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An Importance-Performance Gap Analysis for Innovation in Public Transport Financing: Critical Success Factors of Public-Private Partnership in Mass Rapid Transit in Bangkok

Yaowapa Chaiittipornwong [*], Jun-Won Seo [**], Hyeon Park [***]

Abstract This study examines the Critical Success Factors (CSFs) for Mass Rapid Transit (MRT) projects in Bangkok through Public-Private Partnership (PPP) scheme. It measures the relative importance and performance of 22 CSF indicators of PPP for Bangkok's MRT projects and assesses the gap between importance and performance to prioritize the areas for improvement. This study revealed that eight indicators showed lower performance compared to their importance. Based on the gap analysis, the improvement priorities were identified in the following order: sharing information, incorporating technical elements, clarifying the legal framework, stable committee composition, the various finance resources, improved utilization of the PPP act, a transparent procurement process, and tax incentives. The findings of this research offer strategic insights for enhancing guidelines and processes to address the specific challenges in the PPP project, thereby improving the framework and policies necessary for the successful completion of public transportation projects in developing countries.

Keywords Public-Private Partnership; Critical Success Factor; Mass Rapid transit; Public transportation; Importance-Performance Gap Analysis

I. Introduction

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[*] Master student, International School of Urban Sciences in University of Seoul, Seoulsiripdaero 163, Dongdaemun-gu, Seoul, 130743, Republic of Korea; cgyaowapa@gmail.com
[**] Corresponding, Research Professor, International School of Urban Sciences in University of Seoul, Seoulsiripdaero 163, Dongdaemun-gu, Seoul, 130743, Republic of Korea; junwon1977@uos.ac.kr
[***] Professor, International School of Urban Sciences in University of Seoul, Seoulsiripdaero 163, Dongdaemun-gu, Seoul, 130743, Republic of Korea; hpark@uos.ac.kr

This study investigates the Critical Success Factors (CSFs) for Mass Rapid Transit (MRT) projects in Bangkok, focusing on the Public-Private Partnership (PPP) framework. According to an analysis by the World Economic Forum, while Thailand's national competitiveness ranked 40th among 141 countries, its transport infrastructure ranked 53rd (Schwab, 2019). Additionally, the railroad density ranked 55th and the efficiency of train services ranked notably lower at 75th (Schwab, 2019). Addressing the need to transform Bangkok's transportation system, the government planned to expand the urban rail network across the Bangkok Metropolitan Area (BMA) with 14 lines covering about 560 kilometers over the next two decades (MRTA, 2019). However, undertaking all these as conventional construction procurement projects may pose a burden on the budget.

In response, leveraging the efficiencies of the private sector and the oversight of the public sector through PPPs will reduce the government's financial burden (Hensher et al, 2008; Cumming, 2007). Adopting PPPs allows the government to focus on core competencies, while the private partners bring in technology, management expertise, and innovation, enhancing the quality and efficiency of public service delivery (Edkins & Smyth, 2006; Ko et al., 2017). Therefore, PPP can be considered an innovative financing method that enables infrastructure projects in developing countries with poor financial conditions.

In Bangkok, four lines covering 134.9 km have been constructed and operated through PPP projects. However, these projects have encountered issues such as construction delays and a lack of cooperation from participating companies. To address these issues in future MRT PPP projects, this study aims to conduct an Importance-Performance Gap Analysis of CSF indicators within the context of Bangkok's MRT PPP projects. By doing so, the study seeks to identify which policy resources have been deficient in current MRT PPP projects and how to reallocate policy resources to address the difference between importance and performance in future MRT PPP initiatives.

II. Literature Review

There have been numerous studies on the success factors of PPP projects. Critical Success Factors (CSFs) have been categorized into broader domains like policy, legal frameworks, and governance arrangements (Kulshreshtha et al., 2017; Kim, 2019). Zhang (2004a, 2004b, 2005a, 2005b) outlined essential CSFs, including a conducive investment environment, a project's economic viability, a strong technical consortium, transfer of technology, a sound financial package, and effective risk allocation. Further studies emphasized the importance of macroeconomic stability, shared responsibilities, transparent procurement

processes, and vigilant government oversight as key CSFs (Kulshreshtha et al., 2017; Natalia et al., 2021; Gordon et al., 2013). Van de Velde et al. (2008) also suggested that, in the transport sector PPPs, subsidies and incentives to cover operational costs were necessary for the sustainability of transport services. Other researchers suggested that successful contract execution demanded information sharing and active communication between public and private sectors, necessitating both informal trust-building processes and formal monitoring (Natalia et al., 2021; Shen et al., 2006; Li & Akintoye, 2003; Ho, 2006; Willoughby, 2013).

PPPs also face various challenges of project risks. These risks are categorized into social, political, financial, market, revenue, procurement, construction, and operational risks (Akintoye et al., 1998; Zayed & Chang, 2002; Algarni et al., 2007). To reduce project risk and enhance the government's negotiating power in the PPP projects, effective planning along with comprehensive plans and feasibility assessments like Cost-Benefit Analysis (CBA) and Value for Money (VfM) are vital (Chou & Pramudawardhani, 2015). Issues like improper risk allocation and information scarcity have been challenges in PPP projects in Taiwan and Indonesia (Cui et al, 2018). In countries like China, India, Taiwan, and Hong Kong, risks included limited government finances, inefficiencies in the public sector, contractual ambiguities, and administrative hurdles (Lertsethtakarn, 2016). In Thailand, political climate fluctuations have significantly impacted PPP projects, often leading to reduced direct government involvement (Lertsethtakarn, 2016; Navalersuph & Charoenngam, 2021; Lam and Chow, 1999). Lam and Chow (1999) also identified financial risks such as interest rate fluctuations and currency exchange issues as critical complications in different project phases.

While existing research has focused on identifying success and risk factors, this study differs in that it compares how important these factors are and how well they have been achieved in Bangkok's MRT PPP projects, thereby determining priorities for improvement and resource allocation.

III. Data and Methodology

1. Scope and Target Area

This research defines the success of the MRT PPP project as the timely and cost-effective completion of construction while fulfilling all technical specifications. This study analyzes the importance and performance of the success factor indicators in four MRT PPP projects in Bangkok: Blue Line, Purple Line, Pink Line, and Yellow Line. The MRT PPP initiatives have faced

significant challenges, such as prolonged negotiations between interested parties leading to construction delays, increased government financial support, and limited private sector engagement. Additionally, cost-cutting measures by private entities in response to inadequate fare settings by the Mass Rapid Transit Authority (MRTA) resulted in service quality concerns.

The Blue and Purple Line projects in Bangkok faced challenges due to the early issuance of the request for proposal (RFP) prior to the relevant legal amendments, and lower return on investment (ROI), leading to lengthy negotiations, especially for the Blue Line, which lasted over a year. RFPs were issued before finalizing the amendment of the Act on Private Participation in State Undertaking (PPCU Act), and the MRTA set inviably low MRT fares with overestimated passenger numbers, consequently prolonging discussions. The public sector covered major investment areas like land acquisition, civil works, and consulting, but the private sector, despite support from the Japan International Cooperation Agency (JICA) and Asian Development Bank (ADB), faced financial difficulties, necessitating debt restructuring (JICA, 2008).

The Pink and Yellow Line projects were operated under a legal framework (PPCU Act) amended in 2013, which incentivized private investment and clarified risk-sharing between public and private entities. However, these projects experienced minimal private sector interest, with only two Thailand companies participating, mainly due to the private sector bearing all risks except for land acquisition and some subsidies (Kim, 2019).

Table 1. Profile of Bangkok's MRT PPP Lines

	Blue Line	**Purple Line**	**Pink Line**	**Yellow Line**
Open	Ph.1: Jul. 2004 Ph.2: Apr. 2019	Dec. 2016	Nov. 2020	Nov. 2020
Location	Central Area	North Corridor	West and East Side	East Corridor
Distance	47 km (Ph.1: 20km, Ph.2: 27km)	23 km	34.5 km	30.4 km
Number of Stations	38 stations (Ph.1: 18, Ph.2: 20)	16 stations	30 stations	23 stations
Structure Level	Underground, Elevated	Elevated	Elevated	Elevated
System	Heavy Rail	Heavy Rail	Straddle Monorail	Straddle Monorail
Cost (Mil USD)	5,880 (Ph.1: 3,450, Ph.2: 2,430)	1,800	1,400	1,300
PPP type	Ph.1: BTO[1], Net Cost[2] Ph.2: BOT[3], Net Cost[2]	BTO[1], Gross Cost[4]	BTO[1], Net Cost[2]	BTO[1], Net Cost[2]
Concession period	Ph.1: 25 years Ph.2: 33 years	30 years (Including construction period)	33 years and 3 months (3 years and 3 months for construction,	

			30 years for O&M Services[5])
Role of public sector (MTRA[6])	Land acquisition, Civil work, and Consultant		Land acquisition, Subsidies to Concessionaire
Role of private sector (Concess-ionaire)	Design, manufacture, and supply, Install M&E systems[7], Providing O&M services[5]	Investment in rolling stock, Installing M&E systems[7], Providing O&M services[5]	Investment in Civil work, Installing M&E systems[7], Providing O&M services[5]
Main Agree-ments	The concessionaire can get revenue from fares and commercial development. The concessionaire shared revenue with MTRA[6] for a lump sum amount and percentage based on ROE[8] of the concessionaire at 14.75%. The concessionaire may adjust the fare rate against the consumer price index every two years. There is no guarantee of ridership or revenue.	MRTA[6] will pay a fixed payment covering O&M[5] cost and other agreeable terms to a concessionaire. MRTA will repay the M&E[7] system cost and other conditions agreeable to the concessionaire equally every year for ten years after the commencement of service. MRTA will handle all fare box revenues. The concessionaire will solely undertake all commercial development in stations.	The concessionaire has a right to operate the lines and receive fare box revenues, commercial development fees, and parking fees during the concession period. MRTA[6] will pay the concessionaire subsidies for ten years from the commercial operation date in equal installments.
Issues	Applying the 1992 PPCU Act[9] Long negotiation period over a planned project Low farebox revenue not covering the project cost		Applying the 2013 PPCU Act[9] Few bidding participants (local companies) Distribute risk cost across project stages

Source: based on JICA (2008), Kim (2019), MRTA (2019)

Note: [1] Build-Transfer-Operate; [2] The concessionaire covers costs for civil, electrical, and mechanical engineering, operations, maintenance, and assets, earning revenue from fares and other sources. If these revenues fall short, the government will cover the deficit; [3] Build-Operate-Transfer; [4] The government compensates the concessionaire for the project cost based on a set formula, lowering the operator's financial risk but increasing the government's share in the project; [5] Operation and Maintenance Services; [6] The Mass Rapid Transit Authority; [7] Mechanical and

Electrical system; [8] Return on Equity; [9] Act on Private Participation in State Undertaking

2. Selecting variables

In this study, CSF indicators are categorized into internal and external factors. Internal factors are divided into strategic and risk management planning, feasibility study considerations prior to procurement (Planning), aspects related to contracts and frameworks (Contractual Term), financial requirements and support for enhancing private participation in PPP projects (Finance), verification and transfer of technology in MRT projects (Technology), and finally, the relationship between public and private sectors and the relationship between the public sector and citizens (Cooperation). External factors are segmented into social, economic, and political aspects. The social factor indicator reflects public understanding of private participation in MRT projects. Economic indicators include macroeconomic metrics such as GDP growth. The political factor addresses the stability of the PPP committee in response to regime changes during construction and O&M.

Table 2. Critical Success Factor Indicators for MRT PPP projects

Category		CSF	Indicators	Reference
Internal Factors	Planning	Strategy Plan	SP: Utilization of the national transportation master plan	Kulshreshtha et al, 2017; Kim, 2019
		Feasibility Study	FS: Availability of the cost-benefit analysis (CBA) and the value for money analysis (VfM) before a PPP project	Zhang, 2004a; 2004b; 2005a; 2005b; Chou and Pramudawardhani, 2015
		Risk Management Plan	RM: Availability of a risk management plan for a PPP project	Cui et al, 2018
	Contractual Term	Policy and Law	PL1: Utilization of public policy in a PPP project	Kulshreshtha et al, 2017; Kim, 2019; Natalia et al, 2021; Gordon et al, 2013; Lertsethtakarn, 2016
			PL2: Availability of the PPP Act in Thailand	Kulshreshtha et al, 2017; Kim, 2019; Lertsethtakarn, 2016
			PL3: Clarity of rules and regulations governing a PPP project	Lertsethtakarn, 2016

		Role and Responsibility (R&R)	RR1: Appropriate roles and responsibilities allocation among PPP partners	Kulshreshtha et al, 2017; Kim, 2019; Zhang, 2004a; 2004b; 2005a; 2005b; Natalia et al, 2021; Gordon et al, 2013; Cui et al, 2018
			RR2: Absolute roles of the public sector in clarifying legal constraints for PPP partners	Kulshreshtha et al, 2017; Kim, 2019; Natalia et al, 2021; Gordon et al, 2013; Cui et al, 2018
		Procurement Process	PP: Transparency of the procurement process	Kulshreshtha et al, 2017; Natalia et al, 2021; Gordon et al, 2013; Li and Akintoye, 2003; Zayed and Chang, 2002; Algarni et al, 2007
	Finance	Funding	F1: Ease of accessing financial resources, favorable loan terms, and low-interest rates	Zhang, 2004a; 2004b; 2005a; 2005b; Zayed and Chang, 2002; Algarni et al, 2007; Suparat, 2015
			F2: Financial liquidity of the private sector	Zayed and Chang, 2002; Algarni et al, 2007; Suparat, 2015
		Financial Incentive	FI: Tax incentives for a PPP project	Van de Velde et al, 2008
		Government Guarantee	GG: Government guarantee of compensation for project delays	Van de Velde et al, 2008
	Technology	Technical Qualification	TQ: Specifying technical qualifications for private partners	Zhang, 2004a; 2004b; 2005a; 2005b
		Technology Transfer	TT: Transfer of technology held by the private sector	Zhang, 2004a; 2004b; 2005a; 2005b
		Technology Improvement	TI: Integrating technical factors into the feasibility study	Zhang, 2004a; 2004b; 2005a; 2005b
	Cooperation	Information Sharing	IS: Sharing of project-related information among PPP partners	Natalia et al, 2021; Shen et al, 2006; Li and Akintoye, 2003; Ho, 2006; Willoughby, 2013; Chou and Pramudawardhani, 2015

		Active Communi-cation	AC: Active communication between the public sector and the private sector	Natalia et al, 2021; Shen et al, 2006; Li and Akintoye, 2003; Ho, 2006; Willoughby, 2013
		Resident Cooperation	RC: Activities to request cooperation from residents on a PPP project	Kulshreshtha et al, 2017; Kim, 2019; Akintoye and Taylor, 1998
External Factors	Society	Public Acceptance	PA: Public acceptance of MRT PPP development	Akintoye and Taylor, 1998
	Economy	Economic Growth	EG: Stability of macroeconomic expansion	Kulshreshtha et al, 2017; Zhang, 2004a; 2004b; 2005a; 2005b; Natalia et al, 2021; Gordon et al, 2013; Zayed and Chang, 2002; Algarni et al, 2007
	Politics	Political Stability	PS: Stability of the PPP committee despite the changes in political parties	Zayed and Chang, 2002; Algarni et al, 2007; Lertsethtakarn, 2016; Navalersuph and Charoenngam, 2021; Lam and Chow, 1999

3. Research Methodology

In this study, the Importance-Performance Gap Analysis (IPGA) methodology was employed to evaluate the CSF indicators of the MRT PPP projects. The Importance-Performance Analysis (IPA), an initial version of the IPGA introduced by Martilla and James (1977), serves as a strategic tool designed primarily for developing effective strategies, particularly in the marketing domain. The core concept of IPA involves assessing the importance and performance of various attributes, depicted through a two-dimensional graph where the vertical axis represents the importance, and the horizontal axis indicates the performance. This graphical representation effectively categorizes attributes into four distinct quadrants based on their respective scores in importance and performance (Abalo et al, 2007).

To further refine this model for broader applicability in strategic management across diverse managerial profiles, Lin et al. (2009) proposed the IPGA model. This model integrates the foundational principles of IPA with Gap Analysis, resulting in a more nuanced matrix. In the IPGA, the coordinates are determined using transformed functions of the two axes, employing Relative Importance (RI) and Relative Performance (RP) as the metrics for this cross-sectional analysis. The intersection points for RP are set at 0, while RI is fixed at 1, with the vertical axis denoting the relative performance.

Wang and Lo (2022) outlined the method for calculating RI and RP within the IPGA framework, which involves a three-step process: Step 1) Calculate the average importance value of each indicator (I_j), the average performance value of each indicator (P_j), the average importance value of all variables (I), and the average performance value of all variables (P); Step 2) Use paired sample t-tests to analyze whether the gap between the performance and importance for each indicator is positive (performance > importance), negative (performance < importance), or if there is no significant gap (performance = importance); Step 3) Calculate the RI and RP using the formula below:

$$RI_j = {}^{I_j}/_{I}, \tag{1}$$

$$RP_j = {}^{P_j}/_{P} \text{ (if } P_j > I_j, \text{ significance level of } p<0.05), \tag{2}$$

$$RP_j = -\ {}^{P}/_{P_j} \text{ (if } P_j < I_j, \text{ significance level of } p<0.05), \tag{3}$$

$$RP_j = 0 \text{ (if } P_j=I_j, \text{ or significance level of } p\geq 0.05) \tag{4}$$

The study categorizes the factors into four groups based on their importance and performance levels: 'Keep up the good work (RP≥0, RI≥1)', 'Concentrate here (RP<0, RI>1)', 'Low Priority (RP≤0, RI≤1)', and 'Potential Overkill (RP>0, RI<1)'. This categorization facilitates a targeted approach for maintaining, improving, or reallocating efforts and resources. In the IPGA model, the gap of an element to the intersection coordinates (RP=0, RI=1) in the graph is indicative of its priority level for corrective action. For example, in Figure 1, indicator A positioned further away from these coordinates in quadrant II is assigned a higher priority for resource allocation compared to indicator B, which is closer to the intersection (See Figure 1).

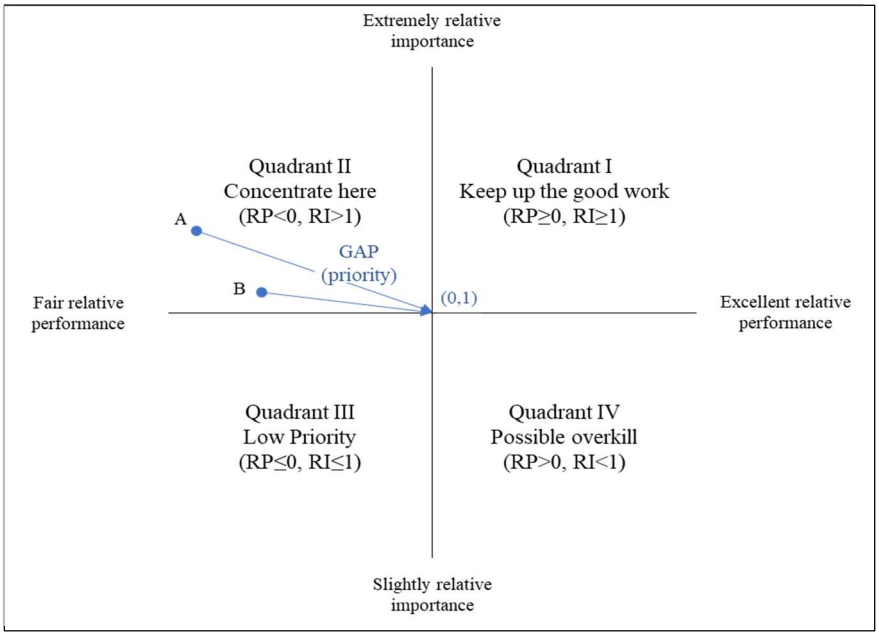

Figure 1. Important-Performance Gap Analysis (IPGA) Matrix
Source: based on Lin et al (2009)

4. Survey Methodology

This study interviewed 53 experts to evaluate the importance and performance of 22 Critical Success Factor (CSF) indicators in Bangkok's Mass Rapid Transit (MRT) Public-Private Partnership (PPP) projects, using a 5-point Likert scale. Initially, a survey was conducted among 100 experts in September 2021, and 69 responses were collected. Of these, 16 were excluded due to incomplete answers, leaving 53 valid responses for analysis.

Among the 53 respondents, 31 were experts working in government agencies responsible for the MRT PPP project, 18 were experts from private companies involved in the MRT PPP project, and the remaining 4 were affiliated with universities and research institutions. The major age groups were 31-40 years old (35.9%, 19 out of 53) and 41-50 years old (28.3%, 15 out of 53). Most respondents held a master's degree (69.8%, 37 out of 53), while 4 respondents (7.6%) held a doctoral degree. Professionally, they were predominantly employed in the engineering sector (35.9%, 19 out of 53), followed by transportation (20.8%, 11 out of 53). Regarding MRT-PPP experience, 72% had been engaged in this field for more than three years, including 36% of respondents for 6 to 10 years.

5. Data on the Importance and Performance of CSF Indicators

The reliability of these survey results is underscored by Cronbach's alpha value of 0.943. The survey results revealed that the average importance score was 4.15, while the average performance score was 3.99. This indicates that in the context of Bangkok's MRT PPP projects, the average performance levels are lower compared to the perceived importance. Out of 22 variables, seven indicators—availability of the PPP act (PL2), clarity of rules and regulations (PL3), ease of accessing funding (F1), specifying technical qualifications (TQ), integrating technical factors into feasibility studies (TI), information sharing (IS), and stability of the PPP committee (PS)—were rated lower in performance compared to their importance at 99% confidence level. Two indicators—transparency of procurement process (PP) and tax incentives (FI)—were rated lower in performance compared to their importance at 95% confidence level. Conversely, two indicators—financial liquidity of the private sector (F2) and government guarantee of compensation for project delays (GG)—were rated higher in performance than in importance at 99% confidence level. The other 11 indicators are not significantly different in their importance and performance.

Table 3. Importance and performance values of CSF Indicators in MRT PPP projects

Critical Success Factor Indicator	Importance		Performance		Difference	
	Mean	SD	Mean	SD	P-I	Sig
SP: Utilization of the national transportation master plan	4.30	0.77	4.26	0.81	-0.038	0.755
FS: Availability of the cost-benefit analysis (CBA) and the value for money analysis (VfM) before a PPP project	4.11	0.89	4.11	0.78	0.000	1.000
RM: Availability of a risk management plan for a PPP project	4.19	0.83	4.19	0.79	0.000	1.000
PL1: Utilization of public policy in a PPP project	4.25	0.85	4.42	0.60	0.170	0.095
PL2: Availability of the PPP Act in Thailand	4.36	0.81	4.00	0.71	-0.358	0.007**
PL3: Clarity of rules and regulations governing a PPP project	4.45	0.72	3.66	0.71	-0.792	0.000**
RR1: Appropriate roles and responsibilities allocation among PPP partners	4.23	0.80	4.19	0.81	-0.038	0.796
RR2: Absolute roles of the public sector in clarifying legal constraints for PPP partners	4.19	0.79	4.28	0.82	0.094	0.471
PP: Transparency of procurement process	4.57	0.72	4.32	080	-0.245	0.014*
F1: Ease of accessing financial resources, favorable loan terms, and low-interest rates	4.40	0.72	3.79	1.04	-0.604	0.000**

F2: Financial liquidity of the private sector	4.08	0.68	4.36	0.68	0.283	0.008**
FI: Tax incentives for a PPP project	4.30	0.77	4.08	0.78	-0.226	0.038*
GG: Government guarantee of compensation for project delays	3.51	0.82	4.15	0.93	0.642	0.000**
TQ: Specifying technical qualifications for private partners	4.04	0.76	3.62	0.90	-0.415	0.007**
TT: Transfer of technology held by the private sector	4.08	0.65	4.04	0.94	-0.038	0.802
TI: Integrating technical factors into feasibility study	4.21	0.72	3.60	0.99	-0.604	0.000**
IS: Sharing of project-related information among PPP partners	4.36	0.76	3.57	0.82	-0.792	0.000**
AC: Active communication between the public sector and the private sector	4.04	0.78	4.21	0.77	0.170	0.182
RC: Activities to request cooperation from residents on the PPP project	3.70	0.93	3.89	0.82	0.189	0.077
PA: Public acceptance of MRT PPP development	3.70	1.01	3.87	0.90	0.170	0.192
EG: Stability of macroeconomic expansion	3.83	0.91	3.57	0.99	-0.264	0.090
PS: Stability of the PPP committee despite the changes in political parties	4.45	0.75	3.72	0.84	-0.736	0.000**
Total	4.15		3.99			

Note: * p<0.05, ** p<0.01, Shading indicates that the performance is significantly lower than the importance.

IV. Results and Discussion

This study classified CSF indicators for MRT PPP projects into four quadrants based on their relative importance and performance values (See Figure 2). In Quadrant I, five variables—public policy utilization (PL1), appropriate roles and responsibilities allocation (RR1), public sector's absolute roles (RR2), master plan utilization (SP), and risk management plan availability (RM)—were placed. These are deemed relatively important, showing no significant difference between importance and performance. Thus, it is considered advisable to maintain the current level of PPP policies and planning related to these indicators.

Quadrant II included eight variables: PPP act availability (PL2), rules and regulations clarity (PL3), procurement process transparency (PP), funding access ease (F1), tax incentives (FI), project-related information sharing (IS), technical factors integration (TI), and PPP committee stability (PS). These are important yet underperforming, falling into the ‘Concentrate Here’ quadrant, suggesting an immediate need for improvement. Therefore, experts have

recognized that there are issues with the laws and regulations supporting the policy to promote PPP projects, specifically in terms of contractual terms. Additionally, there was a demand for enhancing transparency in the PPP procurement process and project-related information sharing. Regarding finance, there was a need for better financial resourcing mechanisms and tax incentives. In the technical issues, there was criticism that the inclusion of technical factors in the feasibility study was insufficient compared to other factors. Furthermore, there was a need to address external factors such as political instability. Therefore, the inadequacies in these PPP frameworks, policies, and activities have become bottlenecks to the successful execution of MRT PPP projects in Bangkok.

In Quadrant III, seven indicators—cost-benefit analysis (CBA) and value for money (VfM) availability (FS), communication between the public and the private sectors (AC), promoting cooperation with residents (RC), technical qualifications specification (TQ), technology transfer (TT), PPP public acceptance (PA), and macroeconomic expansion (EG)—were categorized. Generally, these indicators are important for the success of PPPs. However, experts related to Bangkok's MRT PPP projects pointed out that these indicators are relatively less important and have shown lower performance compared to other indicators. Therefore, these indicators are given a lower priority for improvement in the future MRT PPP project progress.

Quadrant IV comprises two indicators, the financial liquidity in the private sector (F2) and the government-provided financial guarantee for project delays (GG) considered less important yet well-performed. Interviewees do not regard these factors as significant barriers to promoting MRT PPP projects in Bangkok.

Table 4. The value of Importance-Performance and its priority of CSFs in the MRT PPP Project

Quadrant Type	Critical Success Factor Indicators	Relative Importance (RI)	Relative Performance (RP)
Quadrant I (RI≥1, RP≥0) Keep up the good work	PL1: Utilization of public policy in a PPP project	1.023	0.000
	RR1: Appropriate roles and responsibilities allocation among PPP partners	1.018	0.000
	RR2: Absolute roles of the public sector in clarifying legal constraints for PPP partners	1.009	0.000
	SP: Utilization of the national transportation master plan	1.036	0.000
	RM: Availability of a risk management plan for a PPP project	1.009	0.000
Quadrant II (RI>1, RP<0) Concentrate Here	PL2: Availability of the PPP Act in Thailand	1.050	-0.999
	PL3: Clarity of rules and regulations governing a PPP project	1.073	-1.091
	PP: Transparency of procurement process	1.100	-0.925
	F1: Ease of accessing financial resources, favorable loan terms, and low-interest rates	1.059	-1.053
	FI: Tax incentives for a PPP project	1.036	-0.980
	IS: Sharing of project-related information among PPP partners	1.050	-1.120
	TI: Integrating technical factors into the feasibility study	1.014	-1.109
	PS: Stability of the PPP committee despite the changes in political parties	1.073	-1.075
Quadrant III (RI≤1, RP≤0) Low priority	FS: Availability of the cost-benefit analysis (CBA) and the value for money analysis (VfM) before a PPP project	0.991	0.000
	AC: Active communication between the public sector and the private sector	0.973	0.000
	RC: Activities to request cooperation from residence on the PPP project	0.891	0.000
	TQ: Specifying technical qualifications for private partners	0.973	-1.103
	TT: Transfer of technology held by the private sector	0.982	0.000
	PA: Public acceptance of MRT PPP development	0.891	0.000
	EG: Stability of macroeconomic expansion	0.923	0.000
Quadrant IV (RI<1, RP>0) Possible overkill	F2: Financial liquidity of the private sector	0.982	1.091
	GG: Government guarantee of compensation for project delays	0.845	1.039

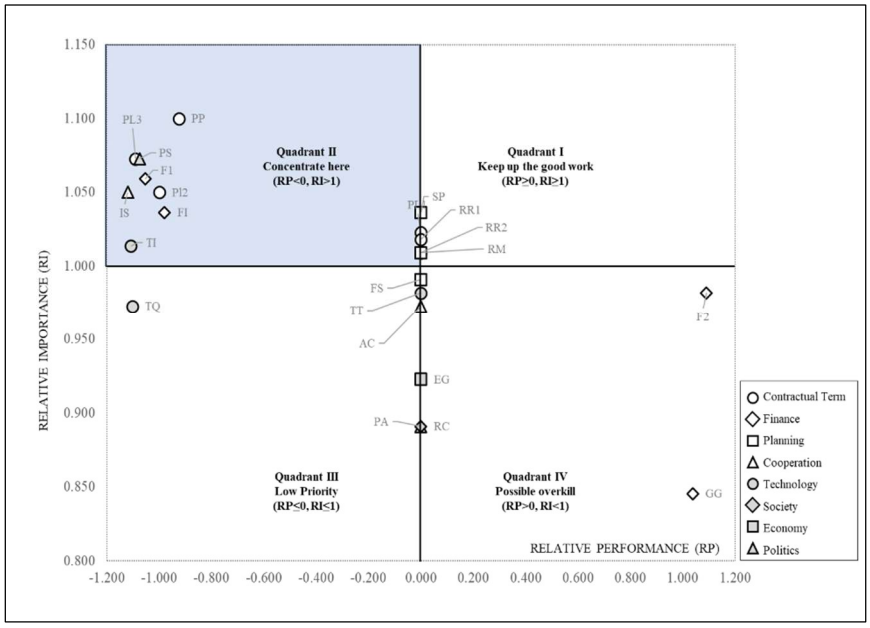

Figure 2. IPA matrix of CSF Indicators for MRT PPP Projects

This research prioritized areas for improvement and resource allocation in future MRT PPP projects in Bangkok by analyzing the distance from the point (0,1) for eight CSF indicators in Quadrant II. In Quadrant II, a greater distance from the point (0,1) indicates a stronger need for enhancement.

The top four factors identified for improvement are as follows: First, facilitating information sharing platform between private and public entities (IS, Cooperation Factor); second, incorporating technical elements during the feasibility study stage (TI, Technology Factor); third, clarifying the legal framework (PL3, Contractual Term Factor); and fourth, ensuring minimal changes in committee composition despite regime changes (PS, Politics Factor).

Additionally, four other improvement tasks were identified within the financial and contractual term factors: fifth, enabling the various finance resources including ODA funding (F1, Finance Factor); sixth, improved utilization of PPP act (PL2, Contractual Term Factor); seventh, establishing a transparent procurement process (PP, Contractual Term Factor); and eighth, enhancing tax incentives (FI, Finance Factor).

Table 5. Priority of CSF Indicators for Improvement by Gap Analysis

Type	Critical Success Factor Indicators	GAP (Priority)
Improvement (Quadrant II)	IS: Sharing of project-related information among PPP partners	1.121 (1)
	TI: Integrating technical factors into the feasibility study	1.109 (2)
	PL3: Clarity of rules and regulations governing a PPP project	1.094 (3)
	PS: Stability of the PPP committee despite the changes of political parties	1.077 (4)
	F1: Ease of accessing financial resources, favorable loan terms, and low-interest rates	1.055 (5)
	PL2: Availability of the PPP Act in Thailand	1.000 (6)
	PP: Transparency of procurement process	0.930 (7)
	FI: Tax incentives for a PPP project	0.981 (8)

V. Conclusions and Implication

The Public-Private Partnership (PPP) has been an innovative financing scheme for developing countries with fiscal constraints, enabling infrastructure projects through private funding. Despite its strength, construction and operational challenges persist. Thailand, one of the leaders in ASEAN infrastructure development, has faced difficulties in the MRT PPP projects. Bangkok has encountered hurdles in the timely and cost-effective construction completion of MRT projects, indicating the necessity of improvement of frameworks, planning, and policies by the government to facilitate private participation and ensure successful construction and operation. For this purpose, this study investigated the Critical Success Factor (CSF) priorities for enhancing Bangkok's MRT PPP framework and relevant policies.

The policy implications based on the analysis are as follows. First, government authorities need to establish a platform for the free exchange of project-related information and opinions between public and private entities. In the case of Bangkok's MRT, rather than engaging in dialogue to meet the private sector's demands, the government expected compliance with its requirements. This approach resulted in construction delays and project viability issues. There is a need to seek optimal solutions that align with the private sector's needs through information exchange, not only during but also before the project's commencement. Second, relevant government officials involved in the MRT PPP should enhance their capability to review the technical aspects of MRT projects. In Bangkok, concessions are granted on a project-by-project basis,

leading to fragmented implementations of railway system, and maintenance. This results in duplicated investment and technological and component inefficiencies. The technical feasibility of this approach must be assessed. Third, PPP-related laws, regulations, and processes should be clarified to enable the private sector to fully understand the project. For private companies to correctly perform tasks, the government must improve its capacity to lead and supervise the project. Fourth, adjustments to the committee composition system are necessary to mitigate risks associated with political changes. Lastly, financial support for private participants remains a critical issue. In particular, strategies for securing financial resources and providing tax incentives need to be developed.

This study highlighted the prioritization of CSF indicators using Importance-Performance Gap Analysis. This study is significant in that it identifies success factors that need improvement in developing countries where institutional and social conditions for PPP are relatively less established. However, it primarily focused on procurement and construction phases with limited insight into operational and managerial aspects. Additionally, while the methodology of the study has general applicability, there is a limitation regarding whether the prioritization of each indicator derived from the results can be applied to all developing countries. Future research should expand to encompass both the construction and operational phases of the PPP model and examine cases from other developing countries to derive more generalizable research results.

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