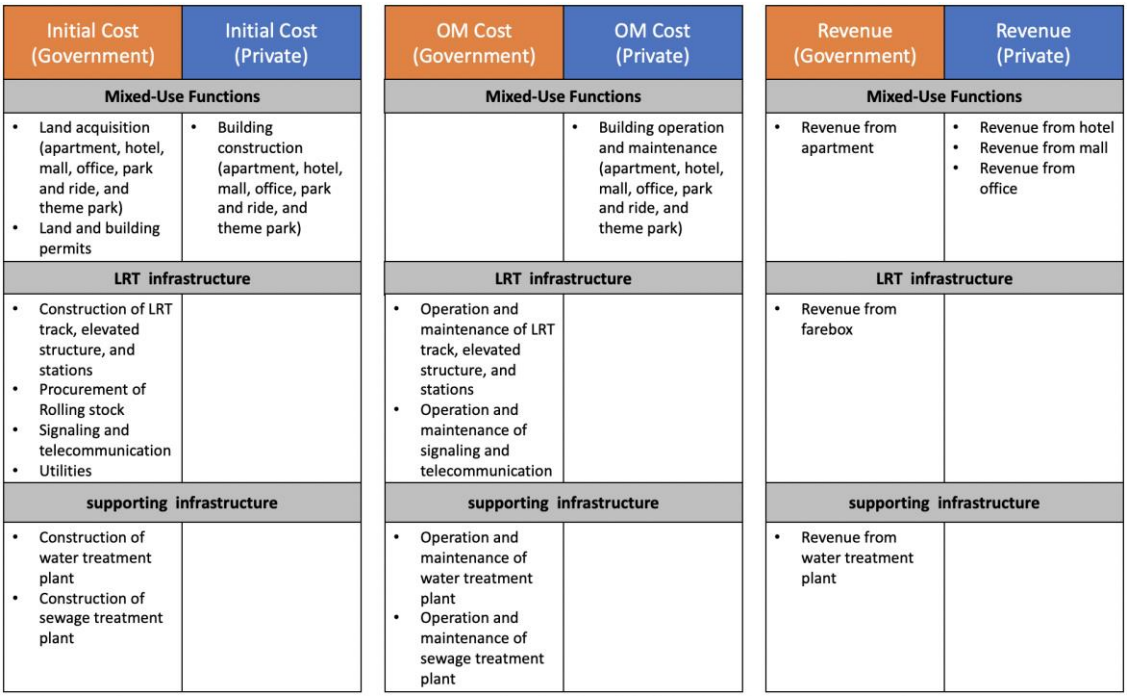

Figure 1: Division of responsibility between the government and private sector

The NPV for each cost and revenue component was calculated based on this distribution of costs and revenue. The share of cost and revenue was then calculated based on the total NPV to which both entities are responsible and entitled. The result is shown in Table 2.

Table 2: Share of costs and revenue between government and private investors

Financial Component	Net Present Value (in millions)		Share (%)	
	Private	Government	Private	Government
Initial Cost	-USD 1,410	-USD 2,127	39.86%	60.14%
OM Cost	-USD 2,550	-USD 1,312	66.02%	33.98%
Revenue	USD 7,480	USD 3,700	72.02%	27.98%

The financing scheme mentioned above generates an IRR of 14.92% for the private sector, which is higher than the WACC for Indonesia's construction and materials sector, indicating the project's financial feasibility. The estimated IRR from this financially engineered scheme is also higher by 5.17% than the original IRR estimation for the TOD LRT Jabodebek project estimated by Berawi et al. (2019).

4.2 INSTITUTIONAL SCHEMES

An institutional scheme was then developed to implement the PPP scheme throughout the project life cycle, from planning, construction, and operational and maintenance. It determines all the stakeholders' respective roles and responsibilities throughout the project. The visual representation of the proposed institutional scheme for PPP implementation in the TOD LRT Jabodebek projects can be seen in Figure 2.

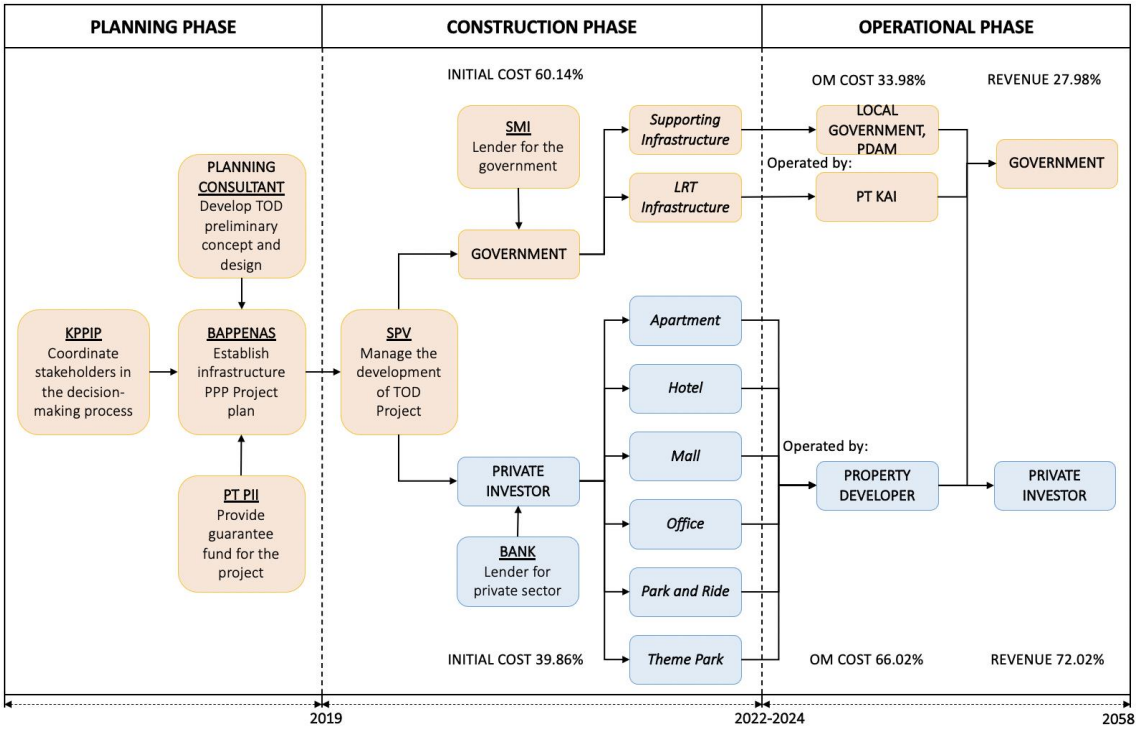

Figure 2: Institutional scheme for TOD LRT Jabodebek projects

During the planning stage, the stakeholders involved are Bappenas, the Indonesia Infrastructure Guarantee Fund (IIGF), the Committee for Acceleration of Priority Infrastructure Delivery (KPPIP), and the planning consultant. Bappenas would establish the plan for infrastructure PPP projects, assess the project's feasibility, sign the PPP contract, confirm the guarantee, and close the financial close. Meanwhile, IIGF would provide a guarantee fund for LRT Jabodebek, which could increase the project's creditworthiness and the private investor's interest in the project investment. Furthermore, the problems in Indonesia's infrastructure development process are due to the ineffective coordination between government and private stakeholders that might have different interests and responsibilities; thus, the role of KPPIP is to coordinate with involved stakeholders throughout the decision-making processes. KPPIP also facilitates the capacity building of the relevant government agencies and institutions at the planning stage to accelerate the development of the TOD LRT Jabodebek LRT projects. Moreover, the planning consultant would provide the TOD LRT Jabodebek project development design, such as project structure designs, building function designs developed in the TOD area, project budget plan calculations, and environmental impact analysis.

At the construction stage, a Special Purpose Vehicle (SPV) responsible for managing the project would be formed through an agreement between the government and private investors. Both the government and private investors will play key roles as shareholders for the SPV, ensuring a robust and balanced ownership structure. As per the result of the financing scheme, the government is encouraged to cover the initial cost for the LRT infrastructure and supporting infrastructure, while the private sector should cover the initial cost for the mixed-use functions. Apart from the shareholders' investment through equity, the SPV might also need other financing sources, such as loans from SMI to the government or banks to the private sector.

For the operational stage of the project, the infrastructure components would be operated by these respective parties. In this case, the LRT would be operated by PT KAI (Indonesia's railway company), and the supporting infrastructure would be operated by a local government company responsible for distributing clean water called PDAM. The mixed-use properties would be operated and maintained by a property developer.

The result of this study is in line with research by Bhagwati and Kumar (2024). The authors discovered that although implementing TOD regulations such as mixed-land use zoning, density control, limited parking, Public-Private Partnership (PPP) financing, and encouraging public-private collaboration near transit stations is essential, financial frameworks are even more crucial for the success of TOD. This makes it feasible on a global scale.

5. CONCLUSIONS

Developing TOD areas around transit stations requires substantial funding, necessitating private sector involvement through PPP schemes. This study proposes an optimal financing model where private investors cover 39.86% of initial costs, 66.02% of operational and maintenance costs, and receive 72.02% of revenue, resulting in a 14.92% IRR, which exceeds the sector's WACC.

This financing structure enhances TOD project feasibility and contributes to the knowledge of transportation financing. It offers a model adaptable to other TOD projects in Indonesia and developing countries. The proposed institutional scheme involves a special-purpose vehicle for managing construction and operations, with revenue-sharing between the government and private investors, promoting sustainable development.

6. ACKNOWLEDGEMENTS

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